



Manoharbai Shikshan Prasarak Mandal Armori's

**MAHATMA GANDHI ARTS, SCIENCE &
LATE NASARUDDINBHAI PANJWANI COMMERCE
COLLEGE, ARMORI**

Dist. Gadchiroli (Maharashtra) 441 208

Affiliated to Gondwana University, Gadchiroli.

Re-accredited by NAAC 'A' with 3.24 CGPA

ANNUAL QUALITY ASSURANCE REPORT

AQAR : 2023~2024

CRITERION – I
CURRICULAR ASPECTS

METRIC NO: ~ 1.3.3.

**METRIC NAME: ~Number of students undertaking project work /
field work/ internships.**



**Web: - mgcollegearmori.ac.in
e-mail: - mgcollege.armori@gmail.com
Phone: - 07137-266558**

Project Work Reports/ Field
Visit Reports of M.Sc.



MANOHARBHAI SHIKSHAN PRASARAK MANDAL ARMORI'S
**MAHATMA GANDHI ARTS, SCIENCE &
LATE NASARUDDINBHAI PANJWANI COMMERCE COLLEGE**



ARMORI Dist. Gadchiroli (M.S.) 441 208
Affiliated to Gondwana University, Gadchiroli
Re-accredited by NAAC 'A' with 3.24 CGPA (2022)
Web: mgcollegearmori.ac.in

Dr. Lalsingh H. Khalsa
Principal & IQAC Chairman
Mob. No. 9422153197
E-mail: lalsinghkhalsa@yahoo.com

Dr. Satish. S. Kola
IQAC Coordinator
Mob. 9595982057
E-mail: satish.kolawar@gmail.com

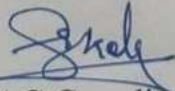
Certificate of Verification


The document herewith is a testimonial of the following specifics;

- AQAR 2023-24
- Criterion - I (Curricular Aspects)
- Metric no. – 1.3.3
- Metric Particular – Number of students undertaking project work / field work/ internships.

It is affirmed that the attached document pertinent to the above cited specifics are duly verified and approved by the IQAC.


Criterion Head


IQAC Coordinator
IQAC-Co-ordinator


IQAC Chairperson
PRINCIPAL
M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli



A
PROJECT WORK
ON

" Review on investigation of food adulteration, "

Submitted
To
Gondwana University, Gadchiroli

In fulfilment of requirement for the award of
degree in

Master of Science (Chemistry)

By
Ku. Asmita Tulshidas Gedam

Under Supervision of

Prof. S. M. Sontakke
Assistant Professor
Department of Chemistry



Post-Graduation Department of Chemistry

**MAHATMA GANDHI ARTS AND SCIENCE & LATE
N.P. COMMERCE COLLEGE ARMORI**

April 2023-24

A
PROJECT WORK
ON

" Review on Investigation of food adulteration "

Submitted
To
Gondwana University, Gadchiroli

In fulfilment of requirement for the award of
degree in

Master of Science (Chemistry)

By
Ku. Asmita Tulshidas Gedam

Under Supervision of

Prof. S. M. Sontakke
Assistant Professor
Department of Chemistry



Post-Graduation Department of Chemistry

**MAHATMA GANDHI ARTS AND SCIENCE & LATE
N.P. COMMERCE COLLEGE ARMORI**

April 2023-24

DECLARATION

I hereby declare that the project work entitled '**Review on Investigation of food adulteration**' submitted here in has been carried out by me in the Department of Chemistry, **Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori**.

The work is original and has not been submitted earlier as a whole or in part for the award of degree of master of science.

The project work, submitted for the award of the degree of "**Master of Science in Chemistry**" of **Gondwana University, Gadchiroli** is original and has not been submitted earlier as a whole or in part to any other university or institution for the award of any degree/diploma or certificate.

A.T.Gedam

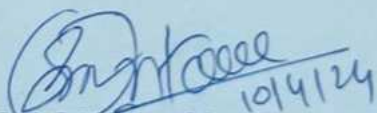
Asmita Tulshidas Gedam

Date: 10/04/2024

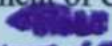
Place: Armori

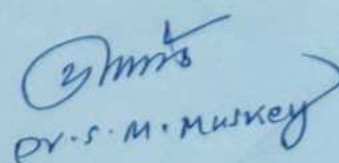
CERTIFICATE

The project work entitled of 'Review on Investigation of food adulteration' submitted by **Asmita Tulshidas Gedam** for the award of degree of master of science in chemistry has been carried out under my supervision **Prof. S. M. Sontakke** department of chemistry in **Mahatma Gandhi Arts and Science & Late N.P. Commerce College Armori, Gondwana University, Gadchiroli**. The work is compressive complete and fit for evaluation.


Prof. S. M. Sontakke

Head, Department of Chemistry


Department of Chemistry
M.G. Art & Science & Late N. P. Commerce
College, Armori, Dist. Gadchiroli


Dr. S. M. Muskey



CERTIFICATE

This is to certify that the work presented in this project "**Review on Investigation of food adulteration**" the own work of **Asmita Tulshidas Gedam** conducted in the Department of Chemistry, Mahatma Gandhi Arts, Science & Late N.P. Commerce College, Armori, under the guidance of **Prof. S. M. Sontakke** This work has not been submitted earlier to my University/Institution for any diploma or degree.

Forwarded By

Dr. L. S. Khalsa
PRINCIPAL
M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli

Mahatma Gandhi Arts, Science & Late N.P. Commerce College, Armori,

Dist. Gadchiroli.

ACKNOWLEDGEMENT

I express my deep sense of gratitude sincere thanks to my supervisor **Prof. S. M. Sontakke** Assistant Professor, Department of Chemistry, **Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori** for his valuable guidance, constant encouragement and keen interest in the development of this work.

I am very thankful to the principal our College Dr. Lalsingh Khalsa for giving permissions to approach various steps of the methodology. I am deeply thankful to Prof. **Prof. S. M. Sontakke**, Head, P. G. Department of Chemistry, Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori, other faculty of the department of Chemistry for their cordial support, valuable information and guidance, which helped me in completing this task through various stages.

I truly appreciate the continuous love, encouragement, supports, and understanding from my family, my all friends during my research study. They are my strength to strike for excellence. Without their supports, I could not finish my project smoothly.

ATGedam

Asmita Tulshidas Gedam

INDEX

S.N.	Particular
1	Introduction
2	Literature survey
3	Materials
4	Method of Detection
5	Conclusion
6	References

INTRODUCTION

Generally adulterant is added in any food item to increase its volume, weight etc. as well as to decrease its costing. Some of the most common adulterated foods are milk and dairy products, atta, edible oils, cereals, spices (whole and ground), legumes, coffee, tea, confectionery, baking soda, soft drinks, vinegar, besan, curry powder, etc. In general there are three types of Adulterants: 1) Intentional adulterants: like sand, marble splinters, stones, mud, other dirt, talc, chalk powder, water, mineral oil and harmful colors. 2) Secondary adulterants e.g. pesticide residues, rodent feces, larvae in food. 3) Metallic impurities: e.g. arsenic from pesticides, Lead from water, waste water from the chemical industry, tin from cans. Adulterants can even be due to mishandling of ingredients as well as improper packaging.

Laboratory detection of adulteration in food items includes various methods such as High Performance Liquid Chromatography (HPLC) for analysis, HPTLC for investigation, GCMC, LCMS-MS for chemical analysis and many more. Such laboratory methods are based on some basic parameters of validation such as accuracy, precision, linearity, limit of detection, limit of quantitation, specificity and robustness. These methods require various instrumentation which is very costly. Laboratory methods provide us the exact results of adulteration with its various range of risk i.e. high, moderate, less depending upon the percentage of adulteration. Adulteration involves alteration in pH of the material and hence can cause severe problems in a healthy life style.

This paper is focused upon the methods of home detection of adulteration in our day to day essential food commodities with available material at home and few laboratory methods for the same. These inhouse methods provide us with the result of purity and impurity, though its percentage for the same cannot be measured, whereas laboratory methods give accurate percentage wise result with the help of chromatographical detection. The paper also focuses on the alteration of pH, its effects and its permissible limits.

LITERATURE SURVEY

Adulteration use was first investigated in 1820 by the German chemist Frederick Accum, who identified many toxic metal poisonings in food and drink. His work antagonized food suppliers and he was ultimately discredited by a scandal over his alleged mutilation of books in the royal institution library. The physician author Hill Hossal conducted extensive studies in the early 1850 which were published in the lancet and led to the 1860 food Adulteration Act and rather legislation (Ghimire, 2016).

Why food adulteration?

Adulteration is present in society from a long time but it was not noticed due to its small scale use and its low impact. But at the present era, economic adulteration is a long term problem affecting the food industry at its most drastic level. According to one survey conducted, adulteration were detected in milk to the tune of 70% with water, turmeric powder-43% with chalk powder, red chilli powder-100% with artificial colour, sugar 37% with chalk powder etc. (Kumar. 2011). As Afzal et al. (2011) the main reason that attracts adulteration is for boosting their cash income by increasing its volume. Even though increasing their profit margins initiated adulteration done by some selfish producers, processors and retailers, the main cause for adulteration is dishonesty and lack of accidental quality assessment on products suspected (Asrat and Zelalem, 2014). As world population is growing at alarming rate, food is often adulterated to meet the needs of this growing population and to feed the large scale population. Another motive for faking and adulteration of goods and services is outsourcing to offshore producers (Hamburg. 2010) Outsourcing became possible because comparatively labour is cheap in some countries and this is also what makes product faking easy since the cost of producing is far less compared to the super normal profits being made (Sicpa, 2012), That is why Cofie (2012) argues that counterfeiting

MATERIALS

1. Beaker
2. Boiling test tubes
3. Test tube stand
4. Conical flask
5. Pipette
6. Samples of milk, honey, ghee, salt

METHODS OF DETECTION

Adulteration of milk with H₂O

Such types of adulterants can give rise to other stomach disorders.

Testing method: Split milk on a polished slanting surface, Pure milk resist to move or moves slowly leaving a white mark behind Milk adulterated with water will flow immediately without leaving a mark.



CONCLUSION

Selecting healthy and non-adulterated foods is essential to daily life to ensure that such foods do not pose any health risks. It is not possible to guarantee healthy food only by visual inspection when the toxic impurities are in ppm. Visually inspecting the food before purchasing it will ensure that there are no insects, visible fungi, foreign objects, etc. Avoid dark coloured, junk and other processed foods. Wash fruits and vegetables thoroughly in running water before it is used. Therefore, after careful examination, the care taken by the consumer at the time of purchase of the food can be of great help. Packaged foods are very important to know the ingredients and the nutritional value. They also help in checking the freshness of the food and the shelf life before use. The consumer should avoid taking food from an unsanitary place and preparing food in unsanitary conditions. Types of food can cause various diseases, Consumption of cut fruits sold in unsanitary conditions should be avoided. It is always better to buy certified food from certified stores.

REFERENCES

1. Food safety and standards authority of India.
2. The Times, Police, 5 February 1984); pg. 14
3. Burros, Marian (9 August 2006), "The Customer Wants a Juicy Steak? Just Add Water" The New York Times
4. Weise, Elizabeth (24 April 2007), "Food tests promise tough task for FDA" USA Today, Retrieved 29 April 2007
5. Thieves fry Kenya's power grid for fast food, Al Jazeera, 28 December 2014
6. Jeffrey M. Pücher, Food in World History New York, Routledge, 2006, pg no. 59
7. Calry, Noel (1 March 2005) The fight against food adulteration", Education in Chemistry, Vol 42, no. 2, Royal Society Of Cheminy, pg no.46-49, Retrieved 19 June 2018
8. Westin A. Price: Against the Grain, Section Bread to feed the masses
9. Juiceless baby juice leads to full-length justice IFDA Consumer, Archived, 10 December 2007 at the Wayback Machine
10. ConAgra Set to Settle Criminal Charges It increased weight and volume of Grain- New York Times
11. Sinha, Kounteya (10 January 2012), "70% of milk in Delhi, Country is adulterated", The Times Of India, Retrieved 23 February 2014
12. Vlasta Pilizota, Nela Nedic, (12 August 1974), OJEC, Official Journal of the European Communities, 1. 221
13. Tajima A. Kawahara S., Shin K, Imaizumi k, Nakamura T, Ito T., Is beef tallow really hazardous to health? Nutr Res. 1995:15:1429-36
14. Singhal RS, Kulkarni PR, Rege DV. (Cambridge: Woodhead Publishing Limited; 1997), Handbook of Indices of Food Quality and Authenticity.

A
PROJECT REPORT

ON

Investigation of foaming capacity various brands of bathing bar

Submitted

To

Gondwana University, Gadchiroli

In fulfilment of requirement for the award of
degree in

Master of Science (Chemistry)

By

Ku. Saroj Bhaskar Donadkar

Under the Supervision of

Prof. S.M. Sontakke

Head

Department of Chemistry



Post-Graduation Department of Chemistry

**MAHATMA GANDHI ARTS AND SCIENCE & LATE N.P. COMMERCE
COLLEGE ARMORI**

Academic Session 2023-2024

△

PROJECT REPORT

ON

Investigation of foaming capacity various brands of bathing bar

Submitted

To

Gondwana University, Gadchiroli

In fulfilment of requirement for the award of

degree in

Master of Science (Chemistry)

By

Ku. Saroj Bhaskar Donadkar

Under the Supervision of

Prof. S.M. Sontakke

Head

Department of Chemistry



Post-Graduation Department of Chemistry

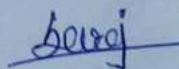
**MAHATMA GANDHI ARTS AND SCIENCE & LATE N.P. COMMERCE
COLLEGE ARMORI**

Academic Session 2023-2024

DECLARATION

I hereby declare that the project work entitled **Investigation of foaming capacity of different bathing bar** submitted here in has been carried out by me in the **Department of Chemistry, Mahatma Gandhi arts and Science & Late N. P. Commerce College Armori.**

The project work, submitted for the award of the degree of **Master of Science in Chemistry of Gondwana University** is original and has not been submitted earlier as a whole or in part to any other university or institution for the award of any degree/diploma or certificate.



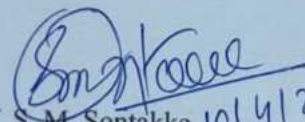
Saroj Bhaskar Donadkar

Date: 04 / 2024

Place: Armori

CERTIFICATE

The project work entitled of **Investigation of foaming capacity of different bathing bar** submitted by **Saroj Bhaskar Donadkar** for the award of degree of master of science in chemistry has been carried out under my supervision as Head, department of chemistry in Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori, Gondwana University Gadchiroli. The work is compressive complete and fit for evaluation.

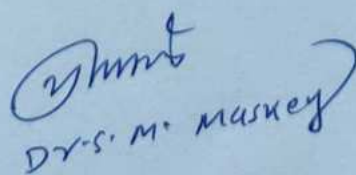


Prof. S. M. Sontakke 10/4/24

Head

Department of Chemistry

Free
Department of Chemistry
M.G. Art & Science & Late N. P. Commerce
College, Armori, Dist. Gadchiroli




Dr. S. M. Maskey



CERTIFICATE

This is to certify that the work presented in this project **Investigation of foaming capacity of different bathing soaps** the own work of **Ms. Saroj Bhaskar Donadkar** conducted in the Department of Chemistry, Mahatma Gandhi Arts, Science & Late N.P. Commerce College, Armori, under the guidance of **Prof. S. M. Sontakke** This work has not been submitted earlier to my University / Institution for any diploma or degree.

Forwarded By


Dr. L. S. Khalsa
PRINCIPAL
M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori,

Dist. Gadchiroli

ACKNOWLEDGEMENT

I express my deep sense of gratitude sincere thanks to my supervisor **Prof. S. M. Sontakke** Head, Department of Chemistry, **Mahatma Gandhi and Science & Late N.P. Commerce College Armori** for his valuable guidance, constant encouragement and been interest in the development of this work.

I am very thankful to the principal our College Dr. Lalsingh Khalsa for giving permissions to work in the laboratory. I am deeply thankful to Prof. S. M. Sontakke, Head, P.G. Department of Chemistry, Mahatma Gandhi Arts and Science and Late N. P. Commerce College Armori, other faculty of the department of Chemistry for their cordial support, valuable information and guidance, which helped me in completing this task through various stages.

I truly appreciate the continuous love, encouragement, supports, and understanding from my family, my all friends during my research study. They are my strength to strike for excellence. Without their support, I could not finish my project smoothly.



Saroj Bhaskar Donadkar

INDEX

Sr. No	Particular
1	Introduction & Literature survey
2	Materials & Method
3	Observation table
4	Conclusion
5	References

INTRODUCTION & LITERATURE SURVEY



Soap is a salt of fatty acid used in a variety of cleansing and lubricating products. In a domestic setting, soaps are surfactants usually used for washing, bathing and other types of housekeeping. In industrial settings, soaps are used as thickeners, components of some lubricants, and precursors to catalysts.

When used for cleaning, soap solubilizes particles and grime, which can then be separated from the article being cleaned. Inhand washing, as a surfactants, when lathered with a little water, soap kills microorganisms by disorganizing their membrane lipid bilayer and denaturing their proteins. It also emulsifies oils, enabling them to be carried away by running water.

Soap is created by mixing fats and oils with a base. Humans have used soap for millennia evidence exists for the production of soap.

MATERIALS

1. Five 100 ml conical flask
2. Five test tubes
3. 100 ml measuring cylinder
4. Test tube stand
5. Weight box
6. Stop watch
7. Five different samples of soap

METHOD

1. Take 100 ml of soap solution from each conical flask and in the corresponding test tubes.
2. Shake the test tubes for 1 minute by covering the mouth by the thumb.
3. Foams will be formed at the top side. Note the height of foam and record the same in the observation table.
4. Repeat the same procedure for the other four samples.
5. Comparing each tube with the others, you are making the order of the height of the foam.

METHOD

1. Take five 100 ml conical flasks and label them as A, B, C, D, E.
2. Take 50 ml of water in each conical flask and then add 2g of different samples of soap to each flask.
3. Warm to dissolve and get a clear solution. Arrange five test tubes on a test tube stand labelled as A, B, C, D and E.
4. Take ICC of soap solution from each conical flask add to the corresponding test tubes.
5. Shake the test tube for 1 minute by covering its mouth by the thumb.
6. Foam will be formed in the test tube. Start the stop watch and note the time taken for the disappearance of foam.
7. Repeat the same procedure for the test tubes B, C, D and E.
8. Shaking each tube with the same force and noting the time taken for disappearance of the foam.

OBSERVATION TABLE

Sr. No	Test tube	Volume of soap solution taken	Volume of water added	Time taken for disappearing foam
1	Dettol	1.0 ml	10 ml	3 hours 53 minutes
2	Santoor	1.0 ml	10 ml	6 hours 20 minutes
3	Liril	1.0 ml	10 ml	2 hours 35 minutes
4	Dove	1.0 ml	10 ml	3 hours 46 minutes
5	Cinthol	1.0 ml	10 ml	4 hours 38 minutes

REFERENCES

1. IITKNC, *Course notes of Chemical Technology*, Part - II, 1st Edition, 2000, p. 100-101.
2. Thomas, Charles S. (1997-05-01), *A Concise History of Detergents and Soap*, Department of Food, Consumer Sciences and Technology, University of Reading, 2017-05-18. Retrieved 2017-05-18.

CONCLUSION

3. *What's The Difference Between Soap and Detergent?* <http://www.thespruce.com>

Foaming capacity of soap is maximum in distilled water as compared to that in tap water. The soap for which the time taken for the disappearance of foam is highest has maximum foaming capacity and is the best quality soap among the soap tested.

REFERENCES

1. IUPAC, Compendium of Chemical Terminology , 2 nd ed. (the Gold Book).
Online corrected : (2006 -)Soap.
2. Tumosa, Charles S. (2001-09-01). A Brief History of Aluminium Stearate as a Component of Paint. cool.coservation-us.org.Archived from the original on 2017-03-18.Retrieved 2017-04-05.
3. Whats The Difference Between Soap and Detergent.cleancult.com.Archived from the original on 2019-12-18.Retrieved 2019-12-18.
4. Data collection to the website like Google,Research gate ,Wikipedia etc .
5. Garzena,Patrizia,and Marina Tadiello. Soap Naturally : Ingredients,Methods and Recipes for Natural Handmade Soap. Mayfield, N.S.W: Programmer , 2004. ISBN 0975676407
6. The Process of Making Soap. Edtech.mcc.edu.
Archived from the original on 15 July 2019.
Retrieved 8 March 2020.
7. www.soap-soap flakes .com Archived 2015-05-26 at the Wayback Machine . soap-flakes .com
Retrieved on 2015-10-31.



Gondwana University

MIDC Road Complex, Gadchiroli-442605, MH, (India)
<https://gugapp.digitaluniversity.ac/>

Blank Mark List For

M.SC.(CHEMISTRY)(with Credits) - Regular-CBCS Pattern - SY M.SC.(CHEMISTRY) - SEM IV For Summer 2024

College : Mahatma Gandhi Arts, Science and Late N.P. Commerce College, Armori , Dist. Gadchiroli. (NAAC A Graded) (020), Burdi, Wadsa Road, Near Petrol Pump, Armori, Armori, Gadchiroli Pin: 441208

Paper Name: PROJECT (PSCHP11)

Practical UA

(Max Mark: 80 Min Mark: 0)

Count of Student: 8

Sr. No.	Seat Number	PRN	Student Name	Signature	Marks	Total
1	6595149	2019033700003081	DONADKAR SAROJ BHASKAR		74	Seventy Four
2	6595150	2019033700003211	GEDAM ASMITA TULSHIDAS		75	Seventy Five
3	6595151	2019033700003215	GHONMODE MARTINA RAJENDRA		75	Seventy Five
4	6595153	2022033700233426	GIRADKAR TRUPTI BALIRAM		68	Sixty Eight
5	6595156	2022033700061494	RAHELE PANKAJ JAGDISH		75	Seventy Five
6	6595158	2019033700003810	SAHARE MRUNESHWARI SHIVCHARAN		75	Seventy Five
7	6595159	2015033700135594	SHARMIN MUNAWWARKHAN PATHAN		65	Sixty Five
8	6595160	2019033700003831	SONKUSARE MONIKA GULAB		75	Seventy Five

Seal

10/04/24
Dr. Satish Kola
(Internal Examiner)

Dr. Sudhiz Maske
(External Examiner)
Signature of Examiner

Date

Instruction

1. While entering the marks, please ensure a clear, legible hand-writing, without any scratches or over-writing.
2. In case of scratches, over-writing or corrections, please re-write the marks separately with your signature.
3. Use English number while entering the marks.
4. Usage of whitener is strictly prohibited.

A Project Report

"Studies on Phytochemical screening of *Murraya koenigii* (Curry leaf) Extract"



Submitted to the
Gondwana University, Gadchiroli

For the degree of
Master of Science (Chemistry)
By

Miss. Monika G. Sonkusare
M.Sc. Chem. Sem. - IV Student

Under the Supervision of

Dr. Satish S. Kola
Assistant Professor
Department of Chemistry



P.G. Department of Chemistry
M.G. Arts, Science & Late. N.P. Commerce
College Armori
2023-24

A Project Report

**“Studies on Phytochemical screening of *Murraya
koenigii* (Curry leaf) Extract”**



**Submitted to the
Gondwana University, Gadchiroli**

**For the degree of
Master of Science (Chemistry)**

**By
Miss. Monika G. Sonkusare**

M.Sc. Chem. Sem. - IV Student

Under the Supervision of

Dr. Satish S. Kola

**Assistant Professor
Department of Chemistry**



**P.G. Department of Chemistry
M.G. Arts, Science & Late. N.P. Commerce
College Armori
2023-24**

DECLARATION

I declare that this project work of "Studies on *Phytochemical Screening of Murraya koenigii* (Curry leaf) Extract" was done by me in M.G. Arts Science and Late. N.P. Commerce College Armori during the academic session 2023-24. This project work has not been submitted earlier to any University or Institution for the award of any diploma or a degree.

Armori

Date: 01/04/2024



Miss. Monika G. Sonkusare

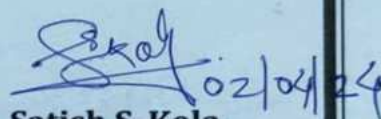
(M.Sc.Chem Sem-IV Student)

CERTIFICATE

This is to certify that **Miss. Monika G. Sonkusare** has carried out his project work on the topic entitled "**Studies On Phytochemical Screening of *Murraya koenigii* (Curry leaf) Extract**" during the academic session **2023-24** under my supervision in the Post Graduate Department of Chemistry, **M.G. Arts Science and Late. N.P. Commerce College Armori** This research work presented in this project is own work of the candidate.

Armori

Date: 01/04/2024


Dr. Satish S. Kola


Assistant Professor

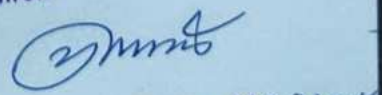
Department of Chemistry


Prof. S. M. Sontakke

Head Department of Chemistry

Department of Chemistry
M.G. Art & Science & Late N. P. Commerce
College, Armori, Dist. Gadchiroli


PRINCIPAL
M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli


Dr. S. M. Marney

ENDORSEMENT BY THE HOD/ PRINCIPAL/C0-ORDINATOR
OF THE INSTITUTION

This is to certify that dissertation entitled "**Studies on Phytochemical Screening of
Murraya koenigii (Curry leaf) Extract**" is a bonafide research work done by
Miss.Monika G. Sonkusare under the guidance of Professor **Dr. Satish S. Kola.**



HOD/Co-ordinator

**M.G. Arts Science and Late. N.P.
Commerce College Armori**

Place:

Date:- 01/04/2024

ACKNOWLEDGMENTS

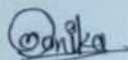
I would like to thank sincerely to my supervisor Dr. Satish Kola, Asst. Professor P.G. Department of Chemistry M.G. Arts Science and Late. N.P. Commerce College Armori they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks Principal of college Dr. Lalsingh Khalsa and Head of Department of chemistry Prof. S.M. Sontakke for constant support and providing necessary facilities.

I would like to thank to teaching staff of the M.G. Arts Science and Late. N. P. Commerce College Armori, Miss. Sonal Kurzekar for their constant encouragement during the journey of my project work.

I am so much thankful to the non-teaching staff for their valuable help in day to day work. I also like to thank my family to support me in every decision about study. I also take this opportunity to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step who provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.


Miss. Monika G. Sonkusare

.....April -2024.....

INDEX

Sr. No.	Content	Page No.
1	Abstract	1-2
2	Introduction	3-7
3	Review of literature	8-9
4	Experimental Work	10-12
5	Result & discussion	13-18
6	Conclusion	19-20
7	References	21-23

Abstract

In the Present Study we have study of Phyto screening compound present in the aqueous curry leaf. The curry leaf extract was prepared in water and Extraction was undergo phytochemical study by using different test for alkaloid, Terpenoids and many naturl Products The result of the aqueous curry leaf extract revealed the presence of phytochemical compounds such as Phenol, tannins, alkaloids, saponins, reduced sugar, proteins, killer-kilani million's, phenol flavonoids and phenol tannins The present study was done to find out the Phytochemical constituents present in the leaf powder of curry leaves.

Introduction

Murraya koenigii is commonly called as curry leaf, which belongs to the family rutaceae. The leaves of *murraya koenigii* was used for flavouring and spicing of food. These leaves were highly valued for their medicinal valued and for characteristic aroma. There are many chemical compounds which helps the human beings in various ways. The compounds are non-nutritive and help in protection against diseases. Commonly curry leaves were accepted for various treatments in curing several disorders. leaves is called by different name by the different ethnic, In Tamil we called as Karivempu, Bengali as Barsunga, in Hindi we called as Kurrypatte¹. Among fourteen global species belongs to the genus of *Murraya*, only *Murraya koenigii* Spreng and *Murraya paniculata* (Linn) is available in India^[1]. *Murraya koenigii* which belong to the family of Rutaceae represents more than 150 genera and 1600 species. The leaves of this plant has been used widely in indian culinary and the chemical substance which responsible for its aromatic characteristic is P- gurjunene, P- caryophyllene, P- elemene and O- phellandrene^[2]. The presence of β - pinene, β - caryophyllene, β - phellandrene and α - pinene has ability to control the food spoilage either alone or by combination^[3]. The author states that the three different morphotypes of *Murraya koenigii* poses different intensity in its flavour. The regular type of *Murraya koenigii* is the fastest growing plant with good looking leaves and with dark green in color. The dwarf type grows as shrub and branches are spread and appears like bushy and the leaves are in light green in color with little taller like regular type and poses its own aroma. The brown type is the most fragrant one, with thick and smallest leaf structure and in dark brown in color^[3].

The aim of this study is to update information about pharmacokinetically, Phytochemical and pharmacological studies of *Murraya koenigii*. Curry leaf is an aromatic tropical and sub-tropical plant originated from India. Besides its culinary purpose, curry leaf is known for its medicinal and industrial applications. The Rutaceae family, which is frequently employed as a medicinally significant herb of Indian origin in the Ayurvedic system of medicine, includes *Murraya koenigii* (*M. koenigii*). *Murraya koenigii* is a multipurpose plant, the plant is a native of India. It is found

References

1. Nayak A, Mandal S, Banerji A, Banerji J., Review on chemistry and pharmacology of *Murraya koenigii* Spreng (Rutaceae), *Journal of Chemical and Pharmaceutical Research.*, (2010), 2(2), 286-299.
2. Saini S.C, Reddy G.B.S., *Murraya koenigii* leaf Extract, *Journal of Pharmacy and Biological Sciences.*, (2013), 7(6), 15-18.
3. Sivakumar C.H.V, Meera I., Antioxidant and biological activities of three morphotypes of *Murraya koenigii* L. from uttarakhand, *Journal of Food Process and Technology.*, (2013), 4(7), 1-7.
4. Sindhu R.K, Arora S., Evaluation of phenolic contents and antioxidant potential of *Murraya koenigii* (L) spreng roots, *Journal of Applied Pharmaceutical Science.*, (2012), 2(11), 120-122.
5. Parul S, Javed A, Neha B, Honey J, Anuj B., Curry leaves- A medicinal herb, *Asian Journal of Pharmaceutical Research.*, (2012), 2(2), 51-53.
6. Sangam, S., Naveed, A., Athar, M., Prathyusha, P., Moulika, S., and Lakshmi, S., *International Journal of Health Sciences and Research.*, (2015), 5(1), 156-164
7. Sivakumar C.H.V, Meera I., Antioxidant and biological activities of three morphotypes of *Murraya koenigii* L. from uttarakhand, *Journal of Food Process and Technology.*, 2013., 4(7), 1-7
8. Chauhan, B., Dedania, J., and Mashru, D. R. C. Review on *Murraya Koenigii*: Versatile Role in Management of Human Health. *World Journal of Pharmacy and Pharmaceutical Sciences.*, (2017), 6(03), 476-493.
9. Kataria, R., Singh, G., Gupta, A., Jalhan, S., and Jindal, A., Academic Sciences Asian Journal of Pharmaceutical and Clinical Research. *Asian Journal of Pharmaceutical and Clinical Research.*, (2012), 5-7.
10. Tan, S. P., Nafiah, M. A., and Ahmad, K. C23-carbazole alkaloids from malayan *murraya koenigii* (L.) spreng. *Journal of Chemical and Pharmaceutical Research.*, (2014), 6(4), 1093-1098.
11. Kumar, V.S., Sharma, A., Tiwari, R., Kumar, S. *Murraya koenigii*: A review. *Journal of Medicinal and Aromatic Plant Science.*, (1999), 2(1), 1139-114
12. Plant, S. A. M., Singh, S., Omre, P. K. B., and Madan, S., (2015)
13. Nishan, M., and Subramanian, P., *Murraya Koenigii* (Curry leave)- a review on its potential. *International Journal of PharmTech Research.*, (2015), 7(4), 566-572.

A Project Report

**"Microwave Assisted Green Synthesis & Molecular
Docking Study of Thiazolidin-4-one Derivatives as
Possible Bioactive Agents"**



**Submitted to the
Gondwana University, Gadchiroli**

**For the degree of
Master of Science (Chemistry)
By**

Miss. Mruneshwari S. Sahare
M.Sc. Chem. Sem. - IV Student

Under the Supervision of

Dr. Satish S. Kola
Assistant Professor
Department of Chemistry



**P.G. Department of Chemistry
M.G. Arts, Science & Late. N.P. Commerce
College Armori
2023-24**

A Project Report
**“Microwave Assisted Green Synthesis & Molecular
Docking Study of Thiazolidin-4-one Derivatives as
Possible Bioactive Agents”**



Submitted to the
Gondwana University, Gadchiroli

For the degree of
Master of Science (Chemistry)

By
Miss. Mruneshwari S. Sahare

M.Sc. Chem. Sem. - IV Student

Under the Supervision of

Dr. Satish S. Kola

Assistant Professor
Department of Chemistry



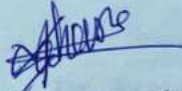
P.G. Department of Chemistry
M.G. Arts, Science & Late. N.P. Commerce
College Armori
2023-24

DECLARATION

I declare that this project work of "Microwave Assisted Green Synthesis & Molecular Docking Study of Thiazolidin-4-one Derivatives as Possible Bioactive Agents" was done by me in M.G. Arts Science and Late. N.P. Commerce College Armori during the academic session 2023-24. This project work has not been submitted earlier to any University or Institution for the award of any diploma or a degree.

Armori

Date: 1-4-2024


Miss. Mruneshwari S. Sahare

(M.Sc.Chem Sem-IV Student)

CERTIFICATE

This is to certify that, Miss. Mruneshwari S. Sahare has carried out his project work on the topic entitled "Microwave Assisted Green Synthesis & Molecular Docking Study of Thiazolidin-4-one Derivatives as Possible Bioactive Agents" during the academic session 2023-24 under my supervision in the Post Graduate Department of Chemistry, M.G. Arts Science and Late. N.P. Commerce College Armori This research work presented in this project is own work of the candidate.

Armori

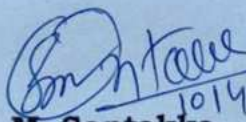
Date: 4-4-2024

 05/04/24

Dr. Satish S. Kola

Assistant Professor

Department of Chemistry

 10/4/24

Prof. S. M. Sontakke

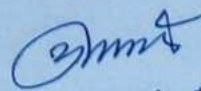
Head Department of Chemistry

head
Department of Chem...
M.G. Art & Science & Late N. P. Commerce
College, Armori, Dist. Gadchiroli



PRINCIPAL

M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli


DR. S. M. Mune

ENDORSEMENT BY THE HOD/ PRINCIPAL/CO-ORDINATOR
OF THE INSTITUTION

This is to certify that dissertation entitled "**Microwave Assisted Green Synthesis & Molecular Docking Study of Thiazolidin-4-one Derivatives as Possible Bioactive Agents**" is a bonafide research work done **Miss. Mruneshwari S. Sahare** under the guidance of Professor **Dr. Satish S. Kola**.

HOD/Co-Ordinator

**M.G. Arts Science and Late. N.P.
Commerce College Armori**

Place:-

Date :- 1-4-2024

INDEX

ACKNOWLEDGMENTS


I would like to thank sincerely to my supervisor **Dr. Satish Kola**, Asst. Professor P.G. Department of Chemistry **M.G. Arts Science and Late. N.P. Commerce College Armori** they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks Principal of college **Dr. Lalsingh Khalsa** and Head of Department of chemistry **Prof. S.M. Sontakke** for constant support and providing necessary facilities.

I would like to thank to teaching staff of the **M.G. Arts Science and Late. N. P. Commerce College Armori**, **Miss. Sonal Kurzekar** and **Joytsna Dahare** for their constant encouragement during the journey of my project work.

I am so much thankful to the non-teaching staff for their valuable help in day to day work. I also like to thank my family to support me in every decision about study. I also take this opportunity to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step who provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.


Miss. Mruneshwari S. Sahare

.....April -2024.....

INDEX

Sr. No.	Content	Page No.
1.	Abstract & Graphical Abstract	01-02
2.	Introduction	03
3.	Material and Methods	04
4.	Experimental Work	05-09
5.	Result & discussion	10
6.	Antimicrobial Activity	11-12
7.	Molecular Docking Study	13-14
8.	IR and ^1H NMR Spectra	15-16
9.	Conclusion & Acknowledgements	17
10.	References	18-21

ABSTRACT

In present work we have reported, a microwave-assisted method was developed to efficiently synthesize a novel series of 4-oxo-thiazolidine (**4a-d**) derivatives. This cyclocondensation reaction involved *N'*-(arylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio) acetohydrazide (**3a-d**) and thioglycolic acid in DMF. The acetohydrazide (**3a-d**) intermediates were obtained by reacting acetohydrazide (**1**) with various substituted aromatic aldehydes (**2a-d**) in ethanol. The structures of the newly synthesized compounds were confirmed using various analytical techniques, supporting the proposed structures. Gram positive strains like *Staphylococcus aureus* were challenged alongside Gram negative varieties encompassing *Escherichia coli*, *Proteus vulgaris*, and *Salmonella typhi*. Consequences were contrasted with outcomes from the standard treatment Chloramphenicol. All the synthesized compounds (**4a-d**) were docked against Peptide deformylase (PDB ID: 1G2A). The computerized recreations uncovered these substances fitted well into the dynamic site, proposing they could potentially meddle with the objective.

Keywords: acetohydrazide, thiazolidinone, benzofuran, pyrazol, Peptide deformylase.

INTRODUCTION

Microwave-assisted organic synthesis of different heterocyclic moieties is a fast and eco-friendly synthetic approach and it is becoming a very substantial tool of green chemistry as it reduces the time of reaction, requires a safe heating source, it can spread out the yield of the reaction, improves the "atom economy" via the increase of the chemical yield and the selectivity of the product and also it can be beneficial for solvent-free reactions. Heterocyclic compounds are of prominence amongst pharmacologically active molecule henceforth they open innovative dimension for drug discovery by encompassing the advances of well-organized and simple method for synthesis of numerous heterocyclic rings which possess pharmacological activity. Thiazolidinone heterocycles are belong to one of the most intensively investigated five membered heterocyclic compounds containing three carbon atoms with carbonyl group at 4-position, and having one sulphur, one nitrogen in the ring. 4-Thiazolidinone has been considered as a magical moiety which acts as biologically privileged scaffold¹ this fact has been evoked the sizeable attention of many researchers to discover this skeleton as multiple potential biological active motif. The extensive literature survey revealed that 4-thiazolidinones is key moiety having promising a broad spectrum biological activities such as Antibacterial²⁻³, Anticancer⁴, antimalarials⁵, anti-inflammatory⁶, Anti-HIV Agents⁷, anticonvulsant activity⁸, antiviral⁹, antiparkinsonian agents¹⁰, cytotoxic¹¹, Free Radical Scavenging¹², antitubercular¹³ Analgesic¹⁴, Antifungal¹⁵, non-nucleoside inhibitors¹⁶, EGFR and HER-2 kinase inhibitors¹⁷, Benzofuran is also a versatile nucleus which shows broad spectrum of pharmacological activity. When benzofuran is fused with several heterocyclic compounds its biological activities get enhanced and are excellent antifungal, anti-hyperglycemic, analgesic, antiparasitic, antimicrobial agents¹⁸⁻²². one more heterocycle Pyrazoles also reported to retain a wide array of therapeutically activities in literature such as antidiabetic, insecticidal, antagonists of the CB1 receptor, enzyme inhibitor agents, anticorrosion activity, and antitubercular²³⁻²⁴. Inspired by these observations, a

review of the literature showed that even a little alteration to the pharmacophore group of an already-existing bioactive drug can have a significant impact on the therapeutic efficacy of that particular molecule. In light of the aforementioned information and as part of our ongoing efforts to create innovative drugs, we have synthesised a 4- thiazolidinone derivative and integrated it with benzofuran, pyrazole, and oxadiazole moiety in the current work.

EXPERIMENTAL SECTION

Material and methods

The AR grade chemicals from Merck, S.D. Fine, and Aldrich were utilised in the synthesis. The E. Merck TLC aluminium sheet silica gel60F254 was used to monitor the reactions, and the spot in the UV cabinet and iodine chamber was visible. The melting points were measured in an uncorrected open capillary in a paraffin bath. ¹H NMR spectra are acquired using DMSO-d₆ as the solvent and tetramethyl silane as the internal reference on a Bruker AM 400, 400 MHz apparatus. The units used for chemical shifts are parts per million (ppm). Mass spectra obtained by positive-ion Electro Spray Ionisation (ESI) were obtained using a Waters Micromass Q-TOF Micro, a mass spectrophotometer. The IR spectra of KBr and Cumax in cm⁻¹ were recorded using a Shimadzu IR spectrophotometer. Through the use of silica gel 60-120 mesh in column chromatography, the chemicals were purified. Elements analysis was performed using Thermo Scientific Flash-2000. When carbon, hydrogen, and nitrogen were measured in CHN, the sublimed chemical, the obtained values closely matched the calculated values.

EXPERIMENTAL SECTION

Procedure for the Synthesis of *N'*-(arylidene)-2-(5-(5-(benzofuran-2-yl)-1-phenyl-1H-pyrazol-3-yl)-1,3,4-oxadiazol-2-ylthio) acetohydrazide(3a-d): To an equimolar mixture of acetohydrazide(1)²⁹ and 4-methoxybenzaldehyde **2a** 1.21 ml (10 mmol) in absolute EtOH 25 ml is

Table No.4: Physical data of the Synthesized thiazolidinone Derivative (4a-d)

Code	Ar	Reery. Solvent	M.F	m.pt. ^o	%	% Analysis Found (Calculated)			
						Yield	C	H	N	S
4a	4-OCH ₃ -C ₆ H ₄ -	Ethanol	C ₃₁ H ₂₄ N ₆ O ₅ S ₂	254	84	59.55(59.60)	3.92 (3.87)	13.40(11.75)	10.76(10.70)
4b	2-Cl-C ₆ H ₄ -	Ethanol	C ₃₁ H ₂₄ N ₆ O ₅ S ₂	263	80	57.31(57.27)	3.30(3.36)	13.10(13.36)	10.05(10.19)
4c	2-F-C ₆ H ₄ -	Ethanol	C ₃₀ H ₂₁ FN ₆ O ₄ S ₂	269	82	58.75(58.81)	(3.95) (4.03)	11.80(11.99)	9.10 (9.15)
4d	4-OCH ₂ -C ₆ H ₅ - C ₆ H ₄ -	Ethanol	C ₃₇ H ₂₈ N ₆ O ₅ S ₂	276	86	63.30(63.41)	3.97(4.03)	11.2(11.9)	9.10(9.15)

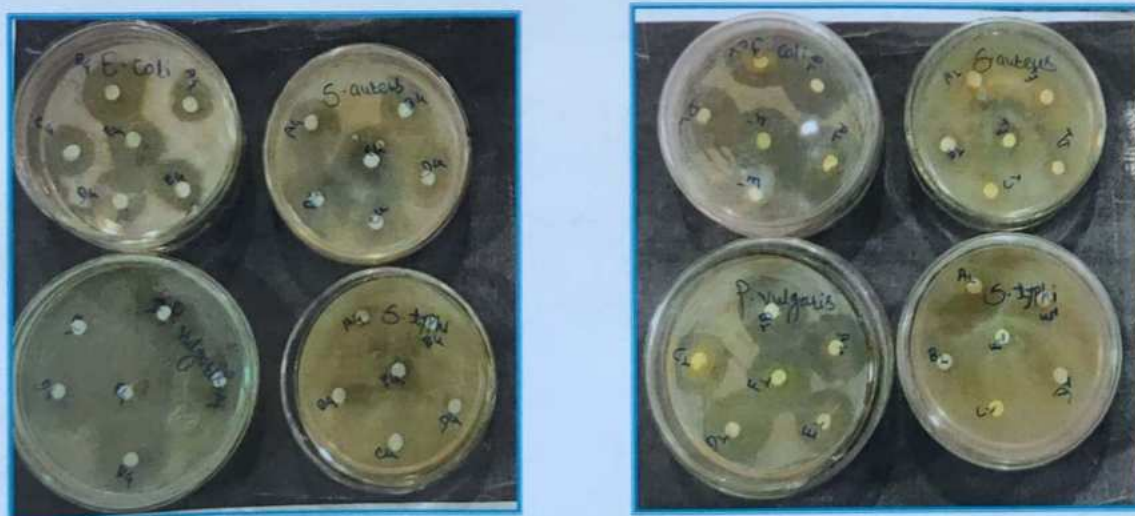
RESULTS AND DISCUSSION

Initially, acetohydrazide **1** and substituted aryl aldehydes **2a-d** were reacted in alcohol to produce intermediate acetohydrazide **3a-d** derivatives in good yield. This was then used in a cyclocondensation reaction with thioglycolic acid in DMF to produce new derivatives of 4-oxo thiazolidine **4a-d**. The -NH- stretch in the IR band of **3a** produced strong absorption bands at 3187 cm⁻¹ and 3493 cm⁻¹, while the C=N and C=O stretches produced bands at 1608 cm⁻¹ and 1680 cm⁻¹, respectively. Three protons of the -OCH₃ group connected to the aromatic ring are responsible for the singlet signal found in ¹H NMR of **3a** at 3.77 ppm. Another singlet at δ 11.69 ppm confirms one proton of the -NHCO- group, and at δ 8.15 ppm it displays a singlet for the proton of azomethine. A signal at the aliphatic region at δ 4.65 confirms that sulphur is connected to methylene. The molecular ion at (m/z) value at 551[M+1]⁺ is further confirmed by ESI-MS mass spectra, and elemental analysis, which yields expected results with molecular formulae C₂₉H₂₂N₆O₄S, further supports this. Every spectral data point above created structure **3a**. The IR spectrum of sample **4a** indicates a clear absorption band at 1655 cm⁻¹, attributed to the CO str. in thiazolidinone. Additionally, a stretch at 696 cm⁻¹ was noted for the C-S-C group, confirming the cyclization of carbohydrazone to thiazolidinone. The ¹H NMR spectrum of sample **4a** showed a singlet at the aliphatic region at δ 4.10

ppm, which was attributed to two proton attached to the -S-CH₂-CONH- group. A further singlet signal at δ 11.66 ppm confirmed one proton of the -CONH- group. A singlet at δ 3.38 ppm confirmed two protons of -CH₂- in the S-CH₂-CO- group. Finally, a notable singlet at δ 5.95 ppm was attributed to one proton of C2 in the thiazolidinone ring. The parent ion peak (m/z) in the ESI-MS spectra of sample 4a was observed at 625[M+H]⁺. This was confirmed by elemental analysis data, which indicated that the obtained data was in good agreement with the chemical formula, C₃₁H₂₄N₆O₅S₂.

ANTIMICROBIAL ACTIVITY

The whole novel synthesized heterocyclic compounds **4a-d** had been screened for their in-vitro antimicrobial activity using disc-diffusion method and compared with well-known commercial antibiotic used-Chloramphenicol. The Antimicrobial screening results were highlights were seen the **Table 1 and 2**.



Antimicrobial Images

From the results, it is indicated that these compounds tested were exhibited variable toxicity against different bacteria. Consequence of bioassay result, compound **4a**, **4b**, **4c** and **4d** have exhibited excellent activity against *S. aureus* and *P. vulgaris* followed by *E. coli*. The variation in toxicity of the compounds may be due to the amalgamation of thiazolidinone with the Substituted benzofuran,

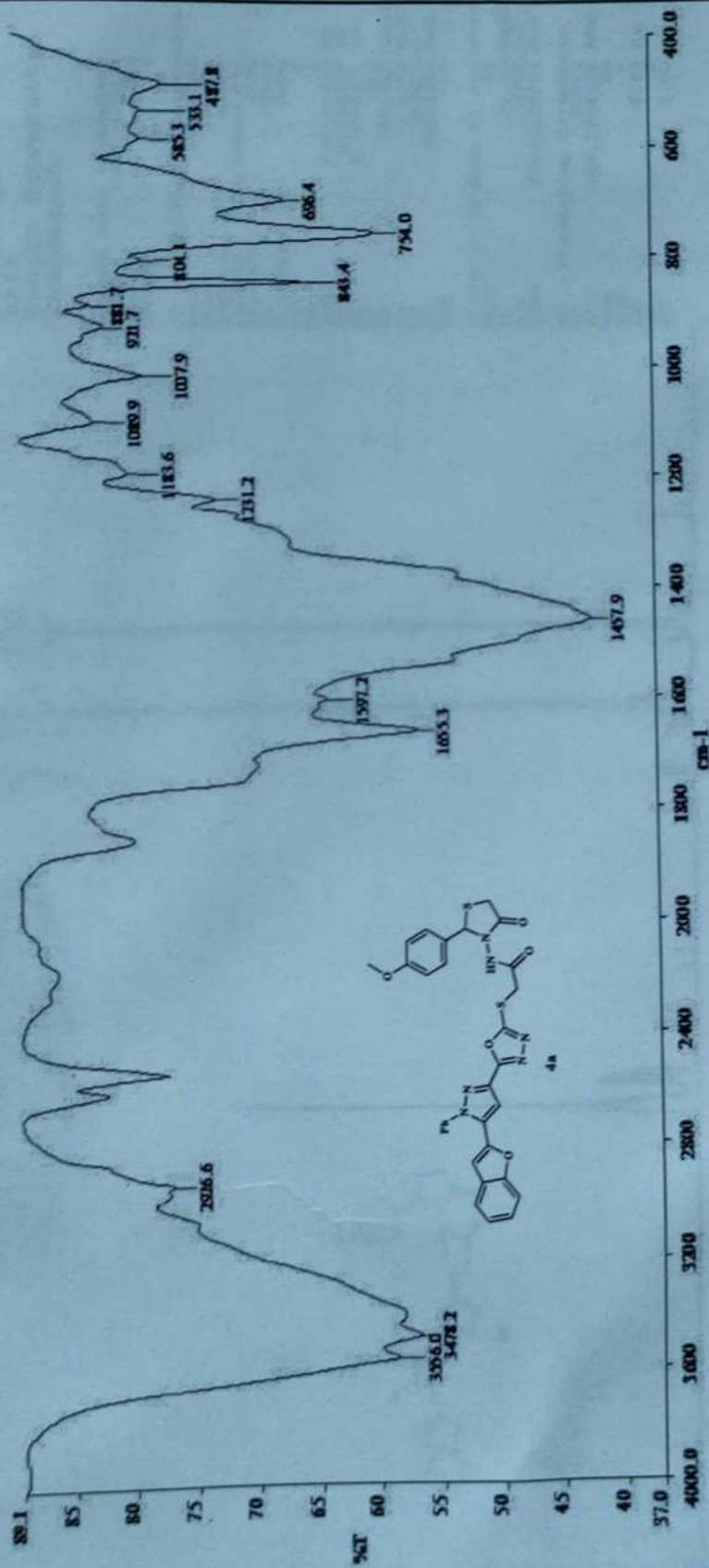
MOLECULAR DOCKING STUDY

In view of the above, to rationalize the exhibited antimicrobial activity by the title compds. and to have an idea about the molecular basis of their interactions Molecular docking study was performed using Autodock tools 1.5.7 package . In this context, the crystal structure file of Peptide deformylase E. coli PDB ID: 1G2A ²⁵ was obtained from the Protein Databank and the protein was prepared for the docking study. Docking was performed according to the standard protocol of Autodock tools 1.5.7 package²⁶, and the compds. were docked against the three-dimensional structure of E. coli PDF enzyme. The procedure for this study was done by the Autodock docking calculation. The default parameters of Autodock were used for docking and 10 docked conformations were generated for each compd. The energy calculations were performed using genetic algorithms and the outputs were exported to Discovery Studio 4.5 for the visual inspection of the binding modes and interactions of the compounds with amino acid residues at the pocket active site 27-28. Amino acid residues of the active pocket were GLU41 , GLU42, GLY43, I LE44, GLY45 , LEU46, GLN50, ILE86, GLU87, GLU88, GLY89, CYS90, LEU91, GLU93, PRO94, GLU95, ARG97, LEU125, ILE128, CYS129, HIS132, GLU133. The dock calculations and the hydrogen bond interactions shown in Table, 3 .

Table No: 3. Docking studies of 4-thiazolidinone Derivative (4a-d) against E. coli PDF enzym

Entry	Binding energy (kcal/mol)	Ligand Efficiency	H-bonds Residue-Amino Acid (H-A Distance)	Hydrophobic interaction Residue-Amino Acid (Distance)
4a	-15.53	-0.35	GLY89(2.60),GLU95(2.23), HIS7(2.39)	91LEU,94PRO,125LEU,128ILE,132HIS
4b	-15.31	-0.36	89GLY(2.54),95GLU(2.19)	91LEU, 94PRO,125LEU, 128ILE, 132HIS
4c	-15.06	-0.35	GLY89(2.54),GLU95(2.19)	91LEU(3.35),94PRO(3.75), 125 LEU (3.94), 128ILE(3.15),132HIS(3.64)
4d	-15.57	-0.31	2B VAL(3.41), 4B GLN (3.05)	3B LEU(3.23), 29A ARG(3.61), 29B ARG (3.29), 30B ILE(3.29),51A VAL (3.31), 52A ASP (3.65) , 53B ILE(3.11), 53B ILE(3.97)

RC SAIFF PU, Chandigarh



— Stish Kola-13.sp - 11/16/2017 - 9a-II

IR Spectra of Synthesized Compounds 4a

IR Spectrum of Synthesized Compound 4a

CONCLUSION

In conclusion, we have discussed here a novel series of derivatives of 4-thiazolidinone (**4a-d**). The series of chemicals that were shown were synthesized at respectable yields. Chemistries and spectroscopy were used to determine the structure and purity of freshly synthesized substances. The majority of the synthesised compounds showed good to moderate activity against specific strains of *S. aureus*, *P. vulgaris*, and *E. coli*, whereas *S. typhi* showed low activity.

ACKNOWLEDGEMENTS

The authors would also like to express their gratitude to Miss. Sonal Kurzekar and Miss. Joytsna Dahare for their invaluable support, as well as to The Principal the late M. G. Arts, Science, and Commerce College Armori, the, for his support and collaboration. The Directors of SAIF, Punjab University, Chandigarh, and FTIR, are gratefully acknowledged by the authors.

REFERENCE

1. Prabhakar, Y. S.; Solomon V. R.; Gupta M. K.; Kati S.B. QSAR studies on thiazolidine a biologically privileged scaffold, *Top Heterocycl Chem.*, **2006**, 4, 161-249.
2. Desai C. N.; Joshi V. V.; Rajpara M. K.; Makwana H. A. A new synthetic approach and in vitro antimicrobial evaluation of novel imidazole incorporated 4-thiazolidinone motifs, *Arabian J. of Chem.*, **2017**, 10, 589-599.
3. Idrees M.; Kola S.; Siddiqui N. J. Synthesis, characterization and antimicrobial Screening of some novel 5-(benzofuran-2-yl)-n'-(2-substituted-4-oxothiazolidin-3-yl)-1-phenyl-1hpyrazole-3-carboxamide derivatives, *Rasayan j. Chem.*, **2019**, 12(4), 1725-1733.
4. Kaminsky D.; Den Hartog G.J.M.; Wojtyra M.; Lelyukh M.; Gzella A.; Bast A. Antifibrotic and anticancer action of 5-ene amino/iminothiazolidinones, *Eur. J. Med. Chem.*, **2016**, 112, 180-95.
5. Kaur K.; Jain M.; Reddy R.; Jain R. Quinolines and structurally related heterocycles as antimalarials, *Eur. J. of Med. Chem.*, **2010**, 45, 3245-3264.
6. Gouvea D. P.; Vasconcellos A. A.; Berwaldt G.D.A.; Seixas Neto A.C.P.; Fischer G. 2-Aryl-3-(2-morpholinoethyl) thiazolidin-4-ones: Synthesis, anti-inflammatory in vivo, cytotoxicity in vitro and molecular docking studies, *Eur. J. of Med. Chem.*, **2016**, 118, 259-265.
7. Rawal R.K.; Tripathi R.; Katti S.B.; C. Pannecouque, Design, synthesis, and evaluation of 2-aryl-3-heteroaryl-1,3-thiazolidin-4-ones as anti-HIV agents, *Bioorg. Med. Chem.* **2007**, 15, 1725-1731.
8. Bhaumik A.; Chandra A. M.; Saha S.; Mastanaiah J.; Visalakshi T. Synthesis, characterization and evaluation of anticonvulsant activity of some novel 4-thiazolidinone derivatives, *Scholars Academic J. of Pharm.*, **2014**, 3, 128-32.

PROJECT WORK
ON
“Preparation of Hydroxyapatite from Animal Bones.”

*This Project report is submitted to GONDWANA UNIVERSITY, GADCHIROLI.
In partial fulfilment of the requirements for the award of the degree of*

**Master of Science
(Chemistry)**

By
Miss. Trupti Baliram Giradkar

Under Supervision of
Dr. Naresh Bansod
Assistant Professor,
Department of Chemistry



Post-Graduation Department of Chemistry
MAHATMA GANDHI ARTS, SCIENCE AND LATE N.P. COMMERCE
COLLEGE, ARMORI.
Gadchiroli, (Maharashtra)- 441208

2023-2024

PROJECT WORK

ON

“Preparation of Hydroxyapatite from Animal Bones.”

*This Project report is submitted to **GONDWANA UNIVERSITY, GADCHIROLI.**
In partial fulfilment of the requirements for the award of the degree of*

**Master of Science
(Chemistry)**

By

Miss. Trupti Baliram Giradkar

**Under Supervision of
Dr. Naresh Bansod
Assistant Professor,
Department of Chemistry**



Post-Graduation Department of Chemistry
MAHATMA GANDHI ARTS, SCIENCE AND LATE N.P. COMMERCE
COLLEGE, ARMORI.
Gadchiroli, (Maharashtra)- 441208

2023-2024

Declaration

I hereby declare that the Project work entitled "**Preparation of Hydroxyapatite from Animal Bones**". Submitted here in has been carried out by me in the Department of Chemistry of Mahatma Gandhi Arts, Science and N.P. Commerce College, Armori, This work is original and has not been submitted earlier as a whole or in part for the award of any degree of Master of Science.

The project work, submitted for the award of the degree of "**Master of Science in Chemistry**" of **Gondwana University, Gadchiroli** is original and has not been submitted earlier as a whole or in part to any other university or institution for the award of any degree/diploma or certificate.



Miss. Trupti Baliram Giradkar

Date: 10/04/2024

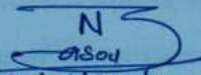
Place: Armori.

Certificate

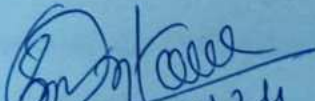
This project work entitled "Preparation of Hydroxyapatite from Animal Bones."

Submitted by **Trupti Baliram Giradkar**, for the award of Master of Science in Chemistry

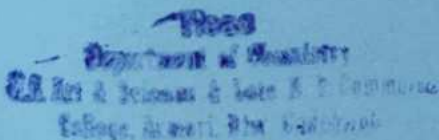
has been carried out under my supervision by **Dr. Naresh D. Bansod**, Department of Chemistry in Mahatma Gandhi Arts, Science and N.P. Commerce College, Armori, awarded by Gondwana University,. The work is compressive complete and fit for evaluation.


10/04/2024

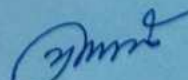
Dr. Naresh D. Bansod,
Assistant Professor
Department of Chemistry,


10/4/24

Forwarded by -
Mr. S. M. Sontakke
Head Department of Chemistry
M. G. College Armori


Department of Chemistry
M.G. Arts & Sciences & Late N.P. Commerce
College, Armori, Dist. Gadchiroli


PRINCIPAL
M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli


Dy-S.M. Murkey

Acknowledgement

I express my deep sense of gratitude and sincere thanks to my supervisor **Dr. Naresh Bansod**, Assistant Professor, Department of Chemistry, **Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori** for his valuable guidance, constant encouragement, and keen interest in the development of this work.

I am very thankful to the principal of our College Dr. Lalsingh Khalsa for giving me permission to approach various steps of the methodology. I am deeply thankful to Mr. **S. M. Sontakke**, Head, P. G. Department of Chemistry, Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori, other faculty of the department of Chemistry for their cordial support, valuable information, and guidance, which helped me in completing this task through various stages.

I truly appreciate the continuous love, encouragement, support, and understanding from my family, my all friends during my research study. They are my strength to strike for excellence. Without their support, I could not finish my project smoothly.

Miss. Trupti Baliram Giradkar

CHAPTER NO.	CONTENT	PAGE NO.
	Abstract	
1.	Introduction	
2.	Material and Methods	
	2.1 Collection and Preparation of Animal Bones	
	2.2 Demineralisation	
	2.3 Purification	
	2.4 Precipitation	
	2.5 Calcination	
3.	Characterisation Techniques	
4.	Result and Discussion	
	4.1 Application	
	4.2 Future Direction	
	4.3 Optimization of Process Parameters	
	4.4 Mechanical Testing	
	4.5 Biological Evaluation	
	4.6 Environmental Impact Assesment	
5.	Conclusion	
6.	Literature Review	
7.	Reference	

Abstract

This study describes the effect of sintering temperature on the microstructural, calcium/phosphorus (Ca/P) ion ratios and mechanical properties of non-separated biowastes processed hydroxyapatite (HAp) prepared through a low cold compaction protocol. The HAp was produced by a sintering temperature of 900 degree celcius. Furthermore, Hap sintered at 900 degree celcius was subjected to sintering temperatures of 1000 and 1100 degree celcius. The structural and Morphological evolution of the fabricated biomaterials were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM) equipped with electron dispersive X-ray analysis (EDX) respectively. Uniaxial compaction using a pressure of 500 pa was used to produce rectangular shaped pellets to investigate the influence of sintering temperature on the mechanical properties of the produced pellets. From XRD analysis, it was found that hydroxyapatite derived from the biowastes showed good thermal stability and did not exhibit phase instability with traces of other calcium phosphates. The SEM micrographs showed microporous structure of the biomaterials and an increase in temperature reduced the porosity and enhanced the mechanical properties. It was also noticed that the trend of transformation of the average shape of pores was from strongly flattened to round at higher sintering temperatures. Electron dispersive X-ray analysis (EDX) revealed that the atomic Ca/P ratios of the as-sintered HAp specimens ranged from 1.58 to 1.79 for sintering temperatures of 900–1100 degree celcius. The synthesized hydroxyapatite powder showed inclusion of the fluorapatite phase at sintering temperature of 1000 degree celcius with a reduction in the crystallite size. For both scenarios (sintering temperature and compaction pressure), a consistent trend in mechanical properties (microhardness, fracture toughness and Young's modulus) is noticed at every point of measurement except for compressive strength. The reduction in compressive strength when compaction pressure was applied could be as a result of the stress induced in the HAp powders during compaction which may have made it more susceptible to cracks. The hardness value obtained for the synthesized hydroxyapatite pellets is in the range of that of actual human femoral cortical bone.

1. Introduction

Some studies have identified abattoirs as sources of pollution because they are known for generating mostly non-separated organic solid and liquid wastes. These biowastes (animal bones) spills are a source of environmental hazards through the contamination of air and also surface and ground waters. Therefore, efforts to valorise these biowastes are a good approach to mitigating these problems. Producing biomaterials from these biowastes has proven to be a useful approach and it has been reported that natural biomaterials have better mechanical properties during long term evolutions. Therefore investigations of microstructural evolutions are very important in developing materials with superior mechanical properties.

A well-known biomaterial, hydroxyapatite (HAp), is a calcium phosphate and recognized to be osteoconductive and bioactive due to its very close similarity to the natural bone mineral. In recent works, HAp has been derived from both natural (mostly biowastes) and synthetic sources by using several processing routes. A lot of works has been devoted to the development of HAp from natural sources like fish bones, porcine bones, eggshells and seashells. The most popular method to synthesize HAp is sintering. Stea and co-workers reported that HAp subjected to sintering process forms very coherent bonds with bone tissues. HAp synthesis techniques have been developed over decades and can be sub categorized into: sintering in conventional muffle furnaces, microwave sintering and the spark plasma method.

Recently, Beaufile and co-workers used a template-assisted electro-deposition method to demonstrate that HAp nanowires production with a well-controlled morphology, size and high aspect ratio can be synthesized with improved biological and mechanical properties. The gradient of mechanical properties for sintered HAp varies in compression and tension. Sintering of HA bioceramics employed for implant-coating or bone fillers affects the porosity, grain size, densification, calcium/phosphorus (Ca/P) ratio and can alter the mechanical properties of the resulting bioceramics. It has also been reported that the mechanical properties of HAp is correlated with the grain sizes and the bonding between the grains, and the pore shapes. The sintering temperature is a major factor which influences all of the mentioned parameters. Microstructural properties can be influenced by thermal gradients during sintering. Lower sintering temperatures can be adopted to ensure better bioactivity for HAp scaffolds and higher sintering temperature regimes and dwell times can be useful in enhancing mechanical properties. It has been suggested that improvement in mechanical properties of HAp can be improved when there is minimal grain growth during sintering.

2. Materials and Methods:

I. Collection and Preparation of Animal Bones:

- Selection of suitable animal bones
- Cleaning and sterilization process

II. Demineralization:

- Acid treatment method
- Enzymatic treatment method
- Comparison of demineralization techniques

III. Purification:

- Filtration process
- Washing steps to remove impurities

IV. Precipitation:

- Preparation of calcium phosphate solution
- Control of pH and temperature for precipitation
- Formation of hydroxyapatite precipitates

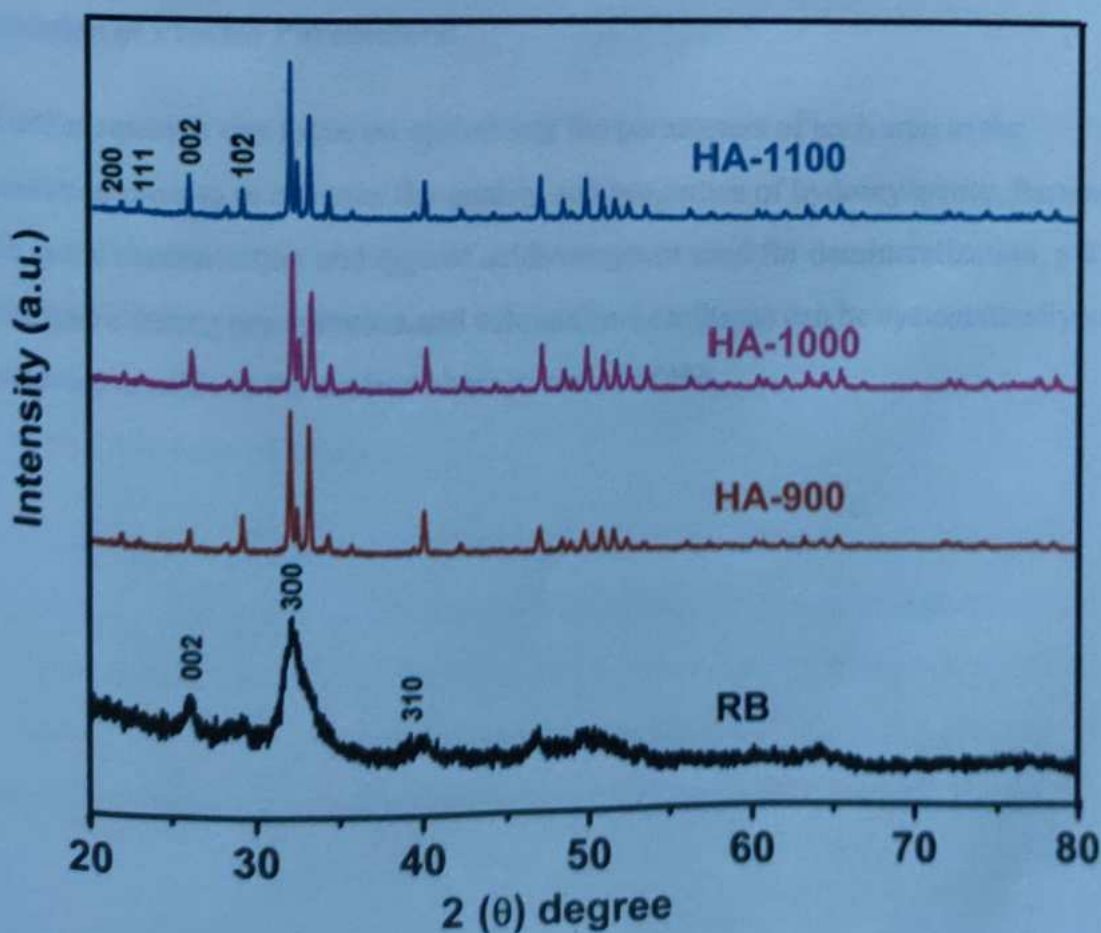
V. Calcination:

- Purpose of calcination
- Temperature and duration optimization
- Effects of calcination on HA properties

3. Characterization Techniques:

Characterization of prepared hydroxyapatite using techniques such as X-ray diffraction (XRD), Fourier- transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). In addition to X-ray diffraction (XRD), Fourier-transforminfrared spectroscopy (FTIR), and scanning electron microscopy (SEM), other characterization techniques such as transmission electron microscopy (TEM), energy- dispersive X-ray spectroscopy (EDS), and atomic force microscopy (AFM) can be employed to analyze the properties of hydroxyapatite derived from animal bones.

- Analysis of HA properties including crystallinity, purity, morphology, and particle size
- Discussion on the feasibility and effectiveness of the proposed method compared to conventional synthesis technique These techniques provide valuable insights into the Structure, composition, and surface morphology of HAnanoparticles.



4. Results and Discussion:

Applications:

- Potential biomedical applications of hydroxyapatite derived from animal bones, including bone substitutes, dental implants, and drug delivery systems
- Comparison of HA produced from animal bones with commercially available HA

Future Directions:

- Optimization of process parameters for improved HA properties
- Investigation of additional characterization techniques
- Exploration of novel applications and modifications of HA derived from animal bones

Optimization of Process Parameters:

- Further research can focus on optimizing the parameters of each step in the preparation process to enhance the quality and properties of hydroxyapatite. Parameters such as the concentration and type of acids/enzymes used for demineralization, pH and temperature during precipitation, and calcination conditions can be systematically varied and studied to achieve the desired characteristics of HA.

Environmental Impact Assessment:

- Assessing the environmental impact of hydroxyapatite production from animal bones is essential to ensure sustainability and minimize ecological footprint. Life cycle assessment (LCA) and eco-design principles can be applied to evaluate the environmental impacts associated with raw material extraction, energy consumption, waste generation, and disposal/recycling of by-products.

5. Conclusion:

- The preparation of hydroxyapatite from animal bones offers a promising and sustainable approach for producing biocompatible and bioactive materials with diverse biomedical applications. Further research and development efforts are needed to optimize the synthesis process, characterize the properties of HA, evaluate its biological performance, and scale up production for commercialization while considering environmental sustainability and regulatory requirements.

Acknowledgments:

- Acknowledge any funding support, collaboration with research institutions or industry partners, and contributions from colleagues, advisors, or mentors who have supported the dissertation project.

6. Literature Review:

- Overview of hydroxyapatite and its importance in biomedical applications
- Synthetic methods of hydroxyapatite production
- Advantages and challenges of using animal bones as a source for HA
- Previous research on the preparation of HA from animal bones

7. References:

1. ELSEVIER research paper on Materials Chemistry and Physics.
2. ELSEVIER research paper on Material Today and Proceeding.
3. www.google.com

**A
PROJECT REPORT
ON**

**"Chemical Analysis of Water Quality in East Vidarbha Region,
Maharashtra, INDIA."**

**This Project Report Is Submitted To
GONDWANA UNIVERSITY, GADCHIROLI.**

**In Partial Fulfilment Of The Requirements For The Award Of
The Degree Of
Master Of Science (Chemistry)**

By

Mr. Pankaj Jagdish Rahele

Under Supervision of

**Dr. Naresh Bansod
Assistant Professor,
Department of Chemistry**



**MAHATMA GANDHI ARTS, SCIENCE AND
LATE N.P. COMMERCE COLLEGE, ARMORI.**

2023-2024

A
PROJECT REPORT
ON
“**Chemical Analysis of Water Quality in East Vidarbha
Region, Maharashtra, INDIA.**”

This Project report is submitted to **GONDWANA UNIVERSITY, GADCHIROLI.**
In partial fulfilment of the requirements for the award of the degree of

**Master of Science
(Chemistry)**

By

Mr. Pankaj Jagdish Rahele

Under Supervision of

Dr. Naresh Bansod
Assistant Professor,
Department of Chemistry



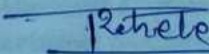
**MAHATMA GANDHI ARTS, SCIENCE AND LATE N.P. COMMERCE COLLEGE,
ARMORI.**

2023-2024

Declaration

I hereby declare that the Project work entitled "**Chemical Analysis of Water Quality in East Vidarbha Region, Maharashtra, INDIA**". Submitted here in has been carried out by me in the Department of Chemistry of Mahatma Gandhi Arts, Science and N.P. Commerce College, Armori, This work is original and has not been submitted earlier as a whole or in part for the award of any degree of Master of Science.

The project work, submitted for the award of the degree of "**Master of Science in Chemistry**" of **Gondwana University, Gadchiroli** is original and has not been submitted earlier as a whole or in part to any other university or institution for the award of any degree/diploma or certificate.

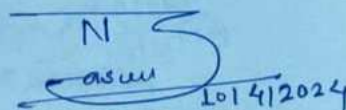

10/04/2024
Mr. Pankaj Jagdish Rahele

Date: 10/04/2024

Place: Armori.

Certificate

This project work entitled “**Chemical Analysis of Water Quality in East Vidarbha Region, Maharashtra, INDIA.**” Submitted by **Pankaj Jagdish Rahele**, for the award of Master of Science in Chemistry has been carried out under my supervision by **Dr. Naresh D. Bansod**, Department of Chemistry in Mahatma Gandhi Arts, Science and N.P. Commerce College, Armori, awarded by Gondwana University,. The work is compressive complete and fit for evaluation.



Dr. Naresh D. Bansod,
Assistant Professor
Department of Chemistry,

Forwarded by –

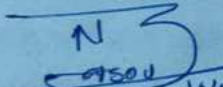
Mr. S. M. Sontakke

Head Department of Chemistry

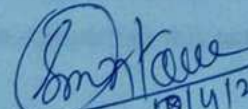
M. G. College Armori

Certificate

This is to certify that the work presented in this project "Chemical Analysis of Water Quality in East Vidarbha Region, Maharashtra, INDIA." the own work of Mr. Pankaj Jagdish Rahele conducted in the Department of Chemistry, Mahatma Gandhi Arts, Science & Late N.P.Commerce College , Armori , under the guidance of Dr. Naresh D. Bansod. This work has not been submitted earlier to my University/ Institution for any diploma or degree.


16/04/2024

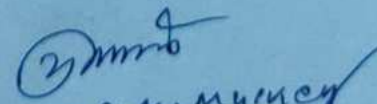
Dr. Naresh D. Bansod,
Assistant Professor
Department of Chemistry,


10/4/24

Mr. S. M. Sontakke,
Head, Department of Chemistry



Dr. L. H. Khalsa
Principal
Mahatma Gandhi Arts, Science & Late
N.P. Commerce College, Armori,
ARMOR, Dist. Gadchiroli
Dist. Gadchiroli

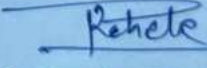

Dr. S. M. Muncy

Acknowledgement

I express my deep sense of gratitude and sincere thanks to my supervisor **Dr. Naresh Bansod**, Assistant Professor, Department of Chemistry, **Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori** for his valuable guidance, constant encouragement, and keen interest in the development of this work.

I am very thankful to the principal of our College **Dr. Lalsingh Khalsa** for giving me permission to approach various steps of the methodology. I am deeply thankful to **Mr. S. M. Sontakke**, Head, P. G. Department of Chemistry, Mahatma Gandhi Arts and Science & Late N. P. Commerce College Armori, other faculty of the department of Chemistry for their cordial support, valuable information, and guidance, which helped me in completing this task through various stages.

I truly appreciate the continuous love, encouragement, support, and understanding from my family, my all friends during my research study. They are my strength to strike for excellence. Without their support, I could not finish my project smoothly.


10/04/2024
Mr. Pankaj Jagdish Rahele
(M.Sc. Chemistry)

INDEX

Sr. No.	CONTENT
	Abstract
1	Introduction
2	Study Area
	2.1 Location Tracking
3	Material and Method
	3.1 Sample Collection
	3.2 Determination of Water Quality
	3.3 Testing Methods
	3.3.1 Description
	3.3.2 pH
	3.3.3 Chlorides
	3.3.4 Total Alkalinity
	3.3.5 Total Dissolved Solids
	3.3.6 Calcium
	3.3.7 Sulphates
	3.3.8 Total Hardness
4	Creation and Database
	4.1 Generation of Graphs
5	Disusion and conclusion

Abstract:

Assessment of water quality of drinking water supplies has always been paramount in the field of environmental quality management. Groundwater and RO (Reverse Osmosis) water quality villages from four districts from Vidarbha region, Maharashtra, INDIA having same geographical area i.e. (Amgaon) Gadchiroli, (Barvha) Bhandara, (Bramhapuri) Chandrapur and (Bondgaon) Gondia has a special significance and needs greater attention of all concerned since it is the only major source for domestic consumption.

In this work we have estimated the ground water and RO water quality of above four villages (from different Districts) having same geographical area which is located on the Vidarbha region of Maharashtra, INDIA. Each sample collected for above villages from the bore wells and Treated R.O. Water; the samples were analysed using standard procedures in the laboratory.

The work gives general introduction with water quality and Indian water scenario and the major reasons for poor quality of water. Since the study is supported by the concept that 'water quality has a major health impact', a brief statement about medical geography is also included.

Keywords: *Ground water, Water (Reverse Osmosis), Water Quality Parameters, Quality measures, Water Testing's.*

1. Introduction:

The availability of a water supply adequate in terms of both quantity and quality is essential to human existence. The demand for water has increased over the years and this has led to water scarcity in many parts of the world. The situation is aggravated by the problem of water pollution or contamination.

India is heading towards a freshwater crisis mainly due to improper management of water resources and environmental degradation. This leads to lack of access to safe potable water supply to millions of people. This freshwater crisis is already evident in many parts of India, varying in scale and intensity depending mainly on the time of the year. According to WHO organization, about 80% of all the diseases in human beings are water born. Further the groundwater, and the pollutants it may carry move with such a low velocity that it may take considerable time for the contaminants to move away from the source of pollution and also degradation in the groundwater quality may remain undetected for years. Once the groundwater is contaminated, its quality cannot be restored by arresting the pollutants from the source.

It therefore becomes imperative to regularly monitor the quality of groundwater and to devise ways and means to protect it. Water quality index is one of the most effective tools to communicate information on overall quality status of water to the concerned user community and policy makers. Thus, it becomes an important parameter for the assessment and management of groundwater.

The purpose of the present study is to estimate the groundwater quality in the Vidarbha region for water resources problems for assessing water quality, determining water availability, preventing flooding, understanding the natural environment, and managing water resources on a local or regional scale.

2. Study Area:

Vidarbha Region is located on the east of Maharashtra, India. The Villages selected for sample collection all are from nearby districts as shown as below Table 1.

Table 1. The Villages selected for sample collection all are from nearby districts.

Sr. No.	Study Area	District	Location
1	Amgaon (Tahsil-Desaiganj)	Gadchiroli	20°38'37.1"N 79°57'14.5"E
2	Barvha (Tahsil-Lakhandur)	Bhandara	20°51'10.5"N 79°51'40.6"E
3	Bramhapuri (Tahsil- Bramhapuri)	Chandrapur	20°36'48.3"N 79°51'58.1"E
4	Bondgaon (Tahsil- Arjuni/Mor.)	Gondia	20°47'18.4"N 80°09'08.9"E

The above districts are rich and varied in its culture. People in this majorly depend upon ground water for drinking and other purposes. For the past few years, these districts are facing a severe water scarcity due to rapid growth of population. Water quality is a major issue in this fast growing world. Water quality becomes a problem due to population explosion, socio-economic growth and poor management of natural resources in the 21st century.

3. Materials & Methods:

3.1 Sample Collection:

The ground water samples are collected manually from the bore wells and after treatment by R.O. (Reverse Osmosis). The samples were analysed using standard procedures in the laboratory. Each 2 samples are collected per location one for ground water (i.e., Borewell) and other for RO plant Water. The list of samples collected was given in Table 2.

Table 2. The list of samples collected from four district

Sr. No.	Study Area	District	Sample collected (Quantity no.)	
			Ground Water	RO Water
1	Amgaon (Tahsil-Desaiganj)	Gadchiroli	1	1
2	Barvha (Tahsil-Lakhandur)	Bhandara	1	1
3	Bramhapuri (Tahsil- Bramhapuri)	Chandrapur	1	1
4	Bondgaon (Tahsil- Arjuni/Mor.)	Gondia	1	1

The Parameters, which are analysed during water analysis, are pH, chlorides, Total Alkalinity, Total Dissolved Solids, Calcium, Sulphates and Total Hardness.

3.2 Determination of Water Quality:

We determine the quality of drinking water by comparison with the standards regulated by the Bureau of Indian Standards Specification for Drinking Water as follows:

Table 3. Specification for Drinking water as per Bureau of Indian Standards

Sr. No.	Parameters	Acceptable Limit	Permissible Limit
1	Description	A Clear Colourless, Odourless Liquid.	A Clear Colourless, Odourless Liquid.
2	pH	6.5 – 8.5	No relaxation
3	Chlorides	250 mg/L	1000 mg/L
4	Total Alkalinity	200 mg/L	600 mg/L
5	Total Dissolved Solids	500 mg/L	2000 mg/L
6	Calcium	75 mg/L	200 mg/ L
7	Sulphates	200 mg/L	400 mg/L
8	Total Hardness	200 mg/L	600 mg/L

4. Creation of Database:

The study is carried out with the help of Field data; Field work was conducted and groundwater samples were collected from above mentioned villages of Vidarbha Region with the help of the map. These samples were tested using standard procedures in the laboratory and the results were tabulated in an excel worksheet.

The Water Quality for each village was determined. The water quality data thus obtained forms the attribute database from the present study.

For greater understanding of derived data and for comparison with the well-established standards. It is necessary to give graphical representation of water quality parameter for better and valued presentation.

Village	Parameter	Value	Unit	Standard	Remarks
Chandrapur	Hardness	150	mg/L	200	Good
Chandrapur	pH	7.5		6.5-8.5	Good
Chandrapur	Dissolved Oxygen	8.5	mg/L	7.0	Good
Chandrapur	Calcium	120	mg/L	150	Good
Chandrapur	Magnesium	30	mg/L	50	Good
Chandrapur	Total Solids	200	mg/L	300	Good
Chandrapur	Chloride	100	mg/L	250	Good
Chandrapur	Sulfate	50	mg/L	100	Good

The map and attribute database generated with the help of GIS software is shown in the figure below.

5. Results and Discussion:

The variations of the physicochemical characteristics along with Water Quality of the ground water and RO Water in the different villages of in four districts were presented through. The quality of ground water varies from place to place. It depends up on both the surface and subsurface characteristics. Presence of landfills, open dump, usage of fertilizers, disposal of industrial wastes, etc., changes the quality of ground water. Even at the same location, from seasons to seasons the quality of ground water varies. The variations of water quality were discussed below.

1. pH:

The pH of Borwell water in villages like Bondgaon and Amgaon are acidic in nature as reference to BIS limit, and other samples are well within the desirable limit of drinking water standards. But Borwell water of those Villages in this region are having pH less than 6.5 which may cause tuberculation of water supply systems. Corrosion and metallic taste are the peculiarities of lower pH shown in Fig. 2

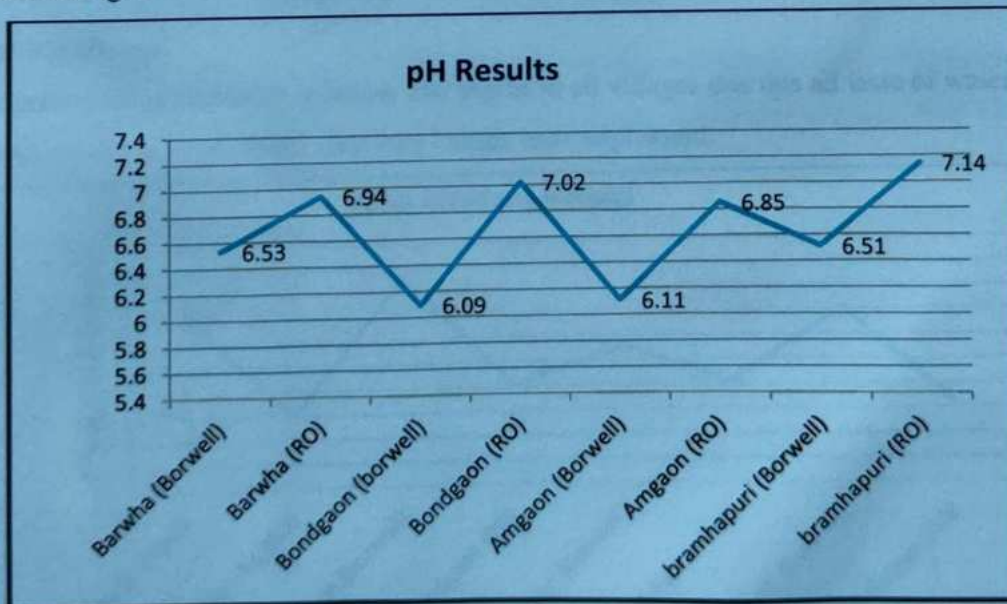


Figure 2. The graph is plotted pH verse sample code

5. CONCLUSION

The present work reveals whether the water is suitable or unsuitable for drinking purposes in the area. The major conclusions drawn from the study were given below.

- It is observed that the all villages the ground water contains more values of each parameter due to this causes human being disease and various complications.
- It is found that all Villages ground water hardness is relatively high requiring use of RO water.
- RO Water has fewer amounts of impurities best water to use in daily routine.
- From the foregoing observations of physic-chemical in the area exceed the BIS limit for drinking water, the inhabitants are of opinion that water quality became poor. So the water quality in the area is mainly affected due to relatively change in environmental pollution and other causes.
- The high level of certain parameters causes some diseases. Certain locations experience high level of contamination. They are due to the influence of local conditions. Generally nutrients show low level that means that there is no chance for the condition of eutrophication. The study concludes monsoon water quality is comparatively good and post-monsoon shows poor water quality in the study area.

The analysis suggests that the groundwater of the area needs some degree of treatment before consumption. The study helps us to understand the quality of the water as well as to develop suitable management practices to protect the ground water resources.

6. REFERENCES:

1. Assessment and Mapping of Ground Water Quality Using Geographical Information Systems -K. SUNDARA KUMAR, P. SUNDARA KUMAR, DR. M. J. RATNAKANTH BABU & DR. CH. HANUMANTHA RAO.
2. A Geographical Analysis of Water Quality in Kalady Panchayat, Kerala, India; Lancelet.T.S. a, J. Brilla Balsam.
3. Bureu of Indian Standard Specification for Drinking Water.
4. FSSAI Manual for Methods of Analysis of Food- Water.
5. An Introduction to Water Quality Analysis, Ritabrata Roy.
6. Methods for collection and analysis of water samples, by FH Rainwater.
7. A Study on the Water Quality of NIT Rourkela – ethesis, by S Frimal.

**A
PROJECT REPORT
ON
"Synthesis and Characterization of Nitrile Butadiene
Rubber - Coconut Husk Composites for Oil and Gas
Applications."**

**This Project Report is Submitted to
GONDWANA UNIVERSITY, GADCHIROLI.**

**In Partial Fulfilment of The Requirements for The Award of
The Degree of
Master of Science (Chemistry)**

**By
Ms. Martina Rajendra Ghonmode**

**Under Supervision of
Dr. Naresh Bansod
Department of Chemistry**



**MAHATMA GANDHI ARTS, SCIENCE AND
LATE N.P. COMMERCE COLLEGE, ARMORI.**

2023-2024

A PROJECT

REPORT

ON

Synthesis and Characterisation of Nitrile Butadiene Rubber - Coconut

HuskComposites for Oil and Gas Applications

A PROJECT SUBMITTED TO

GONDWANA UNIVERSITY, GADCHIROLI

FOR THE DEGREE

MASTER OF

SCIENCE

(CHEMISTRY)

BY

Ms. MARTINA RAJENDRA GHONMODE

(M.Sc. IV SEMESTER)

UNDER THE SUPERVISION OF

Dr. N. D. BANSOD



**MAHATMA GANDHI ARTS, SCIENCE AND LATE N.P.
COMMERCE COLLEGE, ARMORI**

SESSION 2023-24

DECLARATION

I am Martina Rajendra Ghonmode, research scholar, Chemistry Department, University of Gondwana Gadchiroli hereby declare that this research work entitled "*Synthesis and Characterization of Nitrile Butadiene Rubber - Coconut Husk Composites For Oil and Gas Applications*" For M.Sc. Chemistry was done by me and performed at the Department of Chemistry, Mahatma Gandhi College, Armori. This research work has neither been submitted nor presented for any reason, neither by me nor by any other student, at this university.



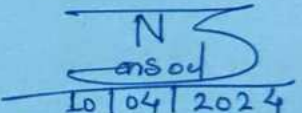
Martina Rajendra Ghonmode

(M.Sc. IV Semester)

CERTIFICATE

This is to certify that the project entitled "*Synthesis and Characterisation of Nitrile Butadiene Rubber - Coconut Husk Composites For Oil and Gas Application*" is an authentic record of my research work carried out as a requirement for the award of the degree of Master of Science (Chemistry) at Gondwana University Gadchiroli, under the guidance of Dr. N. Bansod Asst. Prof. Department of Chemistry, M. G. College, Armori during the period of December 2023 to April 2024.

It is certified that the above statement made by the student is correct to the best of my knowledge and belief


10/04/2024
Dr. Naresh D. Bansod

Date: 10/04/2024

Place: Armori.



CERTIFICATE

This is to certify that the work presented in this project "*Synthesis and Characterisation of Nitrile Butadiene Rubber - Coconut Husk Composites For Oil and Gas Application*" the own work of **Ms. Martina Rajendra Ghonmode** conducted in the Department of Chemistry, Mahatma Gandhi Arts, Science & Late N.P. Commerce College, Armori, under the guidance of **Dr. N. D. Bansod**. This work has not been submitted earlier to my University/Institution for any diploma or degree.

Prof. S. M. Sontakke

Head of the Department of Chemistry

Mahatma Gandhi College, Armori

Dr. N. D. Bansod

Supervisor

Mahatma Gandhi College, Armori

Forwarded By

Dr. L.H. Khalsa
PRINCIPAL

M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli

Mahatma Gandhi Arts, Science & Late N.P. Commerce College,

Armori, Dist. Gadchiroli.

10/04/2024

ACKNOWLEDGEMENT

I wish to record my heartfelt thanks to **Dr. N. D. Bansod Asst. Prof.** Department of Chemistry of Mahatma Gandhi College Armori. This project was possible only because of his active guidance and suggestions for this project problems, constructive criticism, and sincere gratitude for providing all possible facilities in the laboratory for my project. I wish to tender my thanks to **Dr. S. S. Kola Asst. Prof.** Department of Chemistry, Mahatma Gandhi College Armori, for guiding this project. I would like to express my sincere thanks to **Prof. S. M. Sontakke** Head of the Department of Chemistry for encouragement.

I would like to express my thanks to my parents for providing moral support and encouragement and to our colleagues for having stood by us during the duration of the project. I thank the almighty for having given me the strength and ability to complete my work with honesty.



Martina R. Ghonmode

M.Sc. IV Semester

ABSTRACT

Filler is one of the major additives in rubber components to increase their physical properties. There are various types of fillers are used in rubber compounds like rice dusk, and waste from sugar cane other bio-based waste fillers are wheat straw corn/cotton/sunflower stalks, oat straw, orange/apple peels, argan nut shell, sea shell, cuttlebone, sawdust, eggshell powder. But here we see about the coconut husk powder which is the cheapest filler. It is low cost, renewable, high specific strength, and environmentally friendly. Nitrile Butadiene Rubber (NBR) an oil-resistant synthetic rubber proceeds from a copolymer acrylonitrile and butadiene. The NBR is nothing but a synthetic rubber against chemical oil and fuel. The nitrile rubber completely differs from the natural rubber. With the help of NBR, the accidents of the oil and gas industry is reduced and it is used for fuel hoses, gaskets, rollers, and other products in which oil resistance is required. Here we can see NBR is used for oil and gas industries but adding fillers such as coconut husk powder, whether they change their high mechanical, chemical, and strength properties, improve the composite characteristics, properties making suitable applications, corrosion resistance, improve tensile strength and flexibility.

1. INTRODUCTION AND LITERATURE SURVEY

Over the last thirty years, composite materials, plastics, and ceramics have been the dominant emerging engineering materials. The volume and number of applications of composite materials have grown steadily, penetrating and conquering new markets relentlessly [1]. Agricultural wastes which include shells of various dry fruits, rice husks, wheat husks, straws, and hemp fiber can be used to prepare fiber-reinforced polymer composite for commercial use. There is a great opportunity to develop new bio-based products. Natural fibers are of basic interest due to their many advantages. from the point of weight and fiber-matrix adhesion. Existing polymers are mainly blended with different materials with the aim of cost reduction and tailoring the product for specific applications. Environmental regulations and ethical concerns have triggered the search for environmentally friendly materials. A pressing issue in Nigeria today, is the recycling of waste products and other agricultural by-products suitable for the invention and characterization of new materials. Annually, approximately 33 billion coconuts are harvested worldwide with only 15% of these coconuts being utilized for fibers and chips [2-3]. This suggests that there is considerable room to reduce this kind of environmental pollution and enhance the efficiency of using natural resources.

Natural fibers such as cotton, flax, and sisal have been used since historical times in a large variety of products, ranging from clothes to house roofing. Today, these fibers are appraised as environmentally correct materials owing to their biodegradability and renewable characteristics. Moreover, lignocellulosic fibers are neutral concerning the emission of CO₂ [1]. This is an extremely important aspect and puts lignocellulosic fibers as materials in context with the Kyoto Protocol.

2. MATERIALS AND METHOD

Materials:

A brief description of the materials used in this work is described in the following section.

2.1 Acrylonitrile butadiene rubber

Acrylonitrile butadiene rubber, also termed nitrile rubber, Buna-N, and Perbunan, is an industrially important synthetic rubber and it is a family of unsaturated copolymers of acetonitrile and various butadiene monomers (1,2-butadiene and 1,3-butadiene) (Figure 2.3). Although its physical and chemical properties vary depending on the polymer's composition of nitrile content, this form of synthetic rubber is unusual in being generally resistant to oil, fuel, and other chemicals. More the nitrile content within the polymer, the higher the resistance to oils but the lower the flexibility of the material.

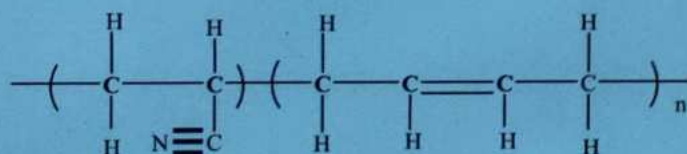


Figure 2.1.1: Structural unit of acrylonitrile butadiene rubber.

It is used in the automotive and aeronautical industry to make fuel and oil handling hoses, seals, grommets, and self-sealing fuel tanks since ordinary rubbers cannot be used.

NBR's ability to withstand a range of temperatures from -40°C to 108°C (-40 to 226°F) makes it an ideal material for aeronautical applications. NBR is also used to create molded goods, footwear, adhesives, sealants, sponges, expanded foams, and floor mats. Its resilience makes NBR a useful material for disposable lab, cleaning, and examination gloves. It is also used in the nuclear industry to make protective gloves. NBR is more resistant to oils and acids than natural rubber and has superior strength, but inferior flexibility.⁵ Nitrile gloves are therefore more puncture-resistant than natural rubber gloves, especially if the latter are degraded by exposure to chemicals or ozone. NBR is less likely to cause an allergic reaction than natural rubber.

NBR used in the present study is, KNB 35L (acrylonitrile content is 34%) and was obtained from Heritage Rubber Ltd. Nagpur, India.

4. REFERENCES

[1] T. Prakash, "Processing and Characterisation of Natural Fiber Reinforced Polymer Composites," Bachelor's Thesis, National Institute of Technology, Rourkela, 2009.

[2] S. N. Monteiro *et al.*

"Mechanical Performance of Coir Fiber/Polyester Composites," *Polymer Testing*, Vol. 27, No. 5, 2008, pp. 591-595. doi:10.1016/j.polymeresting.2008.03.003

[3] W. Wang *et al.*

"Characterization and Utilization of Natural Coconut Fibers Composites," *Materials & Design*, Vol. 30, No. 7, 2009, pp. 2741-2744.

[4] K.G. Satyaanarayana *et al.*

Fabrication and properties of natural fibre-reinforced polyester composites
Composites (1986)

[5] J. Rout *et al.*

The influence of fibre treatment on the performance of coir polyester composites
Comp. Sci. Technology. (2001)

[6] J.R.M. d'Almeida *et al.*

Tensile mechanical properties, morphological aspects and chemical characterization of piassava
(*Attalea funifera*) fibers
Comp. Part A (2006)

[7] J.E.G. van Dam *et al.*

Process for production of high density/high performance binderless boards from whole coconut husk
Ind. Crops Prod. (2004)

A PROJECT REPORT
ON

**“ANALYSIS OF VARIOUS CONTENT OF DIFFERENT
COLD DRINK- AVAILABLE IN ARMORI MARKET”**

A Project Report
Submitted to the

**MAHATMA GANDHI ARTS, SCIENCE & LATE N.
P. COMMERCE COLLEGE, ARMORI**

Affiliate to

GONDWANA UNIVERSITY, GADCHIROLI



**For the degree of
Master of Science (Chemistry)**

By

SHARMIN M. PATHAN

(M.Sc. Chemistry Sem-IV)

Under the Supervision of

DR. SATISH S. KOLA

Assistant Professor

Dept. of Chemistry

DR. NARESH D. BANSOD

Assistant Professor

Dept. of Chemistry

PROF. S. M. SONTAKKE

Head of Dept. of Chemistry

**P.G. DEPARTMENT OF CHEMISTRY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE, ARMORI
(2023- 2024)**

*A PROJECT REPORT
ON*

**“ANALYSIS OF VARIOUS CONTENT OF DIFFERENT
COLDRINK- AVAILABLE IN ARMORI MARKET”**

A Project Report

Submitted to the

**MAHATMA GANDHI ARTS, SCIENCE & LATE N.
P. COMMERCE COLLEGE, ARMORI**

Affiliate to

GONDWANA UNIVERSITY, GADCHIROLI



**For the degree of
Master of Science (Chemistry)**

By

SHARMIN M. PATHAN

(M.Sc. Chemistry Sem-IV)

Under the Supervision of

DR. SATISH S. KOLA

*Assistant Professor
Dept. of Chemistry*

DR. NARESH D. BANSOD

*Assistant Professor
Dept. of Chemistry*

PROF. S. M. SONTAKKE

Head of Dept. of Chemistry

P.G. DEPARTMENT OF CHEMISTRY

**MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE, ARMORI**

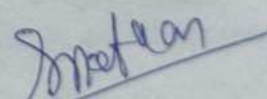
(2023- 2024)

DECLARATION

I declare that this project work on "Analysis of various content of different coldrink- available in armor market." Was done by me in Department of Chemistry, M. G. Arts Science and Late. N. P. Commerce College, Armori during the academic session 2023-24. This project has not been submitted earlier to any university or institution for the award of any diploma or a degree.

Date: 01/04/2024

Place : Armori



SHARMIN M. PATHAN

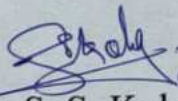
(M.Sc. chem Sem-IV)

CERTIFICATE

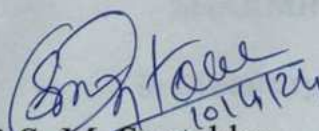
This is certify that dissertation entitled on "Analysis of various content of different coldrink- available in armor market" is a bonafide research work done by SHARMIN M. PATHAN under the supervision of the Department of Chemistry of M. G. Arts Science and Late. N. P. Commerce College, Armori and the same has not been submitted elsewhere for any degree.


Date: 01/04/2024

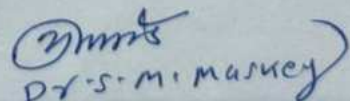
Place: Armori


02/04/24
Dr. S. S. Kola
Project Guide
Dept. of Chemistry

Dr. N. D. Bansod
Project Guide
Dept. of Chemistry


10/4/24
Prof. S. M. Sontakke
Head of Department
Dept. of Chemistry
Head
Department of Chemistry
M.G. Art & Science & Late N. P. Commerce
College, Armori, Dist. Gadchiroli.


PRINCIPAL
M.G. Arts, Science &
Late N.P. Commerce College
ARMORI, Dist. Gadchiroli

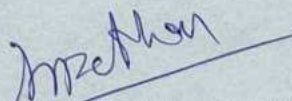

Dr. S. M. Masney

ACKNOWLEDGMENT

I would like to express my sincere thanks, **Dr. S. S. Kola & Dr. N. D. Bansod** Assistant Professor, Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori the guide of the project for their guidance and cooperation and correcting various documents of mine with attention and care, making necessary correction as and when needed.

I express my special thanks to Principal of college **Dr. Lalsingh Khalsa** and Head of Department of chemistry **Prof. S. M. Sontakke**, Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori for their constant encouragement, inspiration and all round support throughout the entire duration.

Lastly, I would also thank my institution and my friends for their co-operation and constant encouragement during preparation. I also extend my heartfelt thanks to my family and well-wishers.



SHARMIN M. PATHAN (M.Sc.

in Chemistry Final Year)

INDEX

Sr. No.	Content	Page No.
1	Glossary	1
2	Abstract	2
3	Introduction	3
4	Literature Review	4
5	History	5
6	Materials And Methods	7
7	Present Work	8
8	Result	22
9	Discussion And Conclusion	27
10	Reference	29

“Analysis of various content of different Coldrink- available in Armori market”

Introduction:-

We all love to have a sip of our favorite soft drinks (aka cold drinks, carbonated water or just soda water) when we are thirsty, especially in summers. And we also love to have a little fizz in it. This fizz is the bubbly effervescence that is produced by adding pressurized carbon dioxide gas to water. The aim of this project is to highlight the composition of cold drinks, the purpose of uses of its ingredients and their impact on human health and the chemistry behind these effects.

Joseph Priestley was the first person to invent soda water. He suspended a bowl of water over a beer vat in a brewery and patiently waited to see what happened. Soon the bowl of water was fizzing with carbon dioxide released from the fermentation of beer. And that was how soda water was born. However, it was only in the later part of the 19th century that soda water was introduced as a popular soft drink. Today, soda water is made by sending pressurized carbon dioxide through water. The high pressure allows more carbon dioxide to dissolve than it would normally be possible. The soda is then packed into an airtight bottle. When this pressurized bottle is opened, the gas rises to the top bubbling. And if you shake the bottle before opening, the soda will spill out splashing all over, when opened.

The era of cold drinks/soft drinks began in early 1950s but as this industry was quite luring as well as profitable, many multinational companies launched their products in different flavours with various brand names such as Sprite, 7up, Pepsi, Coka cola, Mountain Dew, Fanta, Miranda, etc. People take these drinks according to their temperaments and moods, e.g. it is generally believed that Miranda, Fanta and especially Sprite give a feeling of lightness where as Pepsi & Coka Cola activate pulse and brain.

Often a distinction is made between a soft drinks and a cold drink. A soft drink is a non-alcoholic drink which may or may not include fizzy drinks. Examples of such drinks include lemonade or fruit juices. Whereas, the cold drinks (pepsi, Miranda, Fanta, spirite, etc) are majorly composed of alcohol, carbohydrates, carbon dioxide, phosphate ions, sodium benzoate, acesulfame potassium (Ace-K) and caffeine. These ingredients are responsible for the feeling of warmth, lightness and tangy taste which is liked by everyone. But unfortunately, these soft / cold drinks not only provide taste and a little energy but also cause some severe effect on our health which most probably we forget when we take such drinks.

“Analysis of various content of different Coldrink- available in Armori market”

Literature Review:-

❖ Brand preference in soft drinks sector:

The research by William R. George (1999) reveals the purpose of study of factors responsible for brand preference in the soft drink industry. Increasing competition due to globalization has motivated many companies to base their strategies almost entirely on building brands. Brand preference refers to the comparison of different brands and the choice that the consumer makes to select his most preferred brand. This brand preference is influenced by various factors. In the identification of factors affecting the brand preference, it was concluded that brand personality is the most effective factor that affects the brand preference. This brand preference deals with the personality aspects or the external attributes of brand, thus it can be said that consumers prefer any brand by looking at the external attributes of a brand like product design, appeal, packaging, brand positioning etc.

❖ Colour and flavor rule consumer preferences:

Donnelly (1995) said intensity of colour and the flavours are the key drivers behind consumer acceptance of soft drinks. But packaging and labeling are not as important for winning over consumers, according to findings published in the journal *Food Quality and Preference*, the study involves consumers at different stages of development and highlights the importance of adopting a “sensory marketing approach,” said that researchers from French research organization Adiant, the university of Rennes. “Companies need to continuously innovate to maintain market leadership,” wrote the researchers. “When the market is overloaded the challenge consists in creating innovative products able to attract and satisfy consumers.” “This experiment showed the feasibility of the proposed multi-sensory design method based on mixed qualitative and quantitative approaches.” The study also demonstrates the importance of flavor and colour selection for new products. The global flavours market has been valued at some US\$18bn in 2006 (business insights). Meanwhile, the value of the international colourings market was estimated at around \$1.15bn in 2010, up 2.5% from \$1.07bn in 2007, according to Leatherhead Food International (LFI). Natural colours now make up 31 per cent of the colourings market, compared with 40 per cent for synthetics, according to LFI.

HISTORY OF SOFT DRINK CONSUMPTION

The category of soft drinks falls under consumer goods. Soft drinks tend to be non durable and do not last for over 3 years. As non durables,, it has relative price stability in comparison to durable goods.

This history of soft drink has not been traced by scholarly research at present. However preliminary inquiry and investigation of soft drink consumption patterns in human history has revealed that —Soft drinks (may have) first appeared in seventeenth-century Europe as a mixture of water and lemon juice sweetened with honey. In 1676, the Paris-based Compagnie de Limonadiers was founded and granted a monopoly by the French monarchy. Company vendors dispensed cups of lemonade from tank packs on their backs. The first carbonated beverages, which also debuted in Europe, were inspired by the popularity of effervescent water from natural springs, which were widely thought to have medicinal value.11

Many believe that Joseph Priestley was the founder of soft drink manufacturing. He was among the first who experimented with carbon dioxide gas from brewery fermenting vats. In 1772, he invented a small carbonating apparatus in London that pumped carbon dioxide into water.

Mineral salts and flavors were later added as the appeal of soft drinks spread.

Today the soft drink industry is among the most dominant industries in the world. Valuation of the industry differs according to organizations/firms but it is undoubted that the Mineral Waters, Soft Drinks, Fruit and Vegetable Juices industry has a substantial demand around the world. For example the Soft Drink Concentrates Market was estimated to be \$25,500.00 million in 2013, and is projected to reach \$34,761.36 million by 2019.2

However this does not mean that soft drink consumption has remained uniform or static throughout the world. Soft drink consumption varies widely by region and by culture. As a result, consumption does not necessarily coincide closely with population or economic development.

Materials and methods

Various types soft drinks were purchased from local grocery stores from commercial city gadchiroli and were qualitatively analyzed for the presence of sugar, carbon dioxide, alcohol and phosphate while the acidity, pH, and heavy metals concentration were quantified. The presence of sugar, carbon dioxide, phosphates and acidity were determined according to the procedure.

❖ **The following chemicals were used for the analysis of different type of test**

- Benedict's Reagent
- Iodine Crystal
- Potassium Iodine
- Sodium Hydroxide
- Lime Water
- Ammonium Molybdate
- Nitric Acid
- Ph Paper

Procedure for the analysis of different sample of cold-drinks

1. For Slice

1) *Test for glucose:-*

Sr. no	Test	Observation	Inference
1	Benidicts's solution test A small sample of cold drink was taken in a test tube and a few drops of Benedict's reagent were added. The test tube was heated for few seconds. Formation of reddish color confirms the presence of glucose in cold drinks.	Formation of reddish colour	Presence of glucose
2	Fehling's solution test Small samples of cold drinks were taken in a test tube and a few drops of Fehling's A solution and Fehling's B solution was added in equal amount. The test tube was heated in a water bath for 10 minutes. Appearance of brown precipitate confirmed the presence of glucose in cold drinks.	Appearance of brown precipitate	Presence of glucose

Result:- from the above analysis of sample shows the presence of glucose.

2) *Test for sucrose :-*

Test	Observation	Inference
5 ml of samples of cold drink taken in china dish and heated strongly until the change occur. Black colour residue left confirmed the presence of sucrose.	Black colour residue left	Presence of sucrose.

Result:- from the given analysis of sample shows the presence of sucrose.

Discussion:-

A vast amount of laboratory research has been carried out on the effects of carbonated beverages in relation to dental caries and erosion,¹⁵ but very much less has been done on humans and there is a paucity of data. Hence, a randomized comparative clinical trial was done to know the salivary pH changes and buffering capacity of saliva after consumption of cold drink, mixed fruit juice in children. In the present study glass combination electrode was used for assessing salivary pH as it is an established, sensitive and accurate methodology. Usually various colorimetric methods have been employed to determine the pH of saliva. The electronic method with the glass electrode is preferable because of its accuracy.¹⁶ In the present study there were two groups, cold drink & fruit juice. Our study showed a drop in salivary pH after consuming cold drink and fruit juice with more drop in pH in juice group when compared to cold drink users. In the present study, there was a drop in mean salivary pH immediately after consuming cold drinks to 5.47 ± 0.78 from baseline pH 6.99 ± 0.36 . There was a slight increase in the pH after 5 minutes (6.52 ± 0.54) and decrease in pH after 10 minutes (6.46 ± 0.53). After 20 minutes the pH started to rise (6.54 ± 0.46) and a sustained rise was seen after 30 minutes (6.86 ± 0.45) trying to bring back to baseline pH. The time variations with salivary pH were found to statistically significant. When pairwise comparisons were done there was a significant difference obtained in between all the timings except between 5 and 10, 15 minutes as well as between 10 minutes and 15 minutes. The carbonated beverages contain phosphoric acid, citric acid and maleic acid²¹ which may be the reason for decreased salivary pH as shown in this study and enamel demineralization resulting in dental erosion. Presence of acids in the carbonated beverage would have caused the immediate decrease in salivary pH which may have rendered the buffering capacity of saliva to be slow. The present study showed a drastic drop (4.89 ± 0.97) in salivary pH from baseline (6.97 ± 0.39) immediately after consumption of mixed fruit juice. After 5 minutes the pH recovered (6.35 ± 1.07) and this recovery was sustained throughout from 10, 20 and 30 min (6.43 ± 0.53 , 6.59 ± 0.51 and 6.87 ± 0.46 respectively). The time variations with salivary pH showed a significant difference ($df = 5$, $F = 59.599$, $p = < 0.001$, S). Pair wise comparisons showed a significant variation in between all-time intervals except baseline to 30 minutes and 5 minutes to 10, 15 minutes.

Conclusion:-

Present study suggested that there is a decline in the salivary pH after consumption of both types of beverage. There was higher fall in the salivary pH in the case of fruit juice when compared to carbonated drink. Regular consumption of such drinks should be discouraged.



REFERENCES

- ❖ Runge, F. and Friedlieb F. (2014). "Latest phytochemical discoveries for the founding of a scientific phytochemistry" Joseph publications, 20th ed. American. pp. 144–159.
- ❖ Banumathy, and Hema meena, "Customer satisfaction and customer preferences toward Soft drinks," Total Qual. Manage. Bus. Excell. 19 (7) (2006), pp. 843–853.
- ❖ Lata Kiran Banan, Amitha M Hegde. Plaque and salivary pH changes after consumption of fresh fruit juices. The Journal of Clin Ped Dent. 2005; 30(1): 9-13.
- ❖ May J, Waterhouse PJ. Dental erosion and soft drinks. A quantitative assessment of knowledge, attitude, and behaviour using focus groups of school children. A preliminary study. Int J Paediatr Dent. 2003 Nov;13(6):425-33.
- ❖ George K. Stookey. The effect of saliva on dental caries. J Am Dent Assoc. 2008 May;139 Suppl:11S-17S.
- ❖ R. Moazzez, B.G.N. Smith, D.W. Bartlett. Oral pH and drinking habit during ingestion of a carbonated drink in a group of adolescents with dental erosion. Journal of Dentistry 28 (2000) 395–397
- ❖ G. A. SÁNCHEZ & M. V. FERNANDEZ DE PRELIASCO. Salivary pH changes during soft drinks consumption in children. International Journal of Paediatric Dentistry 2003; 13: 251– 257
- ❖ Sardana v , balappanavar AY, Patil GB, Kulkarni N, Sagari SG, Gupta KD. Impact of a modified carbonated beverage on human dental plaque & salivary pH: A in vivo study. Journal of Indian society of pedodontics & preventive dentistry. Jan- mar 2012 ;30(1):7-12
- ❖ Birgul Azrak, Brita Willershausen, Nadja Meyer, Angelika Callaway Course of Changes in Salivary pH-Values after Intake of Different Beverages in Young Children. Oral Health Prev Dent 2008; 6: 159-164
- ❖ Sabyasachi Saha, Gudamarlahally Venkatarayappa Jagannath, Sahana Shivkumar, Sumit Kumar Pal. Effect of commonly consumed fresh fruit juices and commercially available fruit juices on ph of saliva at various time intervals. Journal of International Dental And Medical Research. Volume · 4 · Number · 1 · 2011
- ❖ CuryJA, Rebeio MAB, Dei Bel CuryAA, Derbyshire MTVC, Tabchoury CPM, Biochemicai composition and cariogenicity of dental plaque formed in the presence of sucrose orgiucose and fructose. Caries Res 2000;34:491-497
- ❖ Cornelius T. Bamise, Eyitope O. Ogunbodede, Adeyemi O. O 1 2 1 lusile and 1Temitope A. Esan. Erosive Potential of Soft Drinks in Nigeria. World Journal of Medical Sciences 2007;2 (2): 115-119.

“A GEOLOGICAL FIELD PROJECT REPORT ON”

**“DONGARGAON GRANITE EXPOSED IN AN AROUND
DONGARMASI AND KURUNDIMAL”**

Submitted By

Miss. Saleha A. Khan Pathan

Miss. Vaishnavi D. Kuthe

Mr. Kapil D. Pilare

Mr. Roshan D. Sonkusare

Mr. Sheshraj B. Sonkusare

Guided By

Prof. D. P. Wanmali

Department of Geology

Dr. C.P. Dorlikar (HOD)

Department of Geology



**POST GRADUATE DEPARTMENT OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE**

ARMORI. DIST. GADCHIROLI (M.S.) 441208

2023-2024





**POST GRADUATE DEPARTMENT
OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE ARMORI. DIST. GADCHIROLI (M.S.)
441208**

Dr. C. P. DORLIKAR
HOD
Mo No- 9423422989
Email id: chandrakant.dorlikar@gmail.com

Certificate

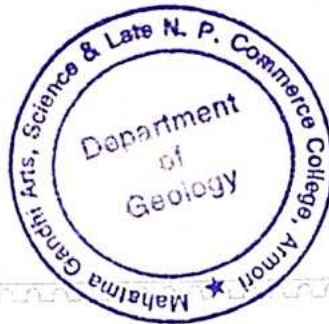
This Is To Certify That A Geological Field Project Report On Entitled
“DONGARGAON GRANITE EXPOSED IN AN AROUND DONGARMASI
AND KURUNDIMAL” Being submitted here as a part – fulfillment for the award of the
degree of Master of Science in Geology, Faculty of Science, Mahatma Gandhi Arts,
Science & Late N. P. Commerce College Gondwana University, Gadchiroli, embodies
result of the bonafide research and field work carried out by Miss. Saleha A. Khan
Pathan, Miss. Vaishnavi D. Kuthe , Mr. Kapil D. Pilare, Mr. Roshan D. Sonkusare,
Mr. Sheshraj B. Sonkusare, during 2023-24.

I further certify that work has not formed the basis for the award of any such
degree, diploma or other title earlier.

(Signature)

Dr. C.P. Dorlikar
Professor & Head
Department of Geology,
M. G. C. Armori

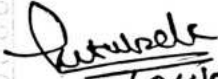
Date: 05/04/2024
Place: Armori



Certificate


This is to certify that Miss. Saleha A. Khan Pathan, Miss. Vaishnavi D. Kuthe, Mr. Kapil D. Pilare, Mr. Roshan D. Sonkusare, Mr. Sheshraj B. Sonkusare has carried out his project work on the topic entitled of A GEOLOGICAL FIELD PROJECT REPORT ON- "DONGARGAON GRANITE EXPOSED IN AN AROUND DONGARMASI AND KURUNDIMAL" during the academic session 2023-24 under my supervision in the Post Graduate Department of Geology, M.G. Arts Science and Late. N.P. Commerce College Armori This Field Project presented in this project is own work of the candidate.

Date :- 13/04/2024


13/04/2024

Internal Examiner

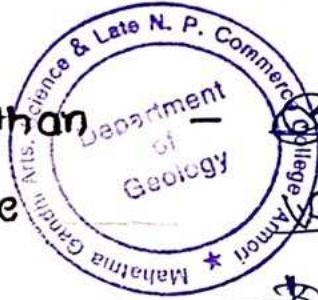
(Prof. P. G. Fulzele)

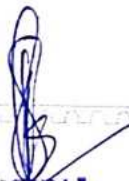

13/04/2024


External Examiner

(Dr. S. S. Gudadhe)

- Saleha A. Khan Pathan
- Vaishnavi D. Kuthe
- Kapil D. Pilare
- Roshan D. Sonkusare
- Sheshraj B. Sonkusare




PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Distt. Gadchiroli


HEAD
Dept. of Geology
M.G. College Armori

DECLARATION

I declare that this project work of "DONGARGAON GRANITE EXPOSED IN AN AROUND DONGARMAZI AND KURUNDIMAL" was done by me in M.G. Arts Science and Late. N.P. Commerce College Armori during the academic session 2023-24. This project work has not been submitted earlier to any University or Institution for the award of any diploma or a degree.

Miss. Saleha A. Khan Pathan
Miss. Vaishnavi D. Kuthe
Mr. Kapil D. Pilare
Mr. Roshan D. Sonkusare
Mr. Sheshraj B. Sonkusare

- Okhan
- Ruthe
- Pilare
- Sonkusare
- Sheshraj

Armori

Date: 05/04/2024



Acknowledgements

I express my special thanks principal of college Dr.Lalsingh Khalsa providing necessary facilities.

I am also thankful to Dr. C.P. Dorlikar Professor & Head, Department Post Grachiate Department of Geology, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori, for help me in various ways

I wish to extend my gratitude to Mr. Priyadarshan Ganvir Sir Assistant Professor, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori for his suggestion and guidance regarding the Field tour.

I am indebted to my parents for all they have done. I am thankful to all my family members, teachers and non teaching staff of the department and friends who are directly or indirectly involved in this this Field Project.

Miss. Saleha A. Khan Pathan - Saleha

Miss. Vaishnavi D. Kuthe - Vaishnavi

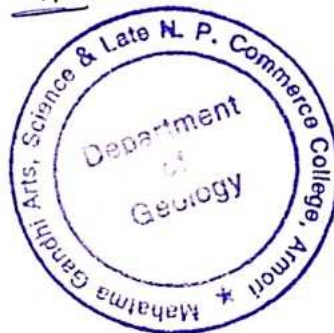
Mr. Kapil D. Pilare Pilare

Mr. Sheshraj B. Sonkusare Sonkusare

Mr. Roshan D. Sonkusare - Sonkusare

Date: 05/04/2024

Place: Armori



Chapter 1

INTRODUCTION

1.1 Purpose of field project Report:

Geology is essentially a field science best studied and understood through extensive field work. A thorough knowledge of the subject therefore demands a good deal of field work and a proper understanding of rocks and their structures observed in the field itself. A student of geology should be familiar with usual techniques and procedures of geological field work associated with it. Geological field work is a serious exercise and any casual approach may affect its accuracy and hamper its usefulness.

Adequate theoretical knowledge of Mineralogy, Petrology, Structural Geology and Stratigraphy helps one in drawing responsible inferences from his/her observations during field work.

Things in nature are very different and complicated than in laboratory, because every process in nature is acted by so many conditions.



Fig 1- Department of Geology Students with Dr. C.P. Dorlikar Sir, Prof Ganvir Sir,
Lecturer Miss. Diksha Wanmali Mam.

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori.

2022-2024

1.2 Aim and objectives:

The main aim and objectives of geological field excursion are as follows;

- 1) To do geological mapping of the area under study.
- 2) To study the mineralogy, petrography of different rocks found in the areas.
- 3) To study the different structures and micro structures of the areas.
- 4) To interpret the geological activities undergone in the area.
- 5) To determine the geological age and sequence of rocks and to interpret the environment of deposition of sediment on the basis of fossil contents.
- 6) To know the economically important minerals potential of the area.

1.3 Scope of Present Work:

The present tour program is a part of curriculum of the M.Sc. Geology, Gondwana University, Gadchiroli (M.S.). This tour provides an opportunity to learn the field Geology and also enables to facilitate the technical report writing.

The scope of present work is though limited to preliminary investigations, but it is also a worthy document of the sum of accurately measured sections and large scale gridded maps. Therefore the present report could be considering an important document to further a detailed geological investigation of the areas.

1.4 Previous work:

The Neoproterozoic Dongargarh mobile belt of central India is characterised by the Dongargarh batholith, an older Nandgaon bimodal volcanic suite and younger Khairagarh volcano-sedimentary sequence. The Dongargarh batholiths are disparate bodies of granites. The most widespread facies of Dongargarh granites are represented by the A-type granites, which occasionally show Rapakivi texture. The Pitepani tholeiites and Bijli rhyolites of the Nandgaon bimodal volcanic suite are spatially and temporally associated with the A-type Dongargarh granites. Extreme differentiation of a relatively primitive and crustally contaminated evolved Pitepani tholeiites followed by mixing, reproduces almost all the major geochemical features of the Dongargarh A-type granites as well as their rapakivi textures.

The Pitepani tholeiites represent asthenospheric decompression melting and associated lithospheric extension in response to slab retreat and accordingly the Dongargarh A-type granites represent extreme differentiation of Pitepani tholeiites in a hot and rifting lithosphere in response to slab retreat. The model is compatible with field relationships, independently corroborated by the A2 character of these granites, that supports and validates the original chrono-stratigraphy of the Dongargarh Supergroup as described by Sarkar (1957, 1958, 1994).

1.5 Instruments used:

- Hammer
- Brunton compass
- Pen knife
- Measuring tape
- Toposheet
- Magnet
- Camera
- Field Notebook
- Haversack

Chapter-2

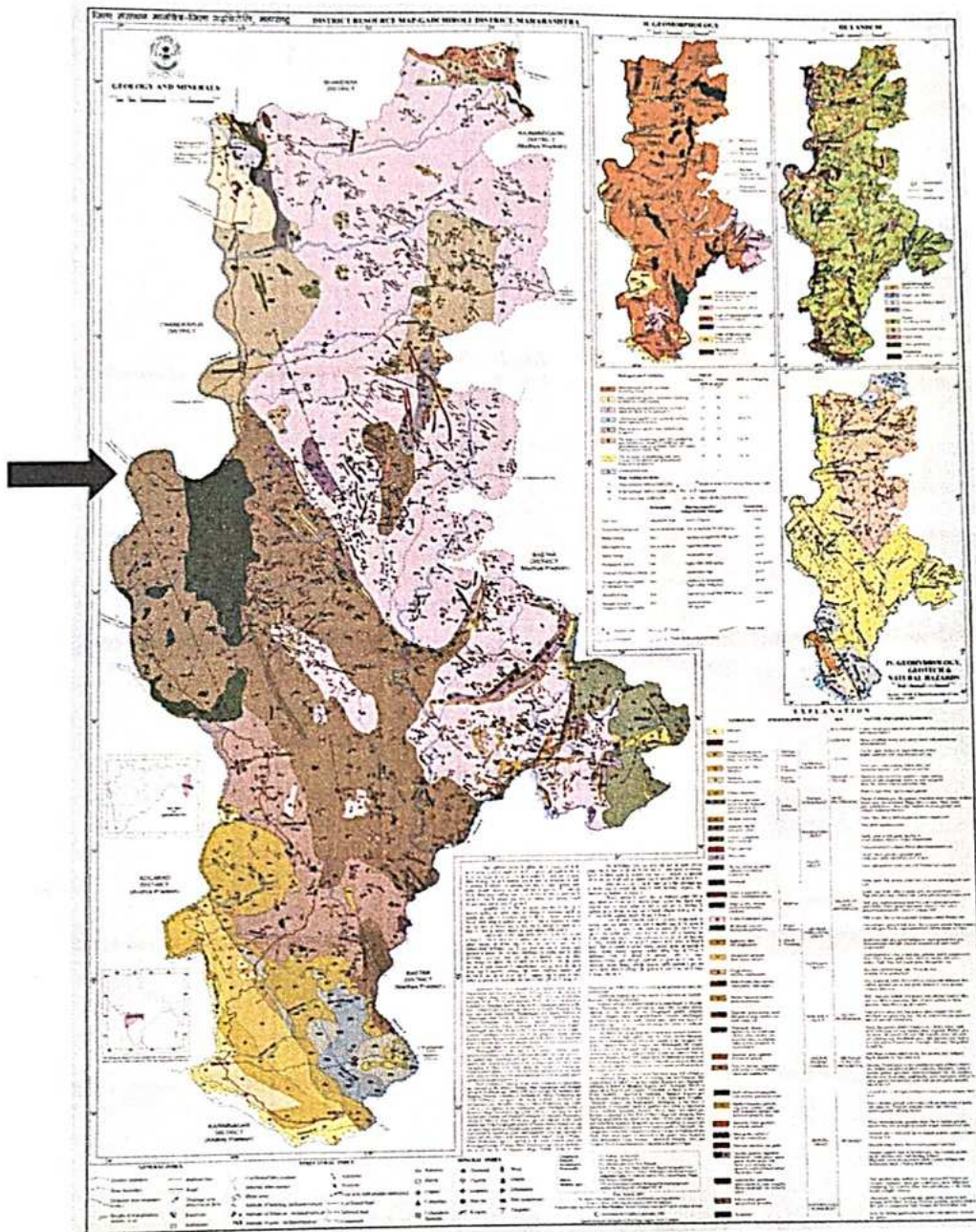
GENERAL GEOLOGY OF GADCHIROLI DISTRICT

Gadchiroli district was carved out on the 26th of August 1982 by the division of erstwhile Chandrapur district. Earlier, it was a part of Chandrapur District and only two places namely Gadchiroli and Sironcha were Tehsils of Chandrapur District before the formation of Gadchiroli District. Gadchiroli Tehsil was created in 1905 by transfer of Zamindari Estate from Brahmapuri and Chandrapur Tehsil. Gadchiroli district was created on August 26, 1982 by bifurcating the Chandrapur district in the place of Brahmapuri, which is part of the Vidarbha region of Maharashtra. In ancient times the region was ruled by the Rashtrakutas, the Chalukyas, the Yadavas of Deogiri and later the Gonds of Gadchiroli. In the 13th century Khandkya Ballal Shah founded Chandrapur. He shifted his capital from Sirpur to Chandrapur. Chandrapur subsequently came under Maratha rule. In 1853, Berar, of which Chandrapur (then called Chanda until 1964) was part, was ceded to the British East India Company. In 1854, Chandrapur became an independent district of Berar. In 1905, the British created the Tehsil of Gadchiroli by transfer of Zamindari state from Chandrapur and Brahmapuri. It was part of the Central Provinces till 1956, when with the reorganisation of the states; Chandrapur was transferred to Bombay state. In 1960, when the new state of Maharashtra was created, Chandrapur became a district of the state.

In 1982 Chandrapur was divided, with Gadchiroli becoming an independent district in the place of Brahmapuri. Gadchiroli district is situated on the North-Eastern side of Maharashtra State & district is situated on the North-Eastern side of Maharashtra State; have State borders of Telangana and Chhattisgarh. Naxalism is highly prevalent in Gadchiroli district and subsequently has been highlighted as part of the Red Corridor, used to describe areas in India that are plagued by Naxalites. They took the shelter in the dense forest & hills of this district.

Gadchiroli district lies between 19 to 21 degree North Latitude and 80 to 81 degree East longitudes. It has a common boarder on North with Bhandara & Gondia Districts, Chandrapur district on the west, Rajnandgaon and Bastar districts of Chhattisgarh to the East and Karimnagar, Bhopalpalli and Adilabad districts of Telangana to the south. It

falls in parts of the Survey of India Toposheet Nos. 56N/13, 65B/02, 56/15, 56M/09,55I/16, 56M/13, 55P/16, 64D/04, 64D/04, 64D/07, 55P/15, 55P/14, 64D/02, 64D/03etc



District Resource map of Gadchiroli

Geologically, Chandrapur district forms a part of Gondwana sedimentary basin. The Gondwana sedimentation took place in Wardha valley where Gondwana sediments have overlay the Archean rocks. Litologically Chandrapur district presents a variety of stratigraphic units right from Archean to recent alluvium and laterites.

LOCAL GEOLOGY OF THE AREA

Geologically The District Contains Almost All Geological Formations Except Deccan Trap. Iron Ore, Base Metals, Barrettes, Limestone's, Corundum. Six crop combination is observed in Korchi, Dhanora & Chamorshi Taluka. Lattitude - $19^{\circ} 68' 72.20''$ N & Longitudes $80^{\circ}00' 03.89''$ E Chamorshi is a small town located in eastern part of Maharashtra state in India. Area Under Toposheet 56 M/13.

The Geology around The Gadchiroli Its area is mainly comprised of rocks such as Granitic Gneisses, Magmatite with the enclaves of hornblendeschist and amphibolite's belonging to the amgoan gneissic complex of Archean Paleoproterozoic Age. The geological formations expressed in order toolder Precambrian, Cuddapah AndVidhyans, The Gondwana Group, Lameta Group.

Chapter- 3 REGIONAL GEOLOGY

BASTAR CRATON - GEOLOGICAL FRAMEWORK

Geological and Tectonic Set Up of Bastar Craton

Rectangular-shaped Bastar craton; an integral part of the Singhum Protocontinent, is bounded by NW-SE trending Godavari and Mahanadi rifts, ENE- WSW trending Narmada-son and NE-SW trending Eastern Ghat Mobile Belt (Radhakrishanan and Naqvi, 1986; Naqvi and Rogers, 1987). These three rifts and associate lineaments of Narmada-Son, Godavari and Mahanadi rifts may have existed since Archean (Naqvi and Rogers, 1987; Rogers, 1996, Rogers and Santosh, 2003; Chaudhuri et al. 2002). The ancient lineaments are deep and probably extended to the mantle. Several large Meso and Neo proterozoic intracratonic basin of the Bastar craton are developed in an intra cratonic rift setting (fig 2.1 and 2.2).

The lineaments, recognized on the basis of LANDSAT MSS imaginary, are mostly parallel to the Godavari and Mahanadi rifts. Most of these lineaments trend NW-SE and generally concentrated over the Precambrian rocks. An Achaean Super continental (~3Ga) known as "Ur", which includes several Indian craton (Dharwar, Bastar Singhbhum), as well as the Kalahari craton of South Africa, the Pilbara craton of western Australia and the coastal region of East Antarctica also supports existence of an intracratonic rift setting in the region since the ancient time (Rogers, 1996; Rogers and Santosh, 2003).

The Archean Bastarcraton, a vast tract of granitoid with inliers of supracrustal rocks of Dongargarh, Sakoli, Sausar, Sukma, Bengpal and Bailadila Series are overlain by many unmetamorphosed Proterozoic Sedimentary basins (Crookshank, 1963; Chaudhari et al. 2002). The superacrustal rocks include different type of metamorphic rocks, a variety of mafic rocks and unmetamorphosed late Proterozoic sedimentary rocks. The presence of cordierite and andalusite/silimanite in metapelites, and absence of garnet in amphibolites, suggest low-pressure metamorphism (Venkatesh and Ramkrishnan, 1985; Mishra et al. 1988; Ramkrishnan, (1990) Chattarjee, (1990)

About Armori Taluka

- Armori is located at 20.46°N 79.98°E
- It has an average elevation of 199 metres (676 feet).
- It is part of Desaiganj subdivision of Gadchiroli district along with the tehsils Desaiganj, Kurkheda and Korchi.
- State-Maharashtra District:Gadchiroli

Armori is a Town and Tehsil in Gadchiroli District of Maharashtra. In India, a tehsil is a sub-division of a district that is responsible for the administration and revenue collection of a particular area within the district. It is an important part of the local governance structure, and plays a crucial role in the development and administration of its local community.

According to census 2011 information the sub-district code of Armori Block (CD) is 04053. Total area of armori tehsil is 718 km². Armori tehsil has a population of 97,097 peoples. Armori tehsil has a population density of 135.3 inhabitants per square kilometre. There are about 23,596 houses in the sub-district.

When it comes to literacy, 70.78% population of armori tehsil is literate, out of which 77.76% males and 63.69% females are literate. There are about 101 villages in armori tehsil,

About Dongarmasi Kurandimal

According to Census 2011 information the location code or village code of Kurandi village is 538556. Kurandi village is located in Armori tehsil of Gadchiroli district in Maharashtra, India. It is situated 25km away from sub-district headquarter Armori (tehsildar office) and 40km away from district headquarter Gadchiroli. As per 2009 stats, Kurandi village is also a gram panchayat.

The total geographical area of village is 108 hectares. Kurandi has a total population of 466 peoples, out of which male population is 236 while female population is 230. Literacy rate of kurandi village is 67.60% out of which 79.66% males and 55.22% females are literate. There are about 120 houses in kurandi village.

Chapter- 4

TOPOGRAPHIC MAPS

Toposheets is a topographic map which is a two dimensional representation of a three dimensional land surface. Topographic maps are differentiated from the other maps in that they show both the horizontal and vertical position of the terrain. Through a combination of contour lines, colours, symbols, labels and other graphical representation. Topographic maps portray the shapes, location of mountains, and many other natural and manmade features.

To identify a map of a particular area, a map numbering system has been adopted by survey of India. Map characterized by large-scale detail and quantitative representation of relief, usually using contour lines

- Traditional definitions require a topographic map to show both natural and man-made features
- A topographic map is typically published as a map series, made up of two or more mapsheets that combine to form the whole map.

Toposheets classified according to scale:

Large scale maps: Scale 1 in 1000 or less than 1000

Medium scale maps: Scale from 1 in 1000 to 1 in 10000

Small scale maps: Scale 1 in 10000 or greater than 10000

Need & scope

- Topographic surveys were prepared by the military to assist in planning for battle and for defensive emplacements. As such, elevation information was of vital importance.
- As they evolved, topographic map series became a national resource in modern nations in planning infrastructure and resource exploitation.

- By the 1980s, databases of coordinates that could be used on computers by moderately skilled end users to view or print maps with arbitrary contents, coverage and scale. (Google Terrain Maps [non satellite image])

Uses of topographic maps

- Topographic maps have multiple uses in the present day: any type of geographic planning or large-scale architecture; earth sciences and many other geographic disciplines; mining and other earth-based endeavours; and recreational uses such as hiking or, in particular, orienteering, which uses highly detailed maps in its standard requirements.

Important Definitions on Toposheets

- **REPRESENTATIVE FRACTION (RF):** It is the ratio between the distances on the map to its corresponding distance on actual ground. The RF on this map is 1:50,000.

- **SCALE :** Scale is the ratio between the distance of any two points on the map and the actual distance of the same points on the ground. The scale of the given map extract is 2 cm: 1 km or 1:50,000.

- **CONTOUR:** Contours are imaginary lines drawn on maps, joining all places with the same height above sea level.

- **CONTOUR INTERVAL:** The interval between two consecutive contours is called contour interval

- **INDEX CONTOUR:** Contour lines are thickened at regular intervals to make it easier to read contours. For example at every 100 mts the contour line is made darker. The darker lines are called Index Contours.

- **TRIANGULATED HEIGHT:** It is the height of a place which has been calculated using trigonometry, represented by a small triangle e.g. $\Delta 540$

- **SPOT HEIGHT:** The height of random places between contours shown with a dot. Eg - .425

- **BENCH MARK -** Height of a place actually marked on a stone pillar, rock or shown on a building as a permanent reference. It is written as BM 200 m.

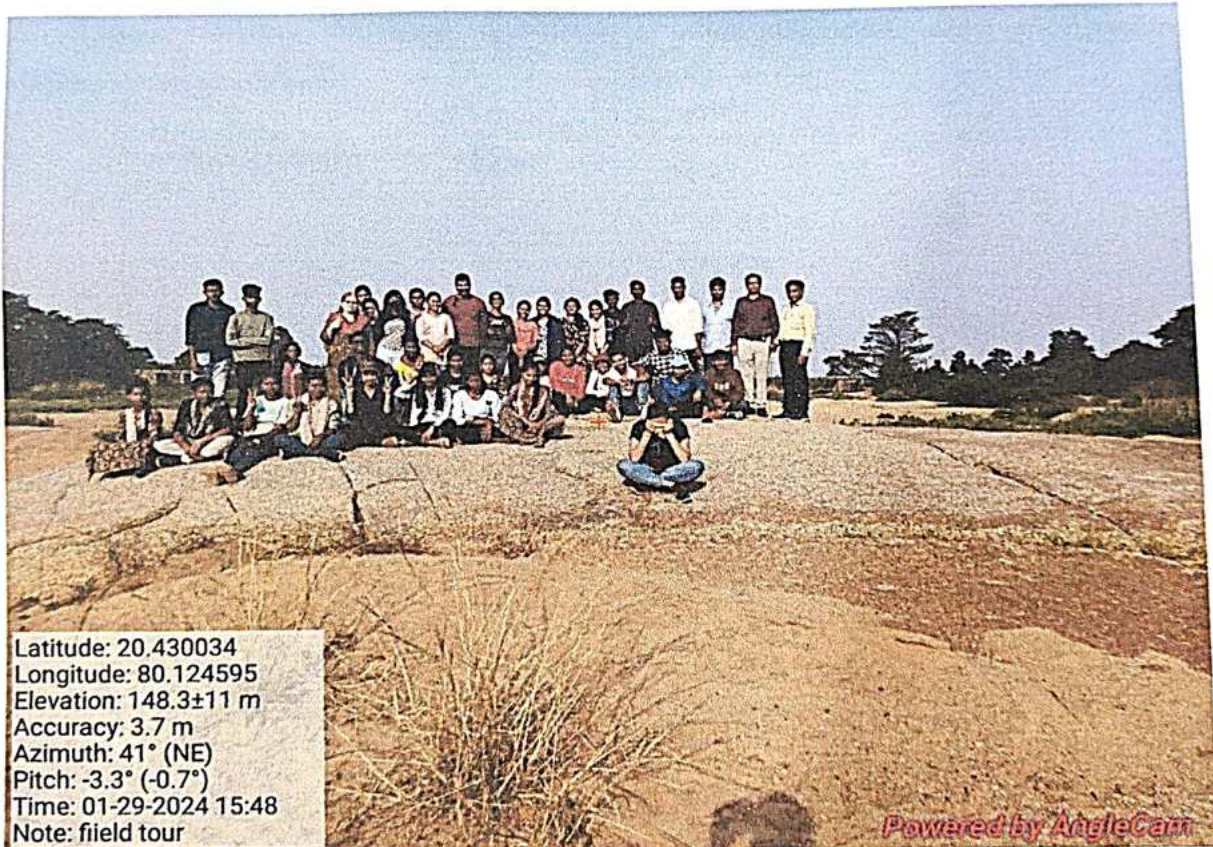
Chapter- 5

VISIT LOCATION

DONGARMASI AND KURANDIMAL

About Location-

Dongar Tamasi village is located in Armori tehsil of Gadchiroli district in Maharashtra, India. It is situated 30km away from sub-district headquarter Armori (tehsildar office) and 46km away from district headquarter Gadchiroli. As per 2009 stats, Kurandi is the gram panchayat of Dongar Tamasi village.



Gabbro: Composition, Types, Properties

Gabbro is a coarse-grained, mafic intrusive igneous rock formed from the slow cooling of magnesium-rich and iron-rich magma into a holocrystalline mass deep beneath the Earth's surface. Slow-cooling, coarse-grained gabbro is chemically equivalent to rapid-cooling, fine-grained basalt. Much of the Earth's oceanic crust is made of gabbro, formed at mid-ocean ridges. Gabbro is also found as plutons associated with continental volcanism. Chemically, gabbro is classified as a mafic rock. This means it's relatively low in silica (45-55%) and rich in iron, magnesium, and calcium. This composition contributes to its dark color and high density. The term "gabbro" originates from the Italian town of Gabbro, near Rosignano Marittimo, Tuscany. In the 18th century, German geologist Abraham Gottlob Werner described a dark-colored, coarse-grained rock found in the area and named it "Gabbro verde" (green gabbro) due to its greenish-gray color. This name eventually shortened to simply "gabbro" and became widely adopted for similar rocks elsewhere.

Intrusive igneous rock

Chemical Composition: Mafic

Color: Dark gray to black, sometimes lighter gray or greenish.

Texture: Coarse-grained, with crystals visible to the naked eye.

Hardness: Hard and strong, can scratch glass.

Mineral composition: Primarily plagioclase feldspar, pyroxene, and olivine.



Gabbro Formation

Gabbro is formed when magnesium-rich and iron-rich magma cools slowly deep beneath the Earth's surface. This type of magma is typically found in the mantle, the layer of rock that lies beneath the Earth's crust. As the magma cools, the minerals crystallize out of solution. The first minerals to crystallize are olivine and pyroxene. These minerals are denser than the magma, so they sink to the bottom of the magma chamber. As more and more minerals crystallize, the magma becomes more and more viscous. Eventually, the magma becomes so viscous that it cannot flow. This is when gabbro is formed. Types of Gabbro Troctolite: Distinguished by its high olivine content (usually exceeding 50%). This gives the rock a greenish-yellow hue and makes it an ultramafic type, meaning it has an even lower silica content than typical gabbro.

Olivine Gabbro: Contains more than 5% olivine but doesn't meet the threshold for troctolite classification. Hornblende Gabbro: Features substantial hornblende (greater than 5%) alongside pyroxene. Quartz Gabbro: Incorporates a minor amount of quartz, indicating more evolved magma compared to typical gabbro.

Gabbro Properties Color: Typically dark gray to black, due to its high content of dark-colored minerals like pyroxene and amphibole.

Texture: Coarse-grained (phaneritic), with individual mineral crystals visible to the naked eye. The crystals are typically interlocking, giving the rock a massive appearance. **Hardness:** Gabbro is a hard and strong rock, with a Mohs hardness of 6-7. This means it can scratch glass, but not steel.

Mineral composition: Primarily composed of pyroxene (augite is most common), plagioclase feldspar (labradorite or bytownite), and sometimes olivine or hornblende. **Chemical composition:** Gabbro has a relatively low silica content (45-55%) and is rich in iron, magnesium, and calcium. This composition is similar to basalt, but gabbro forms from slower cooling of magma underground.

Density: Gabbro is a dense rock, with a specific gravity of around 2.9-3.1. This means it is about three times heavier than water. **Weathering resistance:** Gabbro is generally resistant

Chapter- 6

REFERENCES

Anufriyev Y.N, Stupakov, G.P and Moskalyuk, A.A. (1973). Characteristics of quartz of Kochar Gold deposit. *Ore Geol. Rev.*, v.15, pp. 405-415.

Ague, J.J. (2011). Extreme channelization of fluid and the problem of element mobility during Barrovian metamorphism. *Am. Mineral.*, v. 96, pp. 333-352.

Ahmad, T., Wanjari, N., Kaulina, T.V., Mishra, M.K and Nitkina, E.A. (2008). Geochemical and isotopic characteristics of the Amgaon gneissic complex, Central Indian Shield: Constraints on Precambrian crustal evolution. In: *Proc. Int. Symp. 'Geoscience Resources and Environments of Asian Terranes (GREAT-2008), 4th IGCP 516, and 5th APSEG;* November 24-26, 2008, Bangkok, Thailand.

Asthana, D., Dash, M.R., Pophare, A.M and Khare, S.K. (1996). Interstratified low-high Ti volcanics from arc related Khairagarh Group of Central India. *Curr. Sci.*, v. 71, pp. 304 -306.

Asthana, D., Khare, S.K., Pophare, A.M and Dash, M.R. (1997). Comments on 'Geochemistry of the Dongargarh volcanic rocks, Central India: implications for the Precambrian mantle'. *Precamb. Res.* v. 84, pp. 105-107.

Asthana, D., Kimura, J.I., Shinjo, R., Katukase, M. and Pophare, A.M. (2006). Geochemical and Sr-Pb-Nd-Hf isotopic study of Neoproterozoic "Setouchi-type" high-magnesium andesite suite from Central India. *Geochim. Cosmochim. Acta*, v. 70 (18), Supplement 1, pp. A24-A24, (16th Annual V.M. Goldschmidt Conference 31st August 2006, Melbourne, Australia). doi:10.1016/j.gca.2006.06.062

Berger B.R. and Bethke, P.M. (1985). Geology and geochemistry of epithermal system. *Rev. Econ. Geol.*, v. 2, 298p.

Bons, P.D. (2001). The formation of large quartz vein by rapid ascent of fluids in mobile hydrofractures, *Tectonophy.*, v. 326, pp-1-17.

Chande, V.D. and Rao, M.A. (1983). Final report on Thanewasna Copper investigation, Chandrapur district, Maharashtra. GSI report, GSI Portal, 2010.

Conrad, J., James, R.H., Chaudhuri, A.K., Deb, S.P., Mukhopadhyay, J., Gautam, K.D and N.S.J. (2011). Constraints on the development of Proterozoic basins in central India from $^{40}\text{Ar}/^{39}\text{Ar}$ analysis of authigenic glauconitic minerals. *Geo. Soc. Am. Bull.*, v.123, pp.158-167.

Dong, G., Morrison, G. and Jaireth, S. (1995). Quartz texture in epithermal vein, Queensland- classification, origin and implication. *Econ. Geol.*, v. 90, pp. 1841-1856.

“GEOLOGICAL FIELD PROJECT REPORT ON”

WAIRAGARH AREA

Submitted By : Hemant D. Hargule

Linashree S. Janbandhu

Shashank S. Kawale

Kunal D. Hajare

M.sc. 1st Sem II (Geology)

Guided By : Dr. C. P. Dorlikar Sir (HOD)

Department of Geology



POST GRADUATION DEPARTMENT OF GEOLOGY , MAHATMA GANDHI
ARTS, SCIENCE & LATE N. P. COMMERCE COLLEGE ARMORI, DIST.
GADCHIROLI (M.S.) 441208

2023 - 2034

POST GRADUATE DEPARTMENT OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE ARMORI. DIST. GADCHIROLI (M.S.)
441208

Dr. C. P. DORLIKAR

HOD

Mo No- 9423422989

Email id: chandrakant.dorlikar@gmail.com

Certificate

This Is To Certify That A Geological Field Project Report On Entitled
"Wairagarh Area" Being submitted here as a part – fulfillment for the
award of the degree of Master of Science in Geology, Faculty of Science, Mahatma
Gandhi Arts, Science & Late N. P. Commerce College Gondwana University, Gadchiroli,
embodies result of the bonafide research and field work carried out by **Miss. Linashree S.**
Janbandhu , Mr. Hemant D. Hargule , Mr. Shashank S. kawale , Mr. Kunal D. Hajare during
2023-24.

I further certify that work has not formed the basis for the award of any such
degree, diploma or other title earlier.



Dr. C.P. Dorlikar

Professor & Head
HEAD

Dept. of Geology
Department of Geology
M. G. College Armori
M.G.C. Armori


Date: / /2024

Place: Armori



Certificate

This is to certify that Miss. Linashree s. Janbandhu, Mr. Hemant D. Hargule , Mr. Shashank S. Kawale , Mr. Kunal D. Hajare has carried out his project workon the topic entitled of A GEOLOGICAL FIELD PROJECT REPORT ON- "Wairagarh Area" during the academic session 2023-24 under mysupervision in the Post Graduate Department of Geology, M.G. Arts Science andLate. N.P. Commerce College Armori This Field Project presented in this project is own work of the candidate.

- 1) Linashree S. Janbandhu
- 2) Hemant D. Hargule
- 3) Shashank S. Kawale
- 4) Kunal D. Hajare

Janbandhu
Hargule
Kawale
Hajare



Dasubale
13/04/2024
(Internal Examiner)

Shinde
13/04/2024
(External Examiner)


PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Distt. Gadchiroli

Palve
13/04/24
HEAD
Dept. of Geology
M. G. College Armori

DECLARATION

I declare that this project work of "Wairagarh Area" was done by me in M.G. Arts Science and Late. N.P. Commerce College Armori during the academic session 2023- 24. This project work has not been submitted earlier to any University or Institution

for the award of any diploma or a degree.

Miss. Linashree S. Janbandhu

Mr. Hemant D. Hargule

Mr. Shashank S. Kawale

Mr. Kunal D. Hajare

Janbandhu

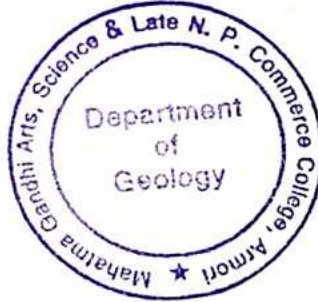
Hargule

Kawale

Hajare

Armori

Date: 05/04/2024



Acknowledgements

I express my special thanks principal of college Dr.Lalsingh Khalsa providing necessary facilities.

I am also thankful to Dr. C.P. Dorlikar Professor & Head, Department Post Grachiate Department of Geology, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori, for help me in various ways

I wish to extend my gratitude to Mr. Priyadarshan Ganvir Sir Assistant Professor, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori for his suggestion and guidance regarding the Field tour.

I am indebted to my parents for all they have done. I am thankful to all my family members, teachers and non teaching staff of the department and friends who are directly or indirectly involved in this this Field Project.

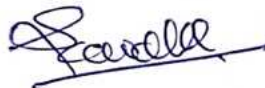
Miss. Linashree S. Janbandhu



Mr.Hemant D. Hargule



Mr. Shashank S. Kawale



Mr.Kunal D. Hajare



Date: / /2024

Place: Armori



CONTENTS

Sr. No.	Name Of Topic
1)	Introduction
2)	Purpose of Field Work
3)	Aim and Objectives
4)	Scope of present work
5)	Instruments used

Sr. No.	General Geology of Gadchiroli District
1)	Spot No. 1 :Vairagarh Deformed class Conglomerate (Diamond)
2)	Spot No. 2: Vairagarh Phyllite

1)	Conclusion
2)	Reference

INTRODUCTION

1) Purpose of field work:

Geology is essentially a field science best studied and understood through extensive field work. A thorough knowledge of the subject therefore demands a good deal of field work and a proper understanding of rocks and their structures observed in the field itself. A student of geology should be familiar with usual techniques and procedures of geological field work associated with it. Geological field work is a serious exercise and any casual approach may effect its accuracy and hamper its usefulness.

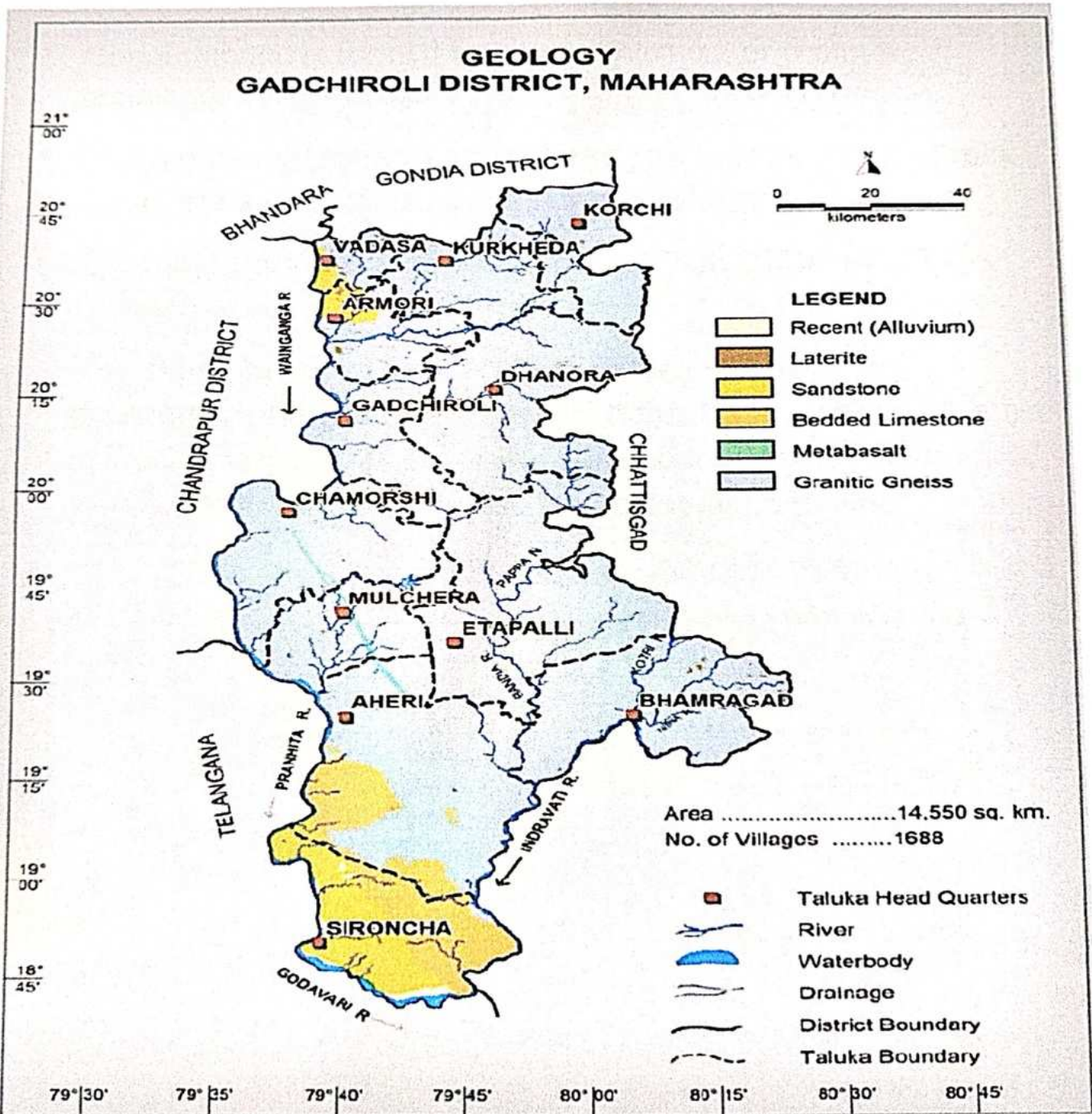
Adequate theoretical knowledge of Mining geology, Minerology, Stratigraphy, Structural Geology, Physical Geology helps one in drawing responsible inferences from his/ her observations during field work.

Things in nature are very different and complicated than in laboratory, because every process in nature is acted by so many conditions.

General Geology of Gadchiroli District :

Spot No. 1 :Vairagarh deformed class Conglomerate (Diamond)

Spot No. 2 :Vairagarh Phyllite



Spot No. 1: vairagarh deformed class of Conglomerate (Diamond)

- Deformed conglomerate is a metamorphic rock that has been changed by heat and pressure.
- Its large, round pebbles are igneous rocks that were swept into the layers of sedimentary rock as they were forming. Then, the rock was buried in the earth crust.
- Conglomerate is formed by river movement or ocean wave action.
- The cementing agents that fill the spaces to form the solid rock conglomerate are silica, calcite or iron oxides.
- The main framework grained are clasts, and those are always rounded or semi-rounded in shape.
- The conglomerate rock have been extensively used in determining finite strain in rocks but this task is beset with must difficulty since the pebbles are ellipsoidal in shape and the final product of deformation is also the ellipsoidal pebbles.



A NOTE ON DIAMOND INCIDENCE IN WAIRAGARH AREA, GARHCHIROLI DISTRICT, MAHARASHTRA

KSASHIDHARAN, A.K.MOIIANTY and ANUPENDU GUI>TA

Geological Survey of India, Seminary I-Iilis, Nngpur - 440 006

Incidence of diamond is reported from the highly deformed polymictic conglomerates of suspected Early Proterozoic age from Wairagarh area, Garhchiroli District, Maharashtra. The gem quality diamond recovered during the ongoing search for kimberlitelamproite rocks in western Bastar craton is an octahedral crystal with a light greenish tint and weighs 0.029g (0.15 carat). Reports of diamond mining in Wairagarh date back to as early as 15th century (Ball, 1884; Satyanarayana, 2000). Mining activity continued till 19th century (Streeter, 1882). These records provide information about richness of the mines and quality of the diamonds won. Despite intensive search by local people, there are no records of diamond recovery for over a century. The present find is first of its kind during the modern times and has opened up new vistas of diamond search in similar geological milieu in the western part of Bastar craton.

GEOLOGICAL SETTING

The Wairagarh area exposes a narrow stretch of (-20 km x 6 km), NNW-SSE trending, low grade, highly deformed metasedimentary belt within the terrain occupied by Archaean Amgaon Gneiss and occurs in the western part of the Bastar craton (WBC) (Fig 1). The metasediments comprise framework- supported polymictic conglomerate, gritty and pebbly arenite, quartzite and quartz-mica schist. Polymictic conglomerate dominates the metasediments and is made up of mixed assemblage of clasts of different composition and size set in a well-foliated quartz- sericite matrix (Fig.2 A). Quartzite dominates the clast population accounting for nearly 80 %, and the remaining includes gneiss, vein quartz, banded ferruginous quartzite and meta-basic rock. The deformed clasts display high degree of flattening and shearing and the host rock records variable (subhorizontal to steep) stretching lineation. The conglomerate grades laterally in to gritty quartzite and mica schist.

DIAMOND FIND

Due to paucity of exposures, the present study was confined to sampling of the left-over outcrops in the walls of old workings. Two bulk samples of one tonne each, from the matrix portion after removing the clasts, from two old working walls and another 0.25 tonnes of laterite sample were collected. These samples, after crushing to 5 mm size were tabled for heavies. Scanning of the heavy concentrates of the conglomerate matrix sample has yielded an octahedral gem quality diamond with typical adamantine lustre, showing well developed crystal faces (Fig 2 B). The diamond grain is 3.5mm long and 2.5mm wide (0.15 carat) with a slight degree of distortion. The specific gravity is determined to be 3.57. The tip of the octahedron is broken. A black coating seen on one face in a cavity appears to be graphite inclusion. The octahedral edges show stepped surfaces, probably as a result of etching or magmatic resorption. On exposure to X-rays, the diamond shows bluish white fluorescence. A powder X-ray diffraction pattern of the crystal was obtained on 1 I4.6mm Gondolfi Camera using Fe radiation with Mn filter at 40 KV and 20 mA. The observed sharp lines at 2.06 Å, 1.26 Å and 1.07 Å agree well with those for diamond (ICDS card no. 6-0675), indicating the crystal to be diamond. The other heavy mineral assemblages present in the conglomerate include garnet (grossular, andradite almandine and high magnesium almandine or G5 garnet), chrome diopside, amphibole, ilmenite, staurolite, chromite and rare tourmaline. The $\text{Ca}/(\text{Ca}+\text{Mg})$ and $\text{Mg}/(\text{Mg}+\text{Fe})$ ratios of chrome pyroxenes do not show comparable chemistry to that of kimberlitic lamproites. Similarly, the chromite grain also does not fall in the diamond inclusion field.

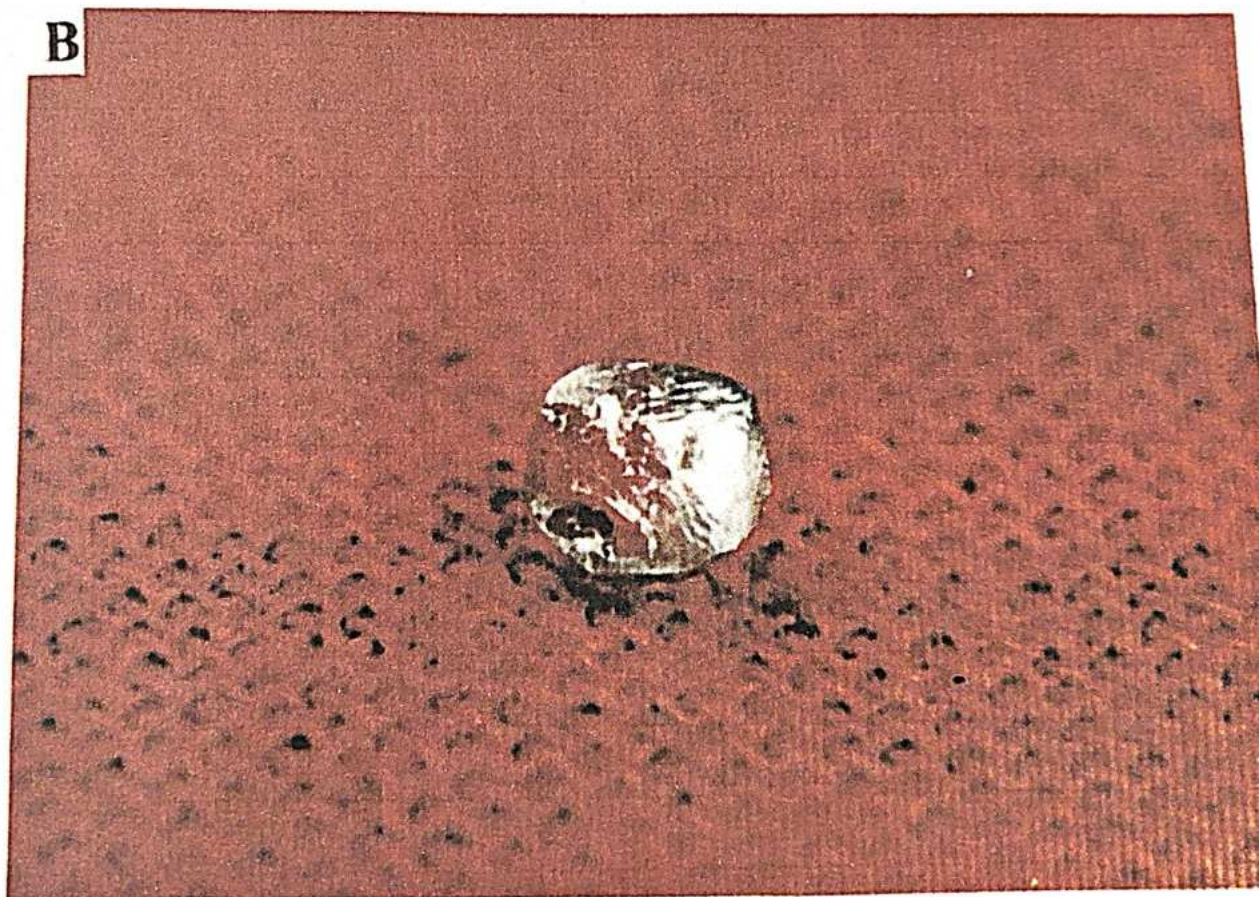


Fig.2. (A). Outcrop of Wairagarh conglomerate showing highly deformed clasts. (B). Octahedral gem quality diamond grain from the conglomerate matrix (length 3.5 mm, breadth 2.5 mm).

DISCUSSION

The Indian shield, like other cratonic areas of the globe, witnessed a major event of Kimberlite Clan Rock (KCR) magmatism around 1.1 Ga. A number of such bodies have been identified in the three cratonic areas viz. Dharwar, Bastar and Bundelkhand. In contrast to the eastern part of the Bastar craton, KCRs have not been identified so far in the WBC. The discovery of diamond in an older conglomerate of probable Palaeoproterozoic age points to a much older diamondiferous intrusion in to the Amgaon Gneiss. The source rock of diamond, probably of Archaean age, may be difficult to locate due to the complex geological processes the terrain has undergone, which include granite intrusion and regional metamorphism, followed by deposition of younger Proterozoic and Gondwana rocks. Diamonds are also reported from metaconglomerate, quartzites and phyllite as old as 2.7 Ga, in Witwatersrand, South Africa. The Tarkwian, Ghana (ca 2 Ga), the Roraima, Venezuela (ca. 1.65 Ga), and Espinhaco, Brazil (Mesoproterozoic) also contain diamonds in greater or lesser extent (Nixon, 1995). The pebbly sandstone associated with the Cumbum Formation, Nallamalai Group in Andhra Pradesh, inferred to be Meso- to Neo proterozoic age, is known to be diamondiferous (Satyanarayana, 2000). In the WBC, though no kimberlitic rocks have been identified so far, the tectonic history and basement characteristics are conducive for emplacement of such rocks. The possibility of rocks other than kimberlites & lamproites being diamondiferous cannot be ruled out. A thorough examination of this aspect is necessary.

Spot No. 2 :Vairagarh Phyllite

- Phyllite is a foliated metamorphic rock rich in tiny sheets of sericite mica.
- Phyllite is a durable and soft rock and used as decorative aggregates, floor tiles, and as exterior buildings, or facig stone.
- The other uses include cemetery markers, commemorative tablets, creative artwork, and writing slates.



Conclusion :

- The overall field project of Gondwana university on the basis of to know the geology, stratigraphy and minerology of Armori taluka in Gadchiroli district the spot are (vairagdh-area).
- It is concluded that the integrated resource analysis helps in the identification of un-biased potential zones of particular structures.
- The method is found to be suitable as it reduces time of the field study and money.

Reference :

- K. Sanshidharan, A. K. Mohanthy and Anupendu Gupta Geological Survey of India, Seminary Hills, Nagpur-440006
- Sarkar, S. N. (1994) Chronostratigraphy and tectonic of Dongargarh Supergroup on Bhandara-durg region, central India, jour. Earth. Sci., v.21, pp. 19-31.
- BALL, V, (1 884) A geologist's contribution to the history of ancient India, The Indian Antiquity, pp.228-248.
- NIXON, P.H. (1995) The morphology and nature of primary diamondiferous occurrences. Jour. Geochem. Explor., v.53, nos. 1-3, pp.4 1-7 1.
- ROY, A., BANDYOPADHYAY, B. K. and HUIN, A.K. (1992) Occurrence and significance of a ductile shear zone near eastern margin of Sakoli Belt in India. Indian Minerals, v.46, pp.323-336.

“A GEOLOGICAL FIELD PROJECT REPORT ON”

**“GABRO- SYENITE COMPLEX EXPOSED IN AN AROUND
KOREGAON - RANGI AREA”**

Submitted By

Miss. Kajal J. Kulmethe
Miss. Shreya P. Kelzarkar
Mr. Aniket K. Kuthe
Mr. Bhargav S. Kuthe

Prof. P. S. Ganvir
Department of Geology

Dr. C.P. Dorlikar (HOD)
Department of Geology



**POST GRADUATE DEPARTMENT OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE
ARMORI. DIST. GADCHIROLI (M.S.) 441208
2023-2024**



**POST GRADUATE
DEPARTMENT OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE ARMORI. DIST. GADCHIROLI
(M.S.) 441208**

Dr. C. P. DORLIKAR
HOD

Mo No- 9423422989

Email id: chandrakant.dorlikar@gmail.com

Certificate

This Is To Certify That A Geological Field Project Report On Entitled
“GABRO- SYENITE COMPLEX EXPOSED IN AN AROUND KOREGAON
RANGI AREA” Being submitted here as a part – fulfillment for the award of the degree
of **Master of Science in Geology, Faculty of Science, Mahatma Gandhi Arts, Science &
Late N. P. Commerce College Gondwana University, Gadchiroli, embodies result of the
bonafide research and field work carried out by Miss. Kajal J. Kulmethe, Miss. Shreya
P. Kelzarkar, Mr. Aniket K. Kuthe, Mr. Bhargav S. Kuthe, during 2023-24.**

I further certify that work has not formed the basis for the award of any such
degree, diploma or other title earlier.

Dr. C.P. Dorlikar

Professor & Head
Department of Geology,
M. G. Commerce College Armori

Date: 05/04/2024

Place: Armori



Certificate

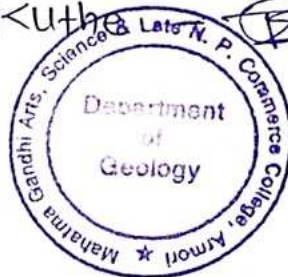
This is to certify that Miss. Kajal J. Kulmethe, Miss. Shreya P. Kelzarkar

Mr. Aniket K. Kuthe, Mr. Bhargav S. Kuthe has carried out his project work on the topic entitled of **A GEOLOGICAL FIELD PROJECT REPORT ON- "GABRO- SYENITE COMPLEX EXPOSED IN AN AROUND KOREGAON, RANGI AREA"** during the academic session 2023-24 under my supervision in the Post Graduate Department of Geology, M.G. Arts Science and Late. N.P. Commerce College Armori This Field Project presented in this project is own work of the candidate.

Kajal J. Kulmethe - Kulmethe.

Aniket K. Kuthe - Aniket.

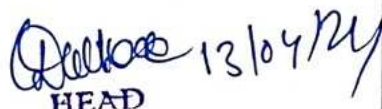
Bhargav S. Kuthe - Bhargav.



Kulmethe
13/04/2024
(Internal Examiner)

Shreya
13/04/2024
(External Examiner)


PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Distt. Gadchiroli


HEAD
Dept. of Geology
M. G. College Armori

DECLARATION

I declare that this project work of "**GABRO-SYENITE COMPLEX EXPOSED IN AN AROUND KOREGAON, RANGI AREA**" was done by me in M.G. Arts Science and Late. N.P. Commerce College Armori during the academic session 2023- 24. This project work has not been submitted earlier to any University or Institution for the award of any diploma or a degree.

Miss. Kajal J. Kulmethe
Miss. Shreya P. Kelzarkar
Mr. Aniket K. Kuthe
Mr. Bhargav S. Kuthe

Kulmethe

ABSENT

- Kuthe
- Kuthe

Armori

Date: 05/04/2024



Acknowledgements

I express my special thanks principal of college Dr.Lalsingh Khalsa providing necessary facilities.

I am also thankful to Dr. C.P. Dorlikar Professor & Head, Department Post Grachiate Department of Geology, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori, for help me in various ways

I wish to extend my gratitude to Mr. Priyadarshan Ganvir Sir Assistant Professor, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori for his suggestion and guidance regarding the Field tour.

I am indebted to my parents for all they have done. I am thankful to all my family members, teachers and non teaching staff of the department and friends who are directly or indirectly involved in this this Field Project.

Miss. Kajal J. Kulmethe - Kulmethe.

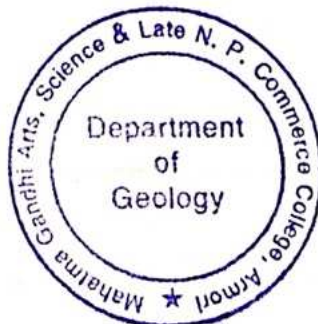
Miss. Shreya P. Kelzarkar -- ABSENT --

Mr. Aniket K. Kuthe - Aniket.

Mr. Bhargav S. Kuthe - Bhargav.

Date: 05/04/2024

Place: Armori



Chapter 1

INTRODUCTION

1.1 Purpose of field project Report:

Geology is essentially a field science best studied and understood through extensive field work. A thorough knowledge of the subject therefore demands a good deal of field work and a proper understanding of rocks and their structures observed in the field itself. A student of geology should be familiar with usual techniques and procedures of geological field work associated with it. Geological field work is a serious exercise and any casual approach may affect its accuracy and hamper its usefulness.

Adequate theoretical knowledge of Mineralogy, Petrology, Structural Geology and Stratigraphy helps one in drawing responsible inferences from his/her observations during field work.

Things in nature are very different and complicated than in laboratory, because every process in nature is acted by so many conditions.



**Fig 1- Department of Geology Students with Dr. C.P. Dorlikar Sir, Prof Ganvir Sir,
Lecturer Miss. Diksha Wanmali Mam.**

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori.

2022-2024

1.2 Aim and objectives:

The main aim and objectives of geological field excursion are as follows;

- 1) To do geological mapping of the area under study.
- 2) To study the mineralogy, petrography of different rocks found in the areas.
- 3) To study the different structures and micro structures of the areas.
- 4) To interpret the geological activities undergone in the area.
- 5) To determine the geological age and sequence of rocks and to interpret the environment of deposition of sediment on the basis of fossil contents.
- 6) To know the economically important minerals potential of the area.

1.3 Scope of Present Work:

The present tour program is a part of curriculum of the M.Sc. Geology, Gondwana University, Gadchiroli (M.S.). This tour provides an opportunity to learn the field Geology and also enables to facilitate the technical report writing.

The scope of present work is though limited to preliminary investigations, but it is also a worthy document of the sum of accurately measured sections and large scale gridded maps. Therefore the present report could be considering an important document to further a detailed geological investigation of the areas.

1.4 Previous work:

Sir L.L Fermor 1930-31 gave a detailed account to The Sausar group and Sakoli group with their characteristic mineralogical differences. According to him the rocks of less metamorphosed sakoli group of Bhandara, Chandrapur, and Gadchiroli show chlorite as a pre-dominant constituent biotite is rare and feldspar is commonly absent. Other characteristic features such as intrusive nature of Quartz vein, grade of metamorphism were also discussed by him.

The stratigraphic classification for the rocks of the south western part of sakoli belt was proposed Roy and Bandyopadhyay (1989).

Chapter-2

GENERAL GEOLOGY OF GADCHIROLI DISTRICT

Gadchiroli district was carved out on the 26th of August 1982 by the division of erstwhile Chandrapur district. Earlier, it was a part of Chandrapur District and only two places namely Gadchiroli and Sironcha were Tehsils of Chandrapur District before the formation of Gadchiroli District. Gadchiroli Tehsil was created in 1905 by transfer of Zamindari Estate from Brahmapuri and Chandrapur Tehsil. Gadchiroli district was created on August 26, 1982 by bifurcating the Chandrapur district in the place of Brahmapuri, which is part of the Vidarbha region of Maharashtra. In ancient times the region was ruled by the Rashtrakutas, the Chalukyas, the Yadavas of Deogiri and later the Gonds of Gadchiroli. In the 13th century Khandkya Ballal Shah founded Chandrapur. He shifted his capital from Sirpur to Chandrapur. Chandrapur subsequently came under Maratha rule. In 1853, Berar, of which Chandrapur (then called Chanda until 1964) was part, was ceded to the British East India Company. In 1854, Chandrapur became an independent district of Berar. In 1905, the British created the Tehsil of Gadchiroli by transfer of Zamindare state from Chandrapur and Brahmapuri. It was part of the Central Provinces till 1956, when with the reorganisation of the states; Chandrapur was transferred to Bombay state. In 1960, when the new state of Maharashtra was created, Chandrapur became a district of the state.

In 1982 Chandrapur was divided, with Gadchiroli becoming an independent district in the place of Brahmapuri. Gadchiroli district is situated on the North-Eastern side of Maharashtra State & district is situated on the North-Eastern side of Maharashtra State; have State borders of Telangana and Chhattisgarh. Naxalism is highly prevalent in Gadchiroli district and subsequently has been highlighted as part of the Red Corridor, used to describe areas in India that are plagued by Naxalites. They took the shelter in the dense forest & hills of this district.

Gadchiroli district lies between 19 to 21 degree North Latitude and 80 to 81 degree East longitudes. It has a common boarder on North with Bhandara & Gondia Districts, Chandrapur district on the west, Rajnandgaon and Bastar districts of Chhattisgarh to the East and Karimnagar, Bhopalpalli and Adilabad districts of Telangana to the south. It

LOCAL GEOLOGY OF THE AREA

Geologically The District Contains Almost All Geological Formations Except Deccan Trap. Iron Ore, Base Metals, Barrettes, Limestone's, Corundum. Six crop combination is observed in Korchi, Dhanora & Chamorshi Taluka. Latitude - $19^{\circ} 68' 72.20''$ N & Longitudes $80^{\circ} 00' 03.89''$ E Chamorshi is a small town located in eastern part of Maharashtra state in India. Area Under Toposheet 56 M/13.

The Geology around The Gadchiroli Its area is mainly comprised of rocks such as Granitic Gneisses, Magmatite with the enclaves of hornblendeschist and amphibolite's belonging to the amgoan gneissic complex of Archean Paleoproterozoic Age. The geological formations expressed in order toolder Precambrian, Cuddapah AndVidhyans, The Gondwana Group, Lameta Group.

Chapter- 3 REGIONAL GEOLOGY

BASTAR CRATON - GEOLOGICAL FRAMEWORK

Geological and Tectonic Set Up of Bastar Craton

The Mesoarchean to Neoarchean period is of particular interest as the Earth may have transitioned from a stagnant lid to a plate tectonic regime during this time (e.g., (Cawood et al., 2018). Many Archean cratons have witnessed extensive granitoid magmatism in the Mesoarchean-Neoarchean, especially around the Archean-Proterozoic transition (Condie and Kröner, 2012, Wang et al., 2016). The Archean-Proterozoic boundary is considered to mark a significant change in geothermal and tectonic regime of continental crust formation (Teixeira and Figueiredo, 1991).

Therefore, granitoids from this period can provide vital clues for understanding continental crust formation and growth during this important phase in the Earth's geological history (Cawood et al., 2018).

The Indian shield is an amalgam of five major Archean cratonic nuclei, i.e., Bastar, Dharwar, Singhbhum, Bundelkhand, and Aravalli that constituted two crustal blocks, the northern and southern blocks. The Aravalli and Bundelkhand cratons comprised the northern Indian block, while the Dharwar, Bastar, and Singhbhum cratons were a part of the southern Indian block. The northern and southern crustal blocks are thought to have amalgamated during the Proterozoic along the Central Indian Tectonic Zone (CITZ), forming the greater Indian landmass Radhakrishna and Naqvi, 1986, Naqvi and Rogers, 1987, Chakraborty et al., 2019, Bhowmik, 2019 and references therein) (Fig. 1a).

The Archean cratons of India record protracted continental crust formation and reworking from the Hadean to the Paleoproterozoic (Upadhyay et al., 2014, Upadhyay et al., 2019, Manikyamba et al., 2017, Jayananda et al., 2018, Chaudhuri et al., 2018, Mondal et al., 2019, Santosh et al., 2020, Ranjan et al., 2020a, Ranjan et al., 2020b). Most of them have witnessed extensive crustal growth/reworking from the Paleoproterozoic to the Neoarchean and were therefore likely to have participated in the Ur supercontinent that is thought to have existed between ~ 3.0 Ga and 2.5 Ga period (Rogers, 1993, Rogers and Santosh, 2003). Mesoarchean (~3.0 Ga) granitoid crust is well-documented in the Singhbhum, Bastar,

About Armori Taluka

- Armori is located at 20.46°N 79.98°E
- It has an average elevation of 199 metres (676 feet).
- It is part of Desaiganj subdivision of Gadchiroli district along with the tehsils Desaiganj, Kurkheda and Korchi.
- State-Maharashtra District:Gadchiroli

Armori is a Town and Tehsil in Gadchiroli District of Maharashtra. In India, a tehsil is a sub-division of a district that is responsible for the administration and revenue collection of a particular area within the district. It is an important part of the local governance structure, and plays a crucial role in the development and administration of its local community.

According to census 2011 information the sub-district code of Armori Block (CD) is 04053. Total area of armori tehsil is 718 km². Armori tehsil has a population of 97,097 peoples. Armori tehsil has a population density of 135.3 inhabitants per square kilometre. There are about 23,596 houses in the sub-district.

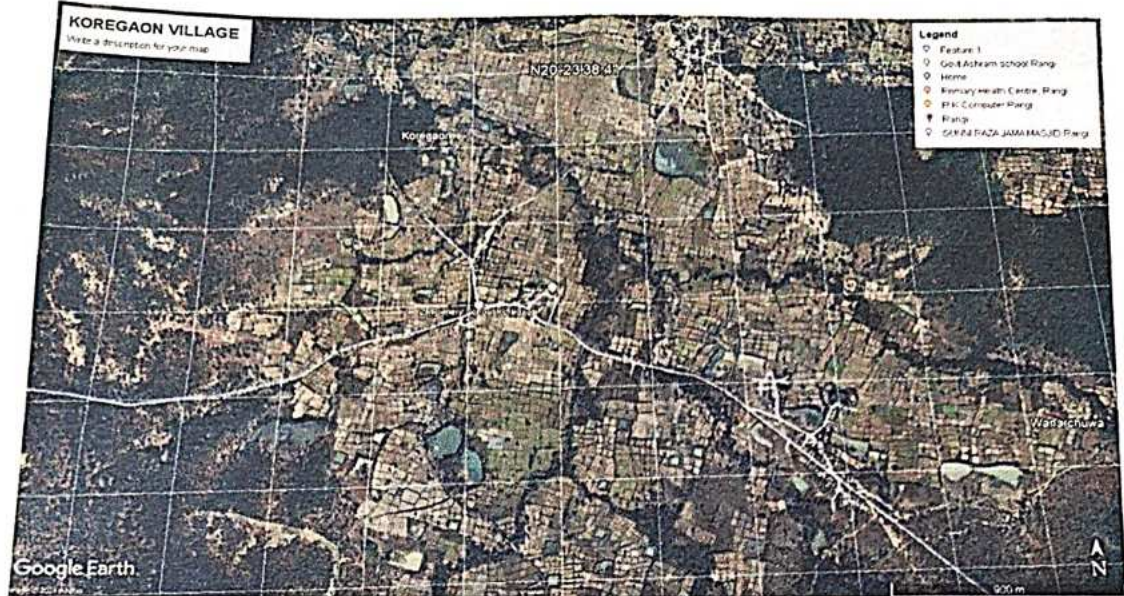
When it comes to literacy, 70.78% population of armori tehsil is literate, out of which 77.76% males and 63.69% females are literate. There are about 101 villages in armori tehsil,

About Dewulgao

Koregaon (w.) is a Village in Armori Taluka in Gadchiroli District of Maharashtra State, India. It belongs to Vidarbha region . It belongs to Nagpur Division . It is located 32 KM towards North from District head quarters Gadchiroli. 903 KM from State capital Mumbai

Koregaon (w.) is surrounded by Desaiganj (Wadsa) Taluka towards North , Kurkheda Taluka towards East , Gadchiroli Taluka towards South , Brahmapuri Taluka towards west .

Gadchiroli , Mul , Pauni , Umred are the near by Cities to Koregaon (w.).



Google Earth Map of Koregaon Village

About Rangi

Rangi village is 538935. Rangi village is located in Dhanora tehsil of Gadchiroli district in Maharashtra, India. It is situated 19km away from sub-district headquarter Dhanora (tehsildar office) and 45km away from district headquarter Gadchiroli. As per 2009 stats, Rangi village is also a gram panchayat.

The total geographical area of village is 1290.37 hectares. Rangi has a total population of 2,206 peoples, out of which male population is 1,060 while female population is 1,146. Literacy rate of rangi village is 77.43% out of which 85.00% males and 70.42% females are literate. There are about 522 houses in rangi village.

When it comes to administration, Rangi village is administrated by a sarpanch who is elected representative of the village by the local elections. As per 2019 stats, Rangi village comes under Gadchiroli assembly constituency & Gadchiroli-Chimur parliamentary constituency.

Chapter- 4

TOPOGRAPHIC MAPS

Toposheets is a topographic map which is a two dimensional representation of a three dimensional land surface. Topographic maps are differentiated from the other maps in that they show both the horizontal and vertical position of the terrain. Through a combination of contour lines, colours, symbols, labels and other graphical representation. Topographic maps portray the shapes, location of mountains, and many other natural and manmade features.

To identify a map of a particular area, a map numbering system has been adopted by survey of India. Map characterized by large-scale detail and quantitative representation of relief, usually using contour lines

- Traditional definitions require a topographic map to show both natural and man-made features
- A topographic map is typically published as a map series, made up of two or more mapsheets that combine to form the whole map.

Toposheets classified according to scale:

Large scale maps: Scale 1 in 1000 or less than 1000

Medium scale maps: Scale from 1 in 1000 to 1 in 10000

Small scale maps: Scale 1 in 10000 or greater than 10000

Need & scope

- Topographic surveys were prepared by the military to assist in planning for battle and for defensive emplacements. As such, elevation information was of vital importance.
- As they evolved, topographic map series became a national resource in modern nations in planning infrastructure and resource exploitation.
- By the 1980s, databases of coordinates that could be used on computers by moderately skilled end users to view or print maps with arbitrary contents, coverage and scale. (Google Terrain Maps [non satellite image])

Uses of topographic maps

- Topographic maps have multiple uses in the present day: any type of geographic planning or large-scale architecture; earth sciences and many other geographic disciplines; mining and other earth-based endeavours; and recreational uses such as hiking or, in particular, orienteering, which uses highly detailed maps in its standard requirements.

Important Definitions on Toposheets

- REPRESENTATIVE FRACTION (RF): It is the ratio between the distances on the map to its corresponding distance on actual ground. The RF on this map is 1:50,000.

- SCALE : Scale is the ratio between the distance of any two points on the map and the actual distance of the same points on the ground. The scale of the given map extract is 2 cm: 1 km or 1:50,000.

- CONTOUR: Contours are imaginary lines drawn on maps, joining all places with the same height above sea level.

- CONTOUR INTERVAL: The interval between two consecutive contours is called contour interval

- INDEX CONTOUR: Contour lines are thickened at regular intervals to make it easier to read contours. For example at every 100 mts the contour line is made darker. The darker lines are called Index Contours.

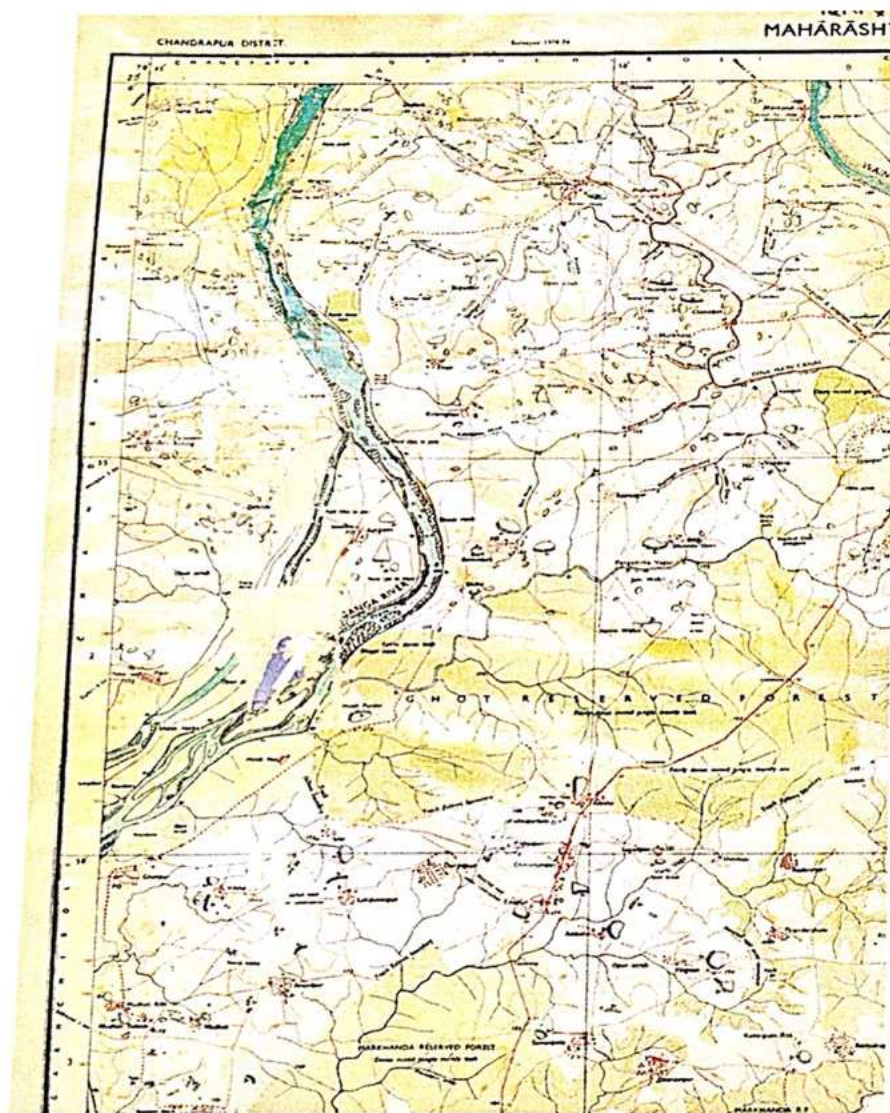
- TRIANGULATED HEIGHT: It is the height of a place which has been calculated using trigonometry, represented by a small triangle e.g. $\Delta 540$

- SPOT HEIGHT: The height of random places between contours shown with a dot. Eg - .425

- BENCH MARK - Height of a place actually marked on a stone pillar, rock or shown on a building as a permanent reference. It is written as BM 200 m.

- RELATIVE HEIGHT: Relative height is the height of a feature with reference to the height of the surrounding land and NOT to sea level. It is represented by the height with a small 'r' e.g. -12r.

TOPOSHEET OF THE STUDY AREA 56 M/13



Chapter- 5

VISIT LOCATION

RANGI - KOREGAON

GABRO COMPLEX AND SYENITE

Gabbro: Composition, Types, Properties

Gabbro is a coarse-grained, mafic intrusive igneous rock formed from the slow cooling of magnesium-rich and iron-rich magma into a holocrystalline mass deep beneath the Earth's surface. Slow-cooling, coarse-grained gabbro is chemically equivalent to rapid-cooling, fine-grained basalt. Much of the Earth's oceanic crust is made of gabbro, formed at mid-ocean ridges. Gabbro is also found as plutons associated with continental volcanism. Chemically, gabbro is classified as a mafic rock. This means it's relatively low in silica (45-55%) and rich in iron, magnesium, and calcium. This composition contributes to its dark color and high density. The term "gabbro" originates from the Italian town of Gabbro, near Rosignano Marittimo, Tuscany. In the 18th century, German geologist Abraham Gottlob Werner described a dark-colored, coarse-grained rock found in the area and named it "Gabbro verde" (green gabbro) due to its greenish-gray color. This name eventually shortened to simply "gabbro" and became widely adopted for similar rocks elsewhere.

Intrusive igneous rock

Chemical Composition: Mafic

Color: Dark gray to black, sometimes lighter gray or greenish.

Texture: Coarse-grained, with crystals visible to the naked eye.

Hardness: Hard and strong, can scratch glass.

Mineral composition: Primarily plagioclase feldspar, pyroxene, and olivine.

Classification of Syenite

Syenite is classified as an intrusive igneous rock, and it is further categorized within the plutonic rock classification. Its classification is based on its mineral composition, texture, and the presence or absence of certain minerals. Here's a breakdown of the classification of syenite:

Igneous Rock: Syenite is fundamentally an igneous rock, which means it forms from the solidification and cooling of molten magma. This sets it apart from sedimentary and metamorphic rocks.

Plutonic (Intrusive) Rock: Syenite is a plutonic rock, also known as intrusive rock. It forms deep within the Earth's crust from slowly cooling magma. It's characterized by its coarse-grained texture, as the slow cooling process allows larger mineral crystals to develop.

Mineral Composition: The key feature of syenite's classification is its mineral composition. It is primarily composed of the following minerals:

Feldspar: Syenite contains a significant amount of feldspar, with orthoclase feldspar being the most common variety. This feldspar imparts the rock's light color.

Mafic Minerals: In addition to feldspar, syenite may contain smaller amounts of dark-colored minerals such as hornblende, mica, or amphibole. These minerals provide the contrasting dark spots in the rock's appearance.

Quartz Absence: One of the distinguishing features of syenite is the absence or minimal presence of quartz. Unlike granite, another intrusive igneous rock, which contains a significant amount of quartz, syenite is devoid of this mineral.

Texture: Syenite exhibits a coarse-grained texture due to the slow cooling process that occurs deep within the Earth's crust. This texture allows for the development of relatively large mineral crystals, making them visible to the naked eye.

Coloration: Syenite often has a salt-and-pepper appearance due to the contrast between its light-colored feldspar and dark mafic minerals.

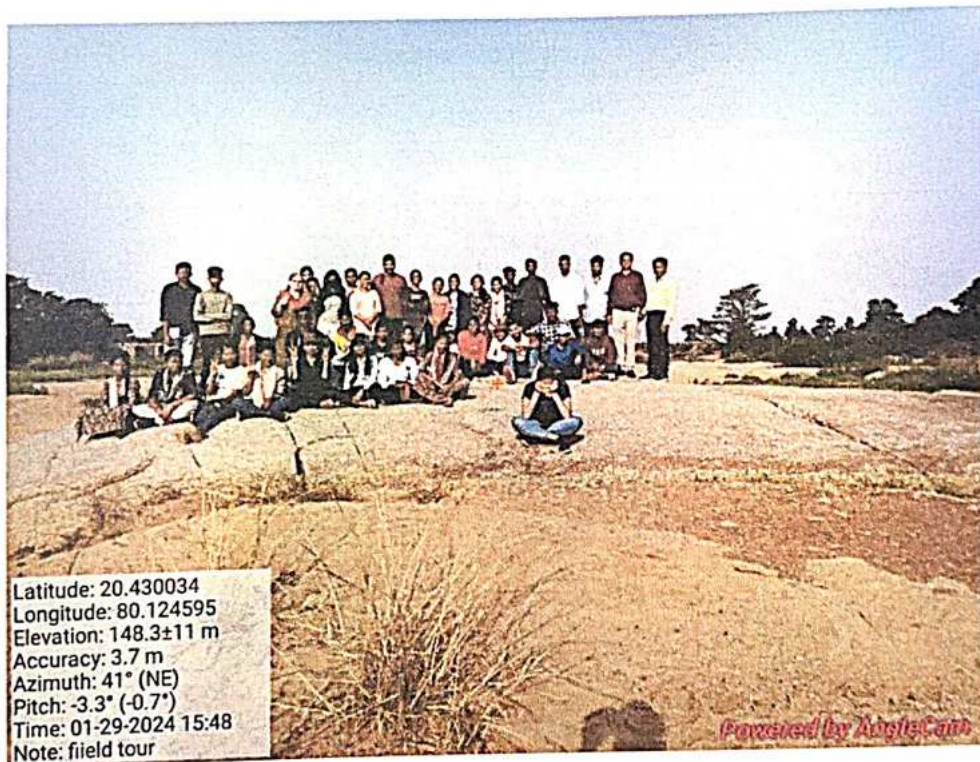
Geological Setting: Syenite is typically found in plutonic rock formations, often in the cores of mountain ranges or other geological settings where deep-seated magma has cooled and solidified.

Microsyenite: Microsyenite is a fine-grained variety of syenite, in contrast to the typical coarse-grained texture. It forms under different cooling conditions and may have a more uniform appearance.

Ijolite: Ijolite is a rare variety of syenite that contains significant proportions of nepheline and other feldspathoid minerals. It is typically found in alkaline rock complexes and is associated with some igneous intrusions.

These various types of syenite can be found in different geological settings and regions, depending on the specific mineral compositions and cooling conditions. The presence of specific minerals, such as nepheline, hornblende, biotite, or fayalite, distinguishes these syenite varieties from one another. Each type may have unique uses or significance in geology and industry based on its mineral composition and characteristics.

Geological Field photo of M.Sc Geology Batch 2023-2024





REFERENCES

- Chatterjee A. (1990) Structure, tectonics and metamorphic in the part of south Bastar, MP Quant. Jour Geol Minmet Soc. India, v.42, pp75-95.
- Chudhari A. k., Saha D., Deb S.P., Mukharjee M.K. and Ghose G, (2002) the purana basins of southern cratonic province of india –A case for Mesoproterozoic fossil rift. Gondwana res.,v 5,pp13-33.
- Cooper, A. F. (1972) Progressive metamorphism of metabasic rock from the Hast schist Group. Journal of Petrology; v.13, pp.457-492.
- Crookshank,h.,(1963) Geology of southern Bastar and Jeypore from the Bailadila range to the Eastern Ghat. Geol. Surv. India Mem., 87. pp.1-150
- Deer, W. A; Howazi, R A and Zussman, J. (1962) Rock Forming Minerals vol.1. Longmans, Green and Co. Ltd, London; 327p.
- Deshpande, G. G, (1996) Geology of Maharashtra, published by Geological society of india, pp.223
- DRM (2001). District Resource Map for Gadchiroli District, Maharashtra, Geological Survey of India, Central Region.
- Mishra, V. P. Singh, P. and Dutta ,N.K. (1988) Stratigrafic, structure and Metamorphic history of Bastar craton. Rec Geol. surv india ,v..117. pp.1-2
- Mishra B. K., et al (1994) Regional Serch for Kimberlite in Tokapal and Sukma areas(indravati sabari Basinal Areas, Bastar District, Madhya Pradesh Rec. Geol.Surv. Ind. Vol 130.part 6)
- Naqvi, S. M. and Rogers, J.J.W. (1987) Precambrian Geology of India. Oxford University press, oxford , 223p.
- Prider, R. T. (1947) Chloritoid And Kalsoorli. Americans Mineralogist, Vol.32, P.471
- Radhakrishna, B. P. And Naqvi, S. M (1986) Precambrian continental if India its Evolution Jour.Geol.,v.94, pp.145-166.
- Robinson, P, Hollocher, K. T. Tracy, R. I. And Dietsch, C.W. (1982) High Grade Indian Metamorphism in South –Central Massachusetts; in Joester, R.L. and Quarrier, S.S Eds Guidebook for fieldtrips in connecticut and south-central massachusetts New England Inter collegiate geological conference 74th annual meeting, state Geological and natural History Survey of connecticut, guidebook No.5,P. 289-339.

Rogers, J. J. W (1996) A History of continental in the past three Billion year Jour. Geol., v.104, pp.99-107.

Rogers J. J. W. and Santosh, M. (2003): Super continental in the earth history: Gondwana Res., v.6pp.357-368.

Roy, A. Bandyopadhyay, B. K., Huin, A. K., Moni, P. C. D. & Shah, S. K. (1995) Geology of Sakoli Fold Belt Nagpur, Bhandara & Gadchiroli Dist. Maharashtra Central India. Unpubl. GSI. Prog Report for F. S. 1989-1994

Sarkar, S. N. 1994 Chornostatigraphy and Tectonics of Dongargarh super Group Precambrian rock on Bhandara –Durg, central india Jour. Earth sci, vol. 21,21
pp.19-31

Sashidharan, K., Ganvir, D.V and Mohanty, A.K. (2001) Serch for Kimberlite and Lamprolite In the western part of the Bastar craton, Maharastra . Geo.Surv.Ind.Spl. Pub. No. 58; pp 45-54.

Venktesh, V. and Ramakishnan, M. (1995) Metamorphic facies map of india Nepal BhutanBangladesh and sri lanka in: sang man lee(Ed) metamorphic map of south and est, Asia (1:10m scale)-explanatory text commission of Geological map ofthe world sub – commission for metamorphic map, pp 18-34.

Yardely, B.W.D. (1990) An Introduction to Metamorphic Petrology elbs, Longman Scientific and Technical, England, 284p.

Radhakrishna, B.P. (1996) Mineral Resources of Karnataka (Page. no. : 285-295).

Umathay. R.M. (2006) Mineral Deposits of India (Page. no. :98-102).

Umeshwar Prasad (2000) Economic Geology and Economic Mineral Deposits (Page. no. :62-68).

“A GEOLOGICAL FIELD PROJECT REPORT ON”

**“DEWULGAON AND AWALGAON AREA OF BANDED
IRON FORMATION, QUARTZITE, METABASALT”**

Submitted By

Miss. Payal V. Bhandekar

Mr. Harshwardhan D. Bhoyar

Mr. Bhuwan P. Bolane

Mr. Shishir S. Chahande

Prof. P. G. Fulzele
Department of Geology

Dr. C.P. Dorlikar (HOD)
Department of Geology



**POST GRADUATE DEPARTMENT OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE
ARMORI. DIST. GADCHIROLI (M.S.) 441208
2023-2024**



**POST GRADUATE DEPARTMENT
OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE ARMORI. DIST. GADCHIROLI (M.S.)
441208**

Dr. C. P. DORLIKAR
HOD
Mo No- 9423422989
Email id: chandrakant.dorlikar@gmail.com

Certificate

This Is To Certify That A Geological Field Project Report On Entitled
“DEWULGAON AND AWALGAON AREA OF BANDED IRON FORMATION,
QUARTZITE, METABASALT” Being submitted here as a part – fulfillment for the
award of the degree of Master of Science in Geology, Faculty of Science, Mahatma
Gandhi Arts, Science & Late N. P. Commerce College Gondwana University, Gadchiroli,
embodies result of the bonafide research and field work carried out by **Miss. Payal V.
Bhandekar, Mr. Harshwardhan D. Bhojar , Mr. Bhuwan P. Bolane, Mr. Shishir S.
Chahande** during 2023-24.

I further certify that work has not formed the basis for the award of any such
degree, diploma or other title earlier.



Date: 5/4/2024
Place: Armori


Dr. C.P. Dorlikar
HOD
Department of Geology,
Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori

Certificate

This is to certify that Miss. Payal V. Bhandekar, Mr. Harshwardhan D. Bhoyar , Mr. Bhuwan P. Bolane, Mr. Shishir S. Chahande has carried out his project work on the topic entitled of **A GEOLOGICAL FIELD PROJECT REPORT ON- "DEWULGAON AND AWALGAON AREA OF BANDED IRON FORMATION, QUARTZITE, METABASALT"** during the academic session 2023-24 under my supervision in the Post Graduate Department of Geology, M.G. Arts Science and Late. N.P. Commerce College Armori This Field Project presented in this project is own work of the candidate.

1) Payal V. Bhandekar



2) Harshwardhan D. Bhoyar





3) Bhuwan P. Bolane




4) Shishir S. Chahande




12/04/2024
(Internal Examiner)


13/04/2024
(External Examiner)


PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Distt. Gadchiroli


HEAD
Dept. of Geology
M. G. College Armori

DECLARATION

I declare that this project work of "DEWULGAON AND AWALGAON AREA OF BANDED IRON FORMATION, QUARTZITE, METABASALT" was done by me in M.G. Arts Science and Late. N.P. Commerce College Armori during the academic session 2023- 24. This project work has not been submitted earlier to any University or Institution for the award of any diploma or a degree.

Miss. Payal V. Bhandekar
Mr. Harshwardhan D. Bhoyar
Mr. Bhuwan P. Bolane
Mr. Shishir S. Chahande





Armori

Date: 5/4/2024



Acknowledgements

I express my special thanks principal of college Dr.Lalsingh Khalsa providing necessary facilities.

I am also thankful to Dr. C.P. Dorlikar Professor & Head, Department Post Grachiate Department of Geology, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori, for help me in various ways

I wish to extend my gratitude to Mr. Priyadarshan Ganvir Sir Assistant Professor, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori for his suggestion and guidance regarding the Field tour.

I am indebted to my parents for all they have done. I am thankful to all my family members, teachers and non teaching staff of the department and friends who are directly or indirectly involved in this this Field Project.

Miss. Payal V. Bhandekar



Mr. Harshwardhan D. Bhoyar



Mr. Bhuwan P. Bolane



Mr. Shishir S. Chahande

Date: 5/4/2024

Place: Armori



Chapter 1

INTRODUCTION

1.1 Purpose of field project Report:

Geology is essentially a field science best studied and understood through extensive field work. A thorough knowledge of the subject therefore demands a good deal of field work and a proper understanding of rocks and their structures observed in the field itself. A student of geology should be familiar with usual techniques and procedures of geological field work associated with it. Geological field work is a serious exercise and any casual approach may affect its accuracy and hamper its usefulness.

Adequate theoretical knowledge of Mineralogy, Petrology, Structural Geology and Stratigraphy helps one in drawing responsible inferences from his/her observations during field work.

Things in nature are very different and complicated than in laboratory, because every process in nature is acted by so many conditions.



Fig 1- Department of Geology Students Dewulgaon Quartzite Mine with Dr. C.P. Dorlikar Sir, Prof Ganvir Sir, Lecturer Miss. Diksha Wanmali Mam.

1.2 Aim and objectives:

The main aim and objectives of geological field excursion are as follows;

- 1) To do geological mapping of the area under study.
- 2) To study the mineralogy, petrography of different rocks found in the areas.
- 3) To study the different structures and micro structures of the areas.
- 4) To interpret the geological activities undergone in the area.
- 5) To determine the geological age and sequence of rocks and to interpret the environment of deposition of sediment on the basis of fossil contents.
- 6) To know the economically important minerals potential of the area.

1.3 Scope of Present Work:

The present tour program is a part of curriculum of the M.Sc. Geology, Gondwana University, Gadchiroli (M.S.). This tour provides an opportunity to learn the field Geology and also enables to facilitate the technical report writing.

The scope of present work is though limited to preliminary investigations, but it is also a worthy document of the sum of accurately measured sections and large scale gridded maps. Therefore the present report could be considering an important document to further a detailed geological investigation of the areas.

1.4 Previous work:

Sir L.L Fermor 1930-31 gave a detailed account to The Sausar group and Sakoli group with their characteristic mineralogical differences. According to him the rocks of less metamorphosed sakoli group of Bhandara, Chandrapur, and Gadchiroli show chlorite as a pre-dominant constituent biotite is rare and feldspar is commonly absent. Other characteristic features such as intrusive nature of Quartz vein, grade of metamorphism were also discussed by him.

The stratigraphic classification for the rocks of the south western part of sakoli belt was proposed Roy and Bandyopadhyay (1989).

Chapter-2

GENERAL GEOLOGY OF GADCHIROLI DISTRICT

Gadchiroli district was carved out on the 26th of August 1982 by the division of erstwhile Chandrapur district. Earlier, it was a part of Chandrapur District and only two places namely Gadchiroli and Sironcha were Tehsils of Chandrapur District before the formation of Gadchiroli District. Gadchiroli Tehsil was created in 1905 by transfer of Zamindari Estate from Brahmapuri and Chandrapur Tehsil. Gadchiroli district was created on August 26, 1982 by bifurcating the Chandrapur district in the place of Brahmapuri, which is part of the Vidarbha region of Maharashtra. In ancient times the region was ruled by the Rashtrakutas, the Chalukyas, the Yadavas of Deogiri and later the Gonds of Gadchiroli. In the 13th century KhandkyaBallal Shah founded Chandrapur. He shifted his capital from Sirpur to Chandrapur. Chandrapur subsequently came under Maratha rule. In 1853, Berar, of which Chandrapur (then called Chanda until 1964) was part, was ceded to the British East India Company. In 1854, Chandrapur became an independent district of Berar. In 1905, the British created the Tehsil of Gadchiroli by transfer of Zamindare state from Chandrapur and Brahmapuri. It was part of the Central Provinces till 1956, when with the reorganisation of the states; Chandrapur was transferred to Bombay state. In 1960, when the new state of Maharashtra was created, Chandrapur became a district of the state.

In 1982 Chandrapur was divided, with Gadchiroli becoming an independent district in the place of Brahmapuri. Gadchiroli district is situated on the North-Eastern side of Maharashtra State & district is situated on the North-Eastern side of Maharashtra State; have State borders of Telangana and Chhattisgarh. Naxalism is highly prevalent in Gadchiroli district and subsequently has been highlighted as part of the Red Corridor, used to describe areas in India that are plagued by Naxalites. They took the shelter in the dense forest & hills of this district.

Gadchiroli district lies between 19 to 21 degree North Latitude and 80 to 81 degree East longitudes. It has a common boarder on North with Bhandara & Gondia Districts, Chandrapur district on the west, Rajnandgaon and Bastar districts of Chhattisgarh to the East and Karimnagar, Bhopalpalli and Adilabad districts of Telangana to the south. It falls

LOCAL GEOLOGY OF THE AREA

Geologically The District Contains Almost All Geological Formations Except Deccan Trap. Iron Ore, Base Metals, Barrettes, Limestone's, Corundum. Six crop combination is observed in Korchi, Dhanora & Chamorshi Taluka. Lattitude - $19^{\circ} 68' 72.20''$ N & Longitudes $80^{\circ} 00' 03.89''$ E Chamorshi is a small town located in eastern part of Maharashtra state in India. Area Under Toposheet 56 M/13.

The Geology around The Gadchiroli Its area is mainly comprised of rocks such as Granitic Gneisses, Magmatite with the enclaves of hornblendeschist and amphibolite's belonging to the amgoan gneissic complex of Archean Paleoproterozoic Age. The geological formations expressed in order toolder Precambrian, Cuddapah And Vidhyans, The Gondwana Group, Lameta Group.

Chapter- 3 REGIONAL GEOLOGY

BASTAR CRATON - GEOLOGICAL FRAMEWORK

Geological and Tectonic Set Up of Bastar Craton

Rectangular-shaped Bastar craton; an integral part of the Singhum Protocontinent, is bounded by NW-SE trending Godavari and Mahanadi rifts, ENE- WSW trending Narmada-son and NE-SW trending Eastern Ghat Mobile Belt (Radhakrishanan and Naqvi, 1986; Naqvi and Rogers, 1987). These three rifts and associate lineaments of Narmada-Son, Godavari and Mahanadi rifts may have existed since Archean (Naqvi and Rogers, 1987; Rogers, 1996, Rogers and Santosh, 2003; Chaudhuri et al. 2002). The ancient lineaments are deep and probably extended to the mantle. Several large Meso and Neo proterozoic intracratonic basin of the Bastar craton are developed in an intra cratonic rift setting (fig 2.1 and 2.2).

The lineaments, recognized on the basis of LANDSAT MSS imaginary, are mostly parallel to the Godavari and Mahanadi rifts. Most of these lineaments trend NW-SE and generally concentrated over the Precambrian rocks. An Achaean Super continental (~3Ga) known as "Ur", which includes several Indian craton (Dharwar, Bastar Singhbhum), as well as the Kalahari craton of South Africa, the Pilbara craton of western Australia and the coastal region of East Antarctica also supports existence of an intracratonic rift setting in the region since the ancient time (Rogers, 1996; Rogers and Santosh, 2003).

The Archean Bastarcraton, a vast tract of granitoid with inliers of supacrustal rocks of Dongargarh, Sakoli, Sausar, Sukma, Bengpal and Bailadila Series are overlain by many unmetamorphosed Proterozoic Sedimentary basins (Crookshank, 1963; Chaudhari et al. 2002). The superacrustal rocks include different type of metamorphic rocks, a variety of mafic rocks and unmetamorphosed late Proterozoic sedimentary rocks. The presence of cordierite and andalusite/silimanite in metapelites, and absence of garnet in amphibolites, suggest low-pressure metamorphism (Venkatesh and Ramkrishnan, 1985; Mishra et al. 1988; Ramkrishnan, (1990) Chattarjee, (1990)

About Armori Taluka

- Armori is located at 20.46°N 79.98°E
- It has an average elevation of 199 metres (676 feet).
- It is part of Desaiganj subdivision of Gadchiroli district along with the tehsils Desaiganj, Kurkheda and Korchi.
- State-Maharashtra District:Gadchiroli

Armori is a Town and Tehsil in Gadchiroli District of Maharashtra. In India, a tehsil is a sub-division of a district that is responsible for the administration and revenue collection of a particular area within the district. It is an important part of the local governance structure, and plays a crucial role in the development and administration of its local community.

According to census 2011 information the sub-district code of Armori Block (CD) is 04053. Total area of armori tehsil is 718 km². Armori tehsil has a population of 97,097 peoples. Armori tehsil has a population density of 135.3 inhabitants per square kilometre. There are about 23,596 houses in the sub-district.

When it comes to literacy, 70.78% population of armori tehsil is literate, out of which 77.76% males and 63.69% females are literate. There are about 101 villages in armori tehsil,

About Dewulgao

Deulgaon village is located in Armori tehsil of Gadchiroli district in Maharashtra, India. It is situated 10km away from sub-district headquarter Armori (tehsildar office) and 25km away from district headquarter Gadchiroli. As per 2009 stats, Deulgaon village is also a gram panchayat.

The total geographical area of village is 986.51 hectares. Deulgaon has a total population of 1,691 peoples, out of which male population is 844 while female population is 847. Literacy rate of deulgaon village is 70.79% out of which 78.79% males and 62.81% females are literate. There are about 419 houses in deulgaon village.

Desaiganj is nearest town to deulgaon for all major economic activities, which is approximately 28km away.



Google Earth Map of Dewulgao and Awalgao Village

About Aawalgao Taluka Bramhpuri

Awalgao village is located in Brahmapuri tehsil of Chandrapur district in Maharashtra, India. It is situated 28km away from sub-district headquarter Brahmapuri (tehsildar office) and 100km away from district headquarter Chandrapur. As per 2009 stats, Awalgao village is also a gram panchayat.

The total geographical area of village is 1714. 01 hectares. Awalgao has a total population of 4,114 peoples, out of which male population is 2,038 while female population is 2,076. Literacy rate of awalgao village is 62.79% out of which 71.93% males and 53.81% females are literate. There are about 1,064 houses in awalgao village.

When it comes to administration, Awalgao village is administrated by a sarpanch who is elected representative of the village by the local elections. As per 2019 stats, Awalgao village comes under Brahmapuri assembly constituency & Gadchiroli-Chimur parliamentary constituency. Brahmapuri is nearest town to awalgao for all major economic activities, which is approximately 28km away.

Chapter- 4

TOPOGRAPHIC MAPS

Toposheets is a topographic map which is a two dimensional representation of a three dimensional land surface. Topographic maps are differentiated from the other maps in that they show both the horizontal and vertical position of the terrain. Through a combination of contour lines, colours, symbols, labels and other graphical representation. Topographic maps portray the shapes, location of mountains, and many other natural and manmade features.

To identify a map of a particular area, a map numbering system has been adopted by survey of India. Map characterized by large-scale detail and quantitative representation of relief, usually using contour lines

- Traditional definitions require a topographic map to show both natural and man-made features
- A topographic map is typically published as a map series, made up of two or more mapsheets that combine to form the whole map.

Toposheets classified according to scale:

Large scale maps: Scale 1 in 1000 or less than 1000

Medium scale maps: Scale from 1 in 1000 to 1 in 10000

Small scale maps: Scale 1 in 10000 or greater than 10000

Need & scope

- Topographic surveys were prepared by the military to assist in planning for battle and for defensive emplacements. As such, elevation information was of vital importance.
- As they evolved, topographic map series became a national resource in modern nations in planning infrastructure and resource exploitation.
- By the 1980s, databases of coordinates that could be used on computers by moderately skilled end users to view or print maps with arbitrary contents, coverage and scale. (Google Terrain Maps [non satellite image])

Uses of topographic maps

- Topographic maps have multiple uses in the present day: any type of geographic planning or large-scale architecture; earth sciences and many other geographic disciplines; mining and other earth-based endeavours; and recreational uses such as hiking or, in particular, orienteering, which uses highly detailed maps in its standard requirements.

Important Definitions on Toposheets

- REPRESENTATIVE FRACTION (RF): It is the ratio between the distances on the map to its corresponding distance on actual ground. The RF on this map is 1:50,000.

- SCALE : Scale is the ratio between the distance of any two points on the map and the actual distance of the same points on the ground. The scale of the given map extract is 2 cm: 1 km or 1:50,000.

- CONTOUR: Contours are imaginary lines drawn on maps, joining all places with the same height above sea level.

- CONTOUR INTERVAL: The interval between two consecutive contours is called contour interval

- INDEX CONTOUR: Contour lines are thickened at regular intervals to make it easier to read contours. For example at every 100 mts the contour line is made darker. The darker lines are called Index Contours.

- TRIANGULATED HEIGHT: It is the height of a place which has been calculated using trigonometry, represented by a small triangle e.g. $\Delta 540$

- SPOT HEIGHT: The height of random places between contours shown with a dot. Eg - .425

- BENCH MARK - Height of a place actually marked on a stone pillar, rock or shown on a building as a permanent reference. It is written as BM 200 m.

- RELATIVE HEIGHT: Relative height is the height of a feature with reference to the height of the surrounding land and NOT to sea level. It is represented by the height with a small 'r' e.g. -12r.

Chapter- 5

VISIT LOCATION

DEWULGAON AND AAWALGAO

BIF, QUARTZITE AND METABASALT

About Location-

Deulgaon village is located in Armori tehsil of Gadchiroli district in Maharashtra, India. It is situated 10km away from sub-district headquarter Armori (tehsildar office) and 25km away from district headquarter Gadchiroli. As per 2009 stats, Deulgaon village is also a gram panchayat.

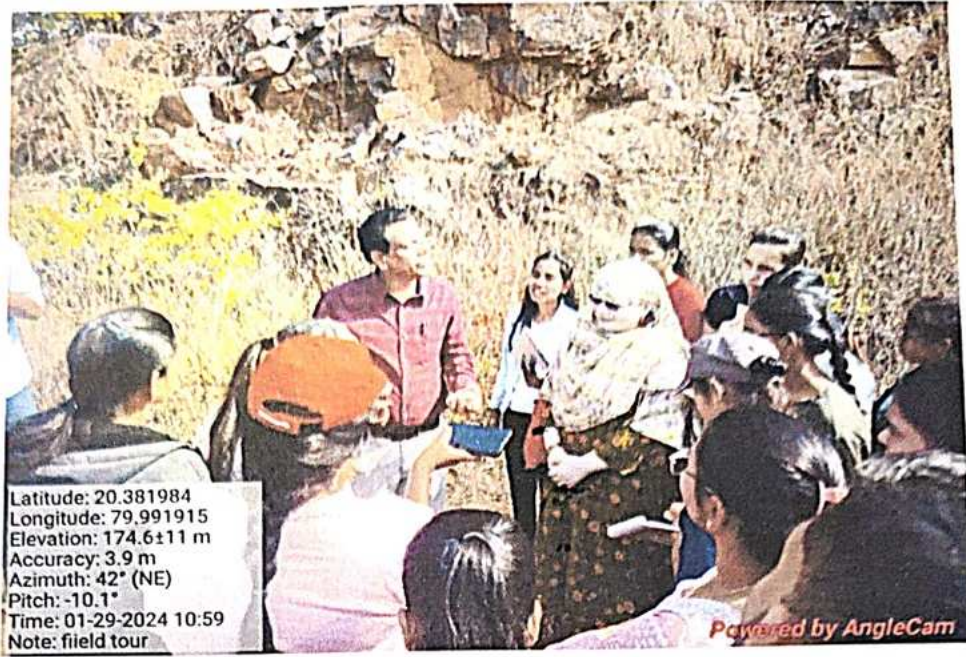
The total geographical area of village is 986.51 hectares. Deulgaon has a total population of 1,691 peoples, out of which male population is 844 while female population is 847. Literacy rate of deulgaon village is 70.79% out of which 78.79% males and 62.81% females are literate. There are about 419 houses in deulgaon village.

Desaiganj is nearest town to deulgaon for all major economic activities, which is approximately 28km away.

Awalgaon village is located in Brahmapuri tehsil of Chandrapur district in Maharashtra, India. It is situated 28km away from sub-district headquarter Brahmapuri (tehsildar office) and 100km away from district headquarter Chandrapur. As per 2009 stats, Awalgaon village is also a gram panchayat.

The total geographical area of village is 1714.01 hectares. Awalgaon has a total population of 4,114 peoples, out of which male population is 2,038 while female population is 2,076. Literacy rate of awalgaon village is 62.79% out of which 71.93% males and 53.81% females are literate. There are about 1,064 houses in awalgaon village.

When it comes to administration, Awalgaon village is administrated by a sarpanch who is elected representative of the village by the local elections. As per 2019 stats, Awalgaon village comes under Brahmapuri assembly constituency & Gadchiroli-Chimur parliamentary constituency. Brahmapuri is nearest town to awalgaon for all major economic activities, which is approximately 28km away.



Dr. Dorlikar sir Explain about the Quartzite and Geology of the area

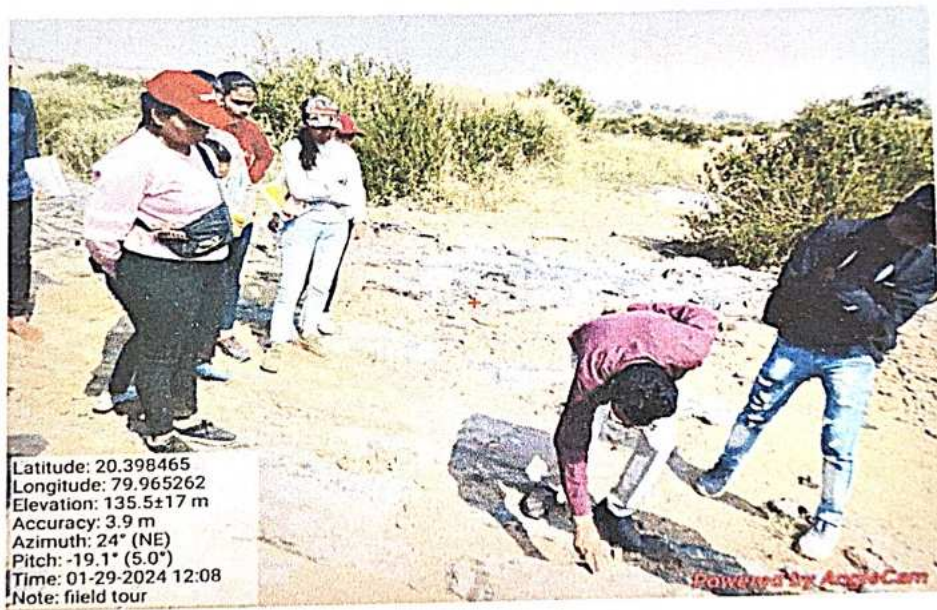


Fig-5.1 Field Photo



Fig-5.2 Dewulgaon Quartzite Mine MSC Geology Students

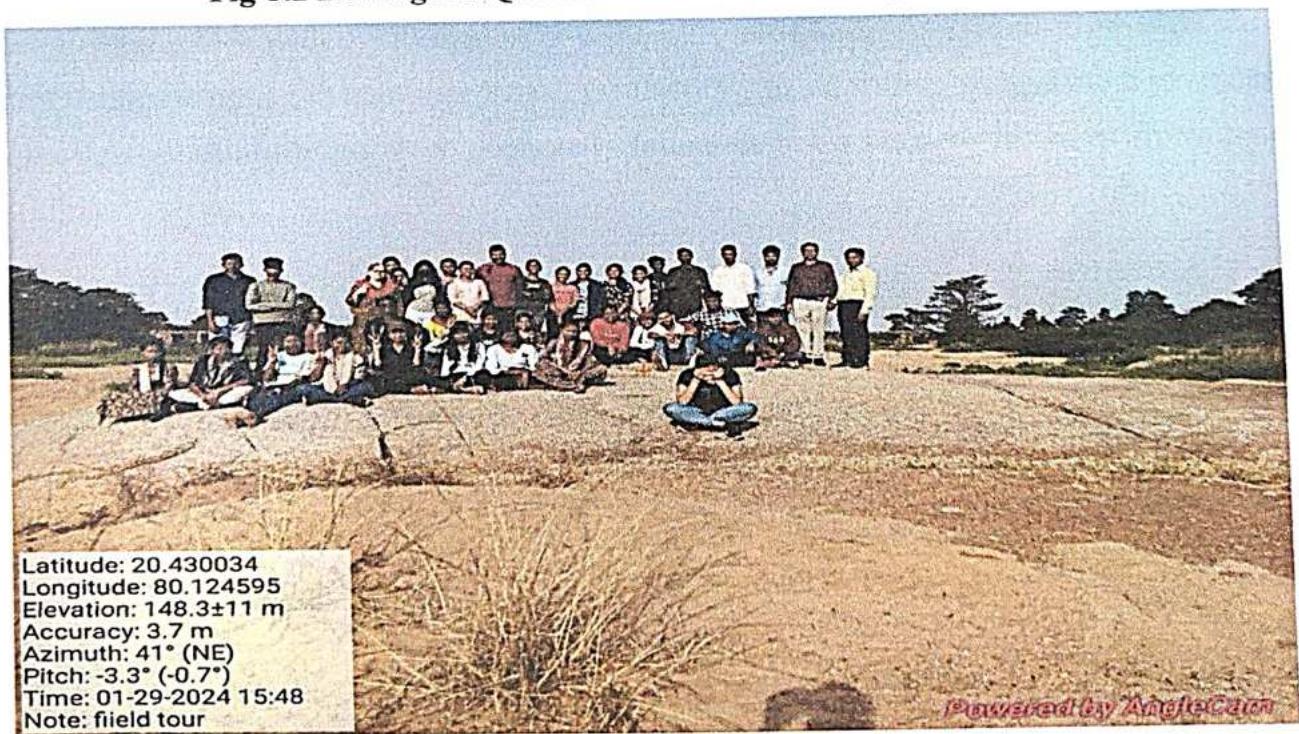




Fig- 5.4 Quartzite

Texture - granular.

Grain size - medium grained; can see interlocking quartz crystals with the naked eye.

Hardness - hard.

Colour - variable - pure quartzite is white but quartzite exists in a wide variety of colours.

Mineralogy - quartz.

Other features - generally gritty to touch.

Uses - pure quartzite is a source of silica for metallurgical purposes, and for the manufacture of brick; as aggregate in the construction and roading industries; as armour rock for sea walls; dimension stone for building facings, paving etc.

PETROGRAPHY OF METABASALT

The Metabasalts occurring in the study are composed of a mineral assemblage:

Quartz + hornblende + actinolite + chloritoid + plagioclase (relict) + clinopyroxene (relict) + sericite + opaque oxides. This mineral assemblage is not akin to a specific metamorphic grade

REFERENCES

- Chatterjee A. (1990) Structure, tectonics and metamorphic in the part of south Bastar, MP Quant. Jour Geol Minmet Soc. India, v.42, pp75-95.
- Chudhari A. k., Saha D., Deb S.P., Mukharjee M.K. and Ghose G, (2002) the purana basins of southern cratonic province of india –A case for Mesoproterozoic fossil rift. Gondwana res.,v 5,pp13-33.
- Cooper, A. F. (1972) Progressive metamorphism of metabasic rock from the Hast schist Group. Journal of Petrology; v.13, pp.457-492.
- Crookshank,h.,(1963) Geology of southern Bastar and Jeypore from the Bailadila range to the Eastern Ghat. Geol. Surv. India Mem., 87. pp.1-150
- Deer, W. A; Howazi, R A and Zussman, J. (1962) Rock Forming Minerals vol.1. Longmans, Green and Co. Ltd, London; 327p.
- Deshpande, G. G, (1996) Geology of Maharastra, published by Geological society of india, pp.223
- DRM (2001). District Resource Map for Gadchiroli District, Maharashtra, Geological Survey of India, Central Region.
- Mishra, V. P. Singh, P. and Dutta ,N.K. (1988) Stratigrafic, structure and Metamorphic history of Bastar craton. Rec Geol. surv india ,v..117. pp.1-2
- Mishra B. K., et al (1994) Regional Serch for Kimberlite in Tokapal and Sukma areas(indravati sabari Basinal Areas, Bastar District, Madhya Pradesh Rec. Geol.Surv. Ind. Vol 130.part 6)
- Naqvi, S. M. and Rogers, J.J.W. (1987) Precambrian Geology of India. Oxford University press, oxford , 223p.
- Prider, R. T. (1947) Chloritoid And Kalsoorli. Americans Mineralogist, Vol.32, P.471
- Radhakrishna, B. P. And Naqvi, S. M (1986) Precambrian continental if India its Evolution Jour.Geol.,v.94, pp.145-166.
- Robinson, P, Hollocher, K. T. Tracy, R. I. And Dietsh, C.W. (1982) High Grade Indian Metamorphism in South–Central Massachusetts; in Joester, R.L. and Quarrier, S.S Eds Guidebook for fieldtrips in connecticut and south-central massachusetts New England Inter collegiate geological conference 74th annual meeting, state Geological and natural History Survey of connectint, guidebook No.5,P. 289-339.

Rogers, J. J. W (1996) A History of continental in the past three Billion year Jour. Geol., v.104, pp.99-107.

Rogers J. J. W. and Santosh, M. (2003): Super continental in the earth history: Gondwana Res., v.6pp.357-368.

Roy, A. Bandyopadhyay, B. K., Huin, A. K., Moni, P. C. D. & Shah, S. K. (1995) Geology of Sakoli Fold Belt Nagpur, Bhandara & Gadchiroli Dist. Maharashtra Central India. Unpubl. GSI. Prog Report for F. S. 1989-1994

Sarkar, S. N. 1994 Chornostatigraphy and Tectonics of Dongargarh super Group Precambrian rock on Bhandara –Durg, central india Jour. Earth sci, vol. 21,21
pp.19-31

Sashidharan, K., Ganvir, D.V and Mohanty, A.K. (2001) Serch for Kimberlite and Lamprolite In the western part of the Bastar craton, Maharastra . Geo.Surv.Ind.Spl. Pub. No. 58; pp 45-54.

Venktesh, V. and Ramakishnan, M. (1995) Metamorphic facies map of india Nepal BhutanBangladesh and sri lanka in: sang man lee(Ed) metamorphic map of south and est, Asia (1:10m scale)-explanatory text commission of Geological map ofthe world sub –commission for metamorphic map, pp 18-34.

Yardely, B.W.D. (1990) An Introduction to Metamorphic Petrology elbs, Longman Scientific and Technical, England, 284p.

Radhakrishna, B.P. (1996) Mineral Resources of Karnataka (Page. no. : 285-295).

Umathay. R.M. (2006) Mineral Deposits of India (Page. no. :98-102).

Umeshwar Prasad (2000) Economic Geology and Economic Mineral Deposits (Page. no. :62-68).

**A DETAIL REPORT ON SYSTEMATIC STUDIES ON
OCCURRENCE AND MOVEMENT OF GROUNDWATER IN
PARTS OF WGK-1 WATERSHED OF DISTRICT
GADCHIROLI, MAHARASHTRA, INDIA.**

THESIS SUBMITTED TO GONDWANA UNIVERSITY, GADCHIROLI

FOR DESSERTATION

MASTER OF SCIENCE IN GEOLOGY

(FACULTY OF SCIENCE)

**SUBMITTED BY
ACHAL RAJENDRA KOKODE**



**SUPERVISED BY
DR. A.P.DHARASHIVKAR
GROUNDWATER SURVEY AND
DEVELOPMENT AGENCY GADCHIROLI
(APRIL 2024)**

CERTIFICATE

This is a certified that ACHAL RAJENDRA KOKODE has carried out project work on "A DETAIL REPORT TO SYSTEMATIC STUDIES ON OCCURRENCE AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED OF DISTRICT GADCHIROLI MAHARASHTRA INDIA." Under the supervision of Dr. A.P. DHARASHIVALKAR, Senior Geologist, G.S.D.A., Gadchiroli for the partial fulfillment of the post-graduate degree in Geology, M.G. Arts, Science and Late N.P Commerce College Armori, affiliated to Gondawana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the post-graduation in Post Graduate Department of Geology, M.G Arts, Science and Late N.P Commerce College Armori, affiliated to Gondawana University, Gadchiroli.

Place: ARMORI

Date: 06-04-2024



Dr. L.H. Khalsa

Principal

M.G College Armori



Dr. C.P. Doflikar

Head

Department of Geology



Internal




External

CERTIFICATE

THIS IS TO CERTIFY THAT THE WORK PRESENTED HERE IN THE THESIS TITLED AS "A DETAIL REPORT ON SYSTEMATIC STUDIES ON OCCURENCE AND MOVEMENT OF GROUNDWATER IN PARTS OF W GK-1 WATERSHED OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA. IS THE OWN WORK OF MS. ACHAL RAJENDRA KOKODE CONDUCTED IN POST GRADUATE DEPARTMENT OF GEOLOGY, MG ARTS, COMMERCE AND SCIENCE COLLEGE, ARMORI UNDER MY SUPERVISION.

THIS WORK HAS NOT BEEN SUBMITTED EARLEAR TO ANY UNIVERSITY OR INSTITUTION FOR ANY DIPLOMA OR DEGREE

DATE: 02.04.2024


DR. A.P. DHARASHIVKAR
Senior Geologist
G. S. D. A. Gadchiroli
SENIOR GEOLOGIST
GROUNDWATER SURVEY'S AND
DEVELOPMENT AGENCY, GADCHIROLI

CERTIFICATE

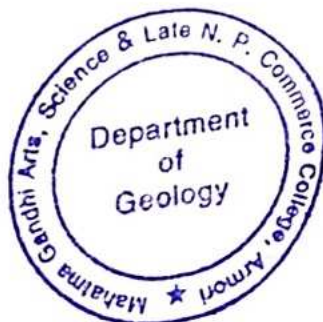
This is a certified that ACHAL RAJENDRA KOKODE has carried out project work on "A DETAIL REPORT TO SYSTEMATIC STUDIES ON OCCURRENCE AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED OF DISTRICT GADCHIROLI MAHARASHTRA INDIA." Under the supervision of Dr. A.P. DHARASHIVALKAR for the partial fulfillment of the post-graduate degree in Geology, M.G. Arts, Science and Late N.P Commerce College Armori, affiliated to Gondawana University, Gadchiroli.


She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the post-graduation in Post Graduate Department of Geology, M.G Arts, Science and Late N.P Commerce College Armori, affiliated to Gondawana University, Gadchiroli.

Place: ARMORI

Date:


Internal Examiner




12/4/24
External Examiner

DECLARATION / UNDERTAKING

I, hereby declare that the work presented in this thesis entitled: "A Detail Report on Systematic studies on Occurrence and Movement of Groundwater in parts of WGK-1 watershed of District Gadchiroli, Maharashtra, India" was carried out by me under the supervision of Dr. Abhijit Dharashivkar. This work or any part of this work is based on original data collection and research and has not been submitted by me to any University/ Institution for the award of any diploma or degree.

Date: 06 .04.2024



Achal Rajendra Kokode

M.G Arts, Commerce and Science

College Armori

ACKNOWLEDGEMENTS

I express my deepest sense of gratitude to my Supervisor, Dr. A. P. Dharashivkar, Senior Geologist, Groundwater Survey and Development Agency Gadchiroli for his valuable and inspiring guidance. His constructive criticism, interest and immense help in the preparation of manuscript as well as interpretation of data need profuse thanks!

I like to express my sincere thanks to Dr. C. P. Dorlikar, Professor and Head, Post Graduate Department of Geology, M.G Collage of Arts, Commerce and Science College, Armori, for his valuable help rendered during the present studies. I am grateful to Prof. Ganvir, Senior Faculty from PG Department of Geology, M.G Arts, Commerce and Science College, Armori for their constant encouragement, inspiring guidance and help extended from time to time during this study.

My sincere thanks are also extended to concerned authorities and staff members of office of Senior Geologist, Groundwater Survey and Development Agency (GSDA), Gadchiroli District, for providing me the most needed analytical database of drinking water samples from my study area and allied GIS data.

I am also thankful to Ms. Diksha Wanmali and Mr. Pranay Fulzele, Faculty in Geology, PG Department of Geology, MG Arts, Commerce and Science College, Armori for their help in actual working on this thesis.

My Special thanks to Our Principal Dr. Khalsa Sir for providing me the systematic environment for the said work and continuous encouragement.

My sincere gratitude towards the Management of MG Arts, Commerce and Science College Armori for their encouragement and enthusiasm during actual tenure of work.

I am thankful to my colleagues **Twinkal, Shruti and Kajal** for their active and enthusiastic support in database sorting, database arrangement and thesis writing. .

I express my thanks to Shri Jitendra Bodele, Laboratory Assistant, PG Department of Geology, MG Arts, Commerce and Science College, Armori for providing us Laboratory facilities during actual tenure of work.

My immense sense of gratitude towards my parents for their constant encouragement, patience, unstinted support and kind blessings enabled me to complete the thesis. Finally, I am forever indebted to all my colleges and those who have directly or indirectly supported me in this endeavor.

Place: Armori
Date: 06 April 2024


(Achar Rajendra Kokode)

ABBREVIATIONS

- AMSL Above Mean Sea Level
- BCM Billion Cubic Meter
- CGWB Central Ground Water Board
- MBGL Meters Below Ground Level
- DRM District Resource Map
- GIS Geographic Information System
- GPS Global Positioning System
- GSDA Groundwater Surveys and Development Agency
- ha Hectare
- Ham Hectare meter
- Km/ km Kilometer
- Lph Liters per hour
- Lpd Liters per day
- Lps Liter per second
- Max Maximum
- MCM Million Cubic Meter
- Min Minimum
- M.S. Maharashtra State
- NWP National Water Policy
- RGNDWM Rajiv Gandhi National Drinking Water Mission
- RS Remote Sensing
- SOI Survey of India
- SWL Static Water Level
- MSL Mean Sea level

ORGANIZATION OF THESIS

The thesis incorporates the various integrated investigations carried out around The Groundwater Surveys and Development Agency has denoted this watershed as WGK-1 The entire watershed mainly falls in Armori Dhanora and Gadchiroli Talukas of Gadchiroli District.

The thesis is divided into 9 chapters followed by list of references. The smaller figures are placed in continuation with the text while larger maps follow the coming pages. Tables are positioned in continuation with the text while plates and annexures exhibiting photographs, as well as research papers, respectively are located at the end of thesis. The chapters in the thesis are organized as follows:

The first chapter brief outline regarding the study area is given.

The second chapter discusses the previous work carried out by various organization like GSDA, CHWB, GSI is given.

In the third chapter the Methodology for actual work, data collection, generation of various kinds of thematic maps etc. is also added.

In the fourth chapter Drainage Patterns is described very briefly.

In fifth chapter Geomorphological features identified in study as per data provided by MRSAC is discussed.

In sixth chapter is Geological setting with stratigraphy is discussed in detail.

In seventh chapter detailed study related rainfall analysis.

In eighth chapter hydrogeology.

In ninth chapter Discussion and Conclusion.

Contents

CHAPTER 1: INTRODUCTION	13
CHAPTER 2: PREVIOUS WORK.....	19
CHAPTER 3: METHODOLOGY	20
CHAPTER 4: DRAINAGE NETWORK.....	22
CHAPTER 5: GEOMORPHOLOGICAL SET UP	23
CHAPTER 6: GEOLOGICAL SET UP	25
CHAPTER 7: RAINFALL ANALYSIS	29
CHAPTER 8: HYDROGEOLOGY	37
CHAPTER 9: DISCUSSION.....	63
REFERENCES.....	65

CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

Groundwater is the main key resource for human beings for living hence it has got immense value. So, in the present study the seasonal and temporal variation in occurrence and movement of groundwater is undertaken. The Dist. Gadchiroli is known as the Aspirational District by Government of India. Even 76 years after Independence the systematic studies on occurrence and movement of groundwater is very little done. So, taking that into consideration the present study is taken.

In the present study Rainfall and its variation with respect to time is taken as it is the sole source of groundwater recharge. The Watershed is taken as the study unit as the surface water flow is controlled by watershed boundaries or morphologic boundaries. The study is limited to parts of GSDA watershed WGK-1.

1.2 STUDY AREA

WGK-1 area covers 104.692 Sq Km area of Gadchiroli district and is located 170 KM south-east of Nagpur city. It included in the Survey of India toposheet number 55P/15 between (Watershed Map, table 1) Longitude $20^{\circ}16'15''$ and Latitudes $79^{\circ}59'20''$ (Fig 1.2), Table.1. The area experiences a tropical dry sub-humid climate. The summer months are much hotter (maximum temperature 43.4°C) while, winter is mild (minimum temperature 14.4°C). The GSDA has categorized the watershed as WGK-1. In WGK-1 area having 49 villages and there are 36 villages from Armori, 5 villages from Dhanora and 8 villages from Gadchiroli.

In our studies I have selected an east part of WGK-1 watershed area and selected study area covers 7766.09 Ha area of WGK-1. In my study area having

CHAPTER 2: PREVIOUS WORK

Dr. A.P Dharashivakar and Nandini Gedam(2021) unpublished report have worked on Drainage morphometry of the study area. In which they given stream order relationships 74.19% first order, 19.35 second order, and 05% third order and 1% fourth order. In this report they carried out work on the various morphometric parameters of the study area.

In our studies I have utilized the database received from the State Groundwater Survey and Development Agency, District Office. In which GIS data is processed in Arc GIS10.4.1 platform and various kinds of maps have been generated which we are adding here as an attachment.

CHAPTER 3: METHODOLOGY

The main aim of the present study is to identify the impact of actual rainfall occurrence and movement of groundwater in specific area of WGK-1 watershed.

In the present investigation exhaustive database on surface and subsurface water resources, geology, geological structures, geomorphology and demography has been collected. The methodology adopted in the present study involves the following steps.

- i. Collection of historical data
- ii. Previous work carried out in aspects like
 - Geology
 - Geomorphology
 - Hydrogeology
- iii. Preparation of various thematic maps
 1. Geological Map
 2. Geomorphological Map
 3. Drainage Map
 4. Existing Water Conservation Structures
 5. Land use and Land Cover.

3.1 Collection of Data

3.1.1 Collection of historical data

In relation to these studies, the historical data like demographic details, rainfall, static water levels, Drainage, village settlement, roads, geomorphology, geology land use etc. are collected by various Government organizations like GSDA, MRSAC and Local Gram Panchayat.

CHAPTER 4: DRAINAGE NETWORK

The WGK-1 Watershed comprises of various Dendritic to Sub dendritic drainage patterns. Mostly drainage is mostly flowing toward North-to-Northwest. Major river is Khobragadi River, and the total rainfall runoff is contributed to Khobragadi River. The Drainage is in majority seasonal one only perennial drainage is Khobragadi River.

A major fourth order stream is flowing in majority towards northwest to west and meeting khobragadi river near chak sonapur.

The watershed WGK-1 could be divisible into 1-6 mini watershed that is 1/1, 1/2, 1/3, 1/4, 1/5, 1/6.

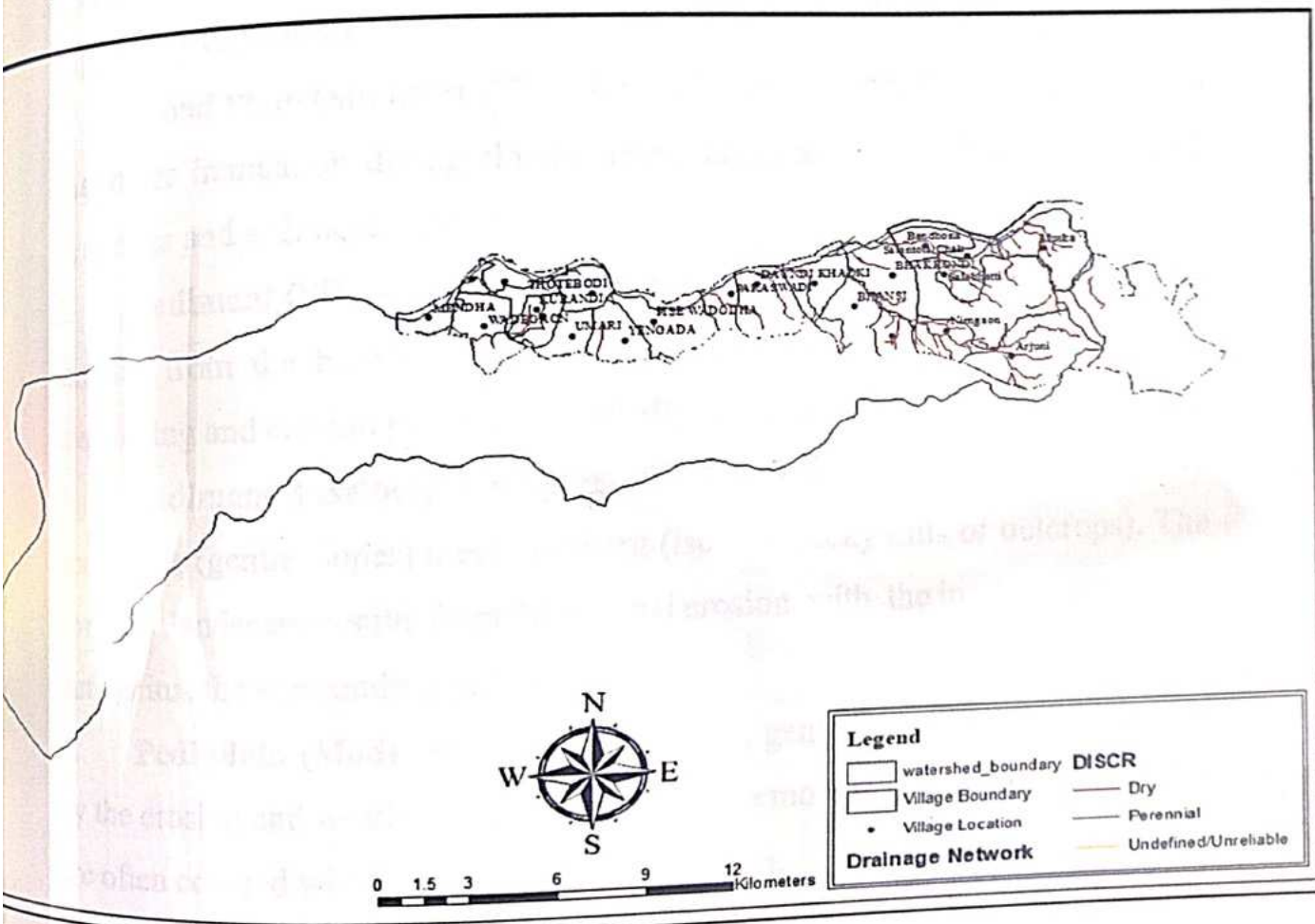


Figure No.2

CHAPTER 5: GEOMORPHOLOGICAL SET UP

The geomorphology of the area influences the quality and availability of groundwater. It determines the surface flow direction and controls the amount and rate of infiltration. The geomorphological features that play a great role in groundwater availability and quality include slope, elevation, drainage density, lineament density, soil, land use and land cover (LULC).

The geomorphic features given in front can be seen in our study area.

1. **Flood Plain (Moderate) FPM** :- These are relatively flat areas adjacent to rivers or streams that experience periodic flooding. The moderate flood plain is characterized by occasional inundation, allowing for fertile soil deposition and supporting vegetation.
2. **Flood Plain (Shallow) FPS** :- Similar to the moderate flood plain, but with shallower inundation during floods. These areas are still influenced by river dynamics and sediment deposition.
3. **Pediment (PD)** :- A gently sloping, erosion-resistant bedrock surface that extends from the base of a mountain or hill. Pediments often form due to weathering and erosion processes, gradually smoothing the landscape.
4. **Pediment Inselberg Complex (PIC)** :- This refers to an area where pediments (gentle slopes) meet inselberg (isolated rocky hills or outcrops). The complex landscape results from differential erosion, with the inselbergs standing out against the surrounding pediment.
5. **Pedi plain (Moderate) PPM** :- A broad, gently undulating plain formed by the erosion and weathering of bedrock. These moderately weathered surfaces are often covered with soil and support vegetation.

CHAPTER 6: GEOLOGICAL SET UP

In the study area watershed WGK-1, contain mainly Amgaon Gneissic complex, Dongargarh Granite, Laterite and Kamthi Sandstone Formation. The geological map is shown below.

Table 2 : Generalized Geological Sequence

	Formation	Lithology
Recent	Alluvium	Soil, Laterite
Upper Gondwana	Chikhiala Formation	Grey to black ferruginous sandstones Ferruginous conglomerate and sandstones
	Kota Formaton	Ferruginous Conglomerates and Sandstones Calcareous sandstones and Limestones
Lower Gondwana	Kamthi Formation	Friable, ferruginous, medium to coarse grained sandstones and ferruginous conglomerates
Pre-Cambrian	Pakal (Cuddapahs)	Limestone with intercalated shales, Conglomerates, Breccias, Quartzites and Sandstones
Archeans	Gneissic Complex	Basic Intrusive and Quartz Pegmatite veins, Granite Gneisses, Banded Magnetite Quartzite and other unclassified metamorphics

CHAPTER 7: RAINFALL ANALYSIS

The Monsoon Rainfall database of last 24 years for Armori, and Dhanora Taluka is taken from the government web site services.maharain.maharashtra.gov.in and is utilized for understanding the behavior pattern of rainfall. Monsoon rainfall data is collected, and the data is analyzed. Taking normal rainfall values from IMD, variation of rainfall was calculated. Accordingly, percentage deviation with respect to normal rainfall is calculated and it is utilized for knowing the cyclicity and trend of rainfall.

The rainfall data is collected on a monthly basis with actual rainy days, and it is well known fact that actual rainfall is directly proportional to ground water levels. In this report static water levels were observed on monthly basis hence to study the impact of rainfall on static water levels of observation wells the measurement cycle is taken on monthly basis.

Here in this chapter the monsoon rainfall data for Taluka Armori, and Dhanora is attached separately. And the deviation from standard is also studied to establish the facts regarding rainfall and its monthly behavioral pattern.

The Monthly rainfall data of Armori and Dhanora for 24 years when studied and analyzed in detail, it is observed that the rainfall is showing vast variation with respect to normal rainfall. Hence for easy understanding and interpretation purposes, the classification of rainfall was done, and the 4 classes were made i.e. 0-10%, 10% – 30%, 30% -50% and > 50% on both side of zero means positive and negative side.

CHAPTER 8: HYDROGEOLOGY

The district is unique in Maharashtra in the sense that the entire area of the district is mainly occupied by metamorphic and igneous rocks along with sedimentary rocks in the southern part. My study area is underlain by the oldest Granites and Gneiss of the Archean.

The occurrence and movement of ground water depends upon the rock formation of the area. It is generally influenced by the following factors.

- Inter-granular primary porosity and permeability.
- Thickness and extent of weathered zones.
- Topographic setting of an area.
- Surface water bodies influence ground water recharge.
- Development of joints, fractures, lineaments constituting secondary porosity and permeability.

8.1 Hard Rock Formation

Archean:- Archean consisting of granite gneisses, schist, etc. occupies my all-study area. These un-weathered rocks do not have inter granular porosity and permeability. Occurrence of ground water in this formation is controlled by the degree of weathering, jointing, and fracturing. These crystalline rocks due to prolonged weathering have produced layers of unconsolidated saprolite material which forms favorable and important source of ground water. The thickness of the weather varies considerably and at times it is more than 20 m. The weathering in coarse grained hard rocks imparts good porosity and permeability and the ground water structures constructed in these rocks give good yields. Laterite is commonly found to cap the weathered rocks at some places. These Laterites have generally low permeability and tends to impede infiltration. The ground water abstraction structures constructed in these rocks have poor yields. Un-weathered rock underlain by the weathered zones, jointed and fractured zones form good

CHAPTER 9: DISCUSSION

The important observation and findings from the study area are discussed and concluded are following.

- 1) The WGK-1 Watershed is comprising of various Dendritic to Sub dendritic drainage patterns. Major river is Khobragadi River, and the total rainfall runoff is contributed to Khobragadi River. The Drainage is in majority seasonal one only perrinial drainage is Khobragadi River.
- 2) A major fourth order stream is flowing in majority towards northwest to west and meeting khobragadi river near chak sonapur.
- 3) The geomorphic features given in front can be seen in our study area.
 - a) Flood Plain (Moderate) FPM
 - b) Flood Plain (Shallow) FPS
 - c) Pediment (PD)
 - d) Pediment Inselberg Complex (PIC)
 - e) Pediplain (Moderate) PPM
- 4) Good Groundwater potential Zone is mainly dominated by geomorphic units like deep pediplain as well as shallow pediplain. Such Favorable hydrological conditions in the zone are suitable for groundwater exploitation.
- 5) Moderate Groundwater potential zone dominated by pediment unit. A gently sloping, erosion-resistant bedrock surface that extends from the base of mounatain or hills.
- 6) At places, shallow and moderate pediplain also covers this zone. The zone is mostly confined to erosion and weathered of bedrocks. This area may still exhibit gentle slopes and are conducive to agriculture.
- 7) Structural hill result from geological processes such as faulting and folding or uplift. Their formation is closely tied to the underlying rock structures.

REFERENCES

CGWB (2003). Ground Water Resources and Development Potential of Nagpur District, Maharashtra, Annual Action Program: 1999-2000. Central Ground Water Board, Central Region, Nagpur. pp. 1-11

Collector Office. Yearly Statistics of rainfall, For last 24 years (2000-2023), Gadchiroli District Maharashtra Collector Office Gadchiroli.

services.maharain.maharashtra.gov.in. Monthly statistics of rainfall and rainy days for last 24 years (2000-2023).

Das, S. (2003). Groundwater overexploitation-India scenario. Proceedings of assessment and management of water resources, society of Geoscientists and Technologist, Bhuwaneshwar, Dec. 2003, pp. 79-92

Das, S. (2005). Groundwater overexploitation and importance of water management in India-Vision-2005. Tenth Indian Geological Congress Foundation lecture series, Karnataka University, Dharwar, Feb,4, 2006, 24p.

Deshpande G.G. (1998). Geology of Maharashtra, Published by Geological Society of India, pp. 7-12.

Deshpande, A.S. (2003). A Geomatics approach in establishment of methodology for watershed eco-development system, Eco. Env. & Cons., Vol 9 (1), pp. 91-94

District Collector Office (2000-2023). Report on rainfall data, District Collectorate Office, Revenue Department. Gadchiroli.

GSDA (2004). Estimation of groundwater resources of Maharashtra as per the recommendation of the GEC 1997 Methodology. Report published jointly

A
PROJECT
ON

**“A GEOLOGICAL STUDY OF BANDED IRON FORMATIONS B-I-F IN AND
AROUND ARMORI DISTRICT GADCHIROLI.”**



SUBMITTEDBY

AMIT ANANDRAO KALE

GUIDEDBY

PROF. P. G. FULZELE

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE


This is certified that AMIT ANANDRAO KALE has carried out project work on "A GEOLOGICAL STUDY OF BANDED IRON FORMATIONS B-I-F IN AND AROUND ARMORI DISTRICT GADCHIROLI" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/2024




PROF. P. G. FULZELE
Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that AMIT ANANDRAO KALE has carried out project work on "A GEOLOGICAL STUDY OF BANDED IRON FORMATIONS B-I-F IN AND AROUND ARMORI DISTRICT GADCHIROLI" under the supervision of PROF. P. G. FULZELE for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/2024


Dr. L. H. Khalsa

Principal

M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

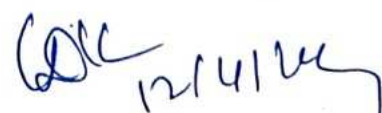



Dr. C. P. Dorlikar

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College


12/4/24
(Ext)


12/4/24
(Incom)

CERTIFICATE

This is certified that AMIT ANANDRAO KALE has carried out project work on "A GEOLOGICAL STUDY OF BANDED IRON FORMATIONS B-I-F IN AND AROUND ARMORI DISTRICT GADCHIROLI" under the supervision of PROF. P. G. FULZELE for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

(Dr. C. P. Doshi)

Internal Examiner
(Dr. C. P. Doshi)



(Dr. S. G. Jene)
12/4/24

External Examiner
(Dr. S. G. Jene)

DECLARATION

I hereby declare that the project report entitled "A GEOLOGICAL STUDY OF BANDED IRON FORMATIONS B-I-F IN AND AROUND ARMORI DISTRICT GADCHIROLI" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of PROF. P. G. FULZELE.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 06/04/2024

Place: Armori


AMIT ANANDRAO KALE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **PROF. P. G. FULZELE**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


AMIT ANANDRAO KALE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASICS OF GEOLOGICAL INVESTIGATION	10
6	BIF	21
7	CONCLUSION	24
8	REFERENCES	26

CHAPTER I

INTRODUCTION

1. INTRODUCTION

Banded iron formations (BIFs; also called banded ironstone formations) are distinctive units of sedimentary rock consisting of alternating layers of iron oxides and iron-poor chert. They can be up to several hundred meters in thickness and extend laterally for several hundred kilometers. Almost all of these formations are of Precambrian age and are thought to record the oxygenation of the Earth's oceans. Some of the Earth's oldest rock formations, which formed about 3,700 million years ago (Ma), are associated with banded iron formations. A typical banded iron formation consists of repeated, thin layers (a few millimeters to a few centimeters in thickness) of silver to black iron oxides, either magnetite (Fe_3O_4) or hematite (Fe_2O_3), alternating with bands of iron-poor chert, often red in color, of similar thickness. A single banded iron formation can be up to several hundred meters in thickness and extend laterally for several hundred kilometers.

Banded iron formation is more precisely defined as chemically precipitated sedimentary rock containing greater than 15% iron. However, most BIFs have a higher content of iron, typically around 30% by mass, so that roughly half the rock is iron oxides and the other half is silica. The iron in BIFs is divided roughly equally between the more oxidized ferric form, Fe(III), and the more reduced ferrous form, Fe(II), so that the ratio Fe(III)/Fe(II+III) typically varies from 0.3 to 0.6. This indicates a predominance of magnetite, in which the ratio is 0.67, over hematite, for which the ratio is 1. In addition to the iron oxides (hematite and magnetite), the iron sediment may contain the iron-rich carbonates siderite and ankerite, or the iron-rich silicates minnesotaite and greenalite. Most BIFs are

2. OBJECTIVES

- To study the general topographic setup of the study area.
- To perform the general geological study of the study area.
- To understand the individual rock unit of the study area.
- To identify the BIF and deduce its characteristics.

CHAPTER 1
INTRODUCTION

3. METHODOLOGY

- The study area was first observed from the Google earth to identify the probable outcrops.
- The field visits has been conducted to mark the sample locations.
- The representative samples were collected by standard procedure.
- The collected samples were then studied in the laboratory.
- The interpretations are drawn from the megascopic study.

4. STUDY AREA

The study area was mapped and few mafic rock exposures were observed;



Figure 1 - Map of study area indicating BIF.

Sample Point

- BIF - 20°22'47.32"N and 79°59'35.78"E

5. BASICS OF GEOLOGICAL INVESTIGATION

The geological field work is carried out to search mineral deposits and to explore ground for many civil engineering works. During the geological survey sufficient data are gathered to prepare geologic maps and reports about a particular area of interest.

5.1 Field Equipment

The equipment that are commonly required for doing a geological field work are as follows.

- Topographic map.
- Compass.
- Hammer
- Haversack
- Altimeter
- Measuring Tape
- Field Notebook

5.2 Method of field work

5.2.1 Preliminary Survey

Before doing field mapping one should first undertake a rapid reconnaissance of the target area by taking topographical map. This will help in choosing suitable mapping procedures and in getting the general idea about the geological problems. The reconnaissance traverses should be planned in such a manner as to come across the different rock types present

6. BIF

Study area is dominated by the metamorphic rocks which include quartzite and probably gneiss. Wainganga and Khobragadi river has developed a large fertile alluvial plain around her channel. Continuous mining activity for quartzite has transformed the area radically. Following is the general geology of the study area.

On megascopic study of BIF fragments following characteristics were observed.

- It is a dark coloured rock with light bands of quartzite, and dark band of iron rich rock.
- It could be a meta-sedimentary rock of having metamorphic origin from sedimentary rock.
- The rock is crystalline in nature.
- It indicates the chemical precipitation.
- Layered structure indicates change in depositional environment.
- Dark coloured iron rich layer could be a result of high iron content.
- Streak of the light coloured mineral is not found indicating hard material like quartz.
- Light coloured bands are formed due to settling of fine sand but on metamorphism they turned into quartzite.
- It could be deposited in an oxidizing environment like shallow water environment.
- Streak of the dark coloured mineral is somewhat cherry red indicating hematite existence.

7. CONCLUSION

Following are the can derived from the results;

- The study area is geologically stable and does not possess any crucial mineral deposit.
- Most of the study area is covered by the alluvial deposits but some patches are also covered by the igneous and metamorphic rocks.
- The banded iron formation is the result of sequential deposition of the iron and quartzite bands.
- The dark color bands essentially contain iron content in the form of hematite.
- The existence of the Hematite is proved by cherry red streak.

Cross, Whitman; Iddings, Joseph P.; Pirsson, Louis V.; Washington, Henry S. (September 1902). "A Quantitative Chemico-Mineralogical Classification and Nomenclature of Igneous Rocks". *The Journal of Geology*. 10 (6): 555–690.

Philpotts, Anthony R.; Ague, Jay J. (2009). *Principles of igneous and metamorphic petrology* (2nd ed.). Cambridge, UK: Cambridge University Press. p. 137.

Singh P. (2010) Engineering and General Geology, S. K. Kataria and Sons.

Bangar K (2020) Principals of Engineering Geology, Standard Publisher Distributor.

Jackson, Julia A., ed. (1997). "mafic". *Glossary of geology* (Fourth ed.). Alexandria, Virginia: American Geological Institute. ISBN 0922152349.

Le Bas, M. J.; Streckeisen, A. L. (1991). "The IUGS systematics of igneous rocks". *Journal of the Geological Society*. 148 (5): 825–833. Bibcode:1991JGSoc.148..825L. CiteSeerX 10.1.1.692.4446. doi:10.1144/gsjgs.148.5.0825. S2CID 28548230.

Philpotts, Anthony R.; Ague, Jay J. (2009). *Principles of igneous and metamorphic petrology* (2nd ed.). Cambridge, UK: Cambridge University Press. p. 137. ISBN 9780521880060.

Cross, Whitman; Iddings, Joseph P.; Pirsson, Louis V.; Washington, Henry S. (September 1902). "A Quantitative Chemico-Mineralogical Classification and Nomenclature of Igneous Rocks". *The Journal of Geology*. 10 (6): 555–690.

Philpotts, Anthony R.; Ague, Jay J. (2009). *Principles of igneous and metamorphic petrology* (2nd ed.). Cambridge, UK: Cambridge University Press. p. 137.

Singh P. (2010) Engineering and General Geology, S. K. Kataria and Sons.

Bangar K (2020) Principals of Engineering Geology, Standard Publisher Distributor.

www.google.com

www.wikipedia.com

A
PROJECT
ON

**“TECHNIQUES IN HYDROGEOCHEMICAL STUDIES: TRADITIONAL AND
CONTEMPORARY APPROACH.”**



SUBMITTEDBY

DIVYA NANAJI NAGOSE

GUIDEDBY

Dr. P. S. GANVIR

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

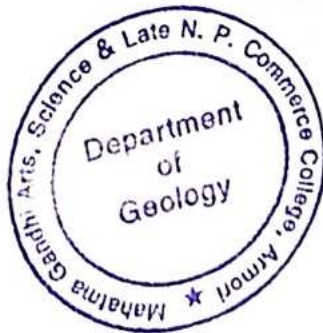
CERTIFICATE

This is certified that DIVYA NANAJI NAGOSE has carried out project work on "TECHNIQUES IN HYDROGEOCHEMICAL STUDIES: TRADITIONAL AND CONTEMPORARY APPROACH" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/2024



Dr. P. S. GANVIR
Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that DIVYA NANAJI NAGOSE has carried out project work on "TECHNIQUES IN HYDROGEOCHEMICAL STUDIES: TRADITIONAL AND CONTEMPORARY APPROACH" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/2024



Dr. L. H. Khalsa


Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College

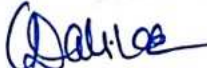

12/4/24
(EXT)

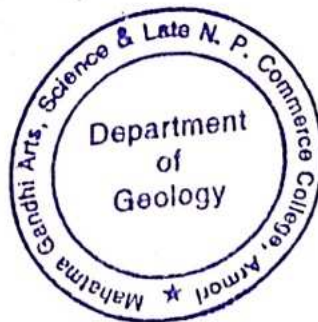

12/04
(IA)


CERTIFICATE

This is certified that DIVYA NANAJI NAGOSE has carried out project work on "TECHNIQUES IN HYDROGEOCHEMICAL STUDIES: TRADITIONAL AND CONTEMPORARY APPROACH" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


Internal Examiner
(Dr. C. P. Doshi)




External Examiner
(Dr. S. G. Jee)

DECLARATION

I hereby declare that the project report entitled "TECHNIQUES IN HYDROGEOCHEMICAL STUDIES: TRADITIONAL AND CONTEMPORARY APPROACH" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. P. S. GANVIR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 05/04/2024

Place: Armori

~~Nagoose~~

DIVYA NANAJI NAGOSE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **Dr. P. S. GANVIR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


DIVYA NANAJI NAGOSE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	HYDRO-GEOCHEMICAL DATA GENERATION	8
5	INTERPRETATION TOOLS	15
5	DISCUSSION	20
6	CONCLUSION	23
7	REFERENCE	25

CHAPTERS

INTRODUCTION

1. INTRODUCTION

A populous country like India; where, the population is dense and diverse with agricultural profession as a major occupation, must review the groundwater studies. The groundwater is contributes majorly in the fresh water resources of India. Our country is having the largest users of groundwater around the world. The quality and quantity of the groundwater are the two sides of the same coin. No side can be avoided or neglected. In the modern world prominent workers are attentive on the quality issue of the groundwater and the present work evaluates the factors controlling this quality.

The data of the hydro-geochemistry can be generated by the standard procedures suggested by multiple agencies. But its interpretations needs standards norms and through understanding of the implications. The selected topic for dissertation is a review topic where the various predictions regarding geology on the basis of the groundwater quality data is evaluated. The groundwater is one of the most crucial sources of fresh water and is highly studied in respect to quantity and quality.

2. OBJECTIVES

- To understand the various sources of hydro-geochemical data generation.
- To comprehend some selective but effective hydro-geochemical interpretation tools.
- To compare the various tools available for hydro-geochemical interpretation.

CHAPTER 1

METHODOLOGY

3. METHODOLOGY

- The study has been majorly done on the secondary data opted from various sources.
- The various techniques of hydro-geochemical data generation have been referred from the APHA guidelines.
- The hydro-geochemical interpretation techniques are also referred from the various sources.
- Finally a cumulative observation was made to predict some of the crucial outcomes.

CHAPTER 4

HYDRO-GEOCHEMICAL DATA GENERATION

4. HYDRO-GEOCHEMICAL DATA GENERATION

As per the guidelines of the APHA 1998 were referred for the identification of the sources;

4.1 Cations

4.1.1 Na/K

The compounds of Alkali and alkaline earth Metal dissociate into atoms when introduced into flame. They get excited on absorbing energy and when they return back to ground state, emit the radiations which lie in the visible spectrum. Each of them have a specific wavelength and imparts a characteristic colour to the flame.

Instrument and method of measurement

- Instrument Description
- Source of flame: Burner in the FPM.
- Nebuliser: To send homogenous solution into the flame.
- Optical system: Convex mirror and lens transmits the light emitted from atoms.
- Colour filters: Isolate the relevant wavelength to be measured.
- Photo detector: Measures the intensity of radiations emitted by flame.
- Switch ON the compressor and the instrument.
- Switch on the regulator and ignite the flame.

5. INTERPRETATION TOOLS

5.1 Stiff's Diagram

This diagram can be used to understand the dominance of the various cations and anions in an individual sample.

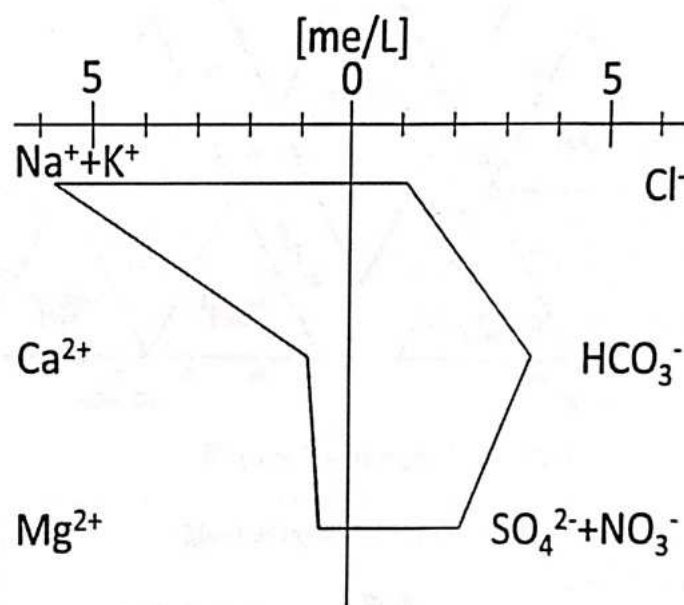


Figure 1 - Stiff's diagram

5.2 Piper Plots -

The piper plot is the graphical representations where the results of the water samples are plotted on the tri-linear graphs. This type of plot explains the type of groundwater and hydro-geochemical facies of the analyzed groundwater (Karanth 1997).

6. Discussion

Following are the opinions that can be deduced by the various interpretation techniques;

Traditional

Graphs -

The representation of the graphs manifests multiple outputs regarding the geology of the sample. The intensity of the specific ion in the sample or dominance of any ion in overall area can explain much about the local geology.

Stiff's Plot -

This plot explains the individual sample and generates a brief report over the dominance of any ion. Such report explains the specific source of the ion from the local geology and hence fairly helpful in understanding the local geology.

Piper Plot -

This plot clearly elaborates the hydro-geochemical facies, which is actually a detailed report over the ion dominance in the overall samples taken. Such detailed report can elaborate all the necessary information related to the local geology. A specific facies represents a specific set of local geology. Hence, the piper diagram is a very important mode of interpretations in hydro-geochemical studies.

A
PROJECT
ON

**“IDENTIFICATION OF ARTIFICIAL GROUNDWATER RECHARGE POINTS
IN METAMORPHIC TERRAIN AROUND ARMORI AREA OF DIST. -
GADCHIROLI.”**



SUBMITTEDBY

GAURAV BHAGWAN PENDAM

GUIDEDBY

Dr. P. S. GANVIR

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE

This is certified that GAURAV BHAGWAN PENDAM has carried out project work on “IDENTIFICATION OF ARTIFICIAL GROUNDWATER RECHARGE POINTS IN METAMORPHIC TERRAIN AROUND ARMORI AREA OF DIST. - GADCHIROLI” under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori
Date- 06/04/2024



Dr. P. S. GANVIR
Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that GAURAV BHAGWAN PENDAM has carried out project work on "IDENTIFICATION OF ARTIFICIAL GROUNDWATER RECHARGE POINTS IN METAMORPHIC TERRAIN AROUND ARMORI AREA OF DIST. - GADCHIROLI" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 12/04/2024


Dr. E. H. Khalsa

Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar


Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College

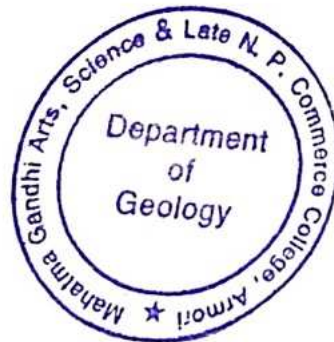

12/4/24


CERTIFICATE

This is certified that GAURAV BHAGWAN PENDAM has carried out project work on "IDENTIFICATION OF ARTIFICIAL GROUNDWATER RECHARGE POINTS IN METAMORPHIC TERRAIN AROUND ARMORI AREA OF DIST. - GADCHIROLI" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


Internal Examiner
C.D.S. C.P. Dorkar




External Examiner
12/4/24

DECLARATION

I hereby declare that the project report entitled "IDENTIFICATION OF ARTIFICIAL GROUNDWATER RECHARGE POINTS IN METAMORPHIC TERRAIN AROUND ARMORI AREA OF DIST. - GADCHIROLI" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. P. S. GANVIR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 05/04/2024

Place: Armori



GAURAV BHAGWAN PENDAM

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **Dr. P. S. GANVIR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


GAURAV BHAGWAN PENDAM

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASIC CONCEPTS	10
6	LOCAL GEOLOGY AND AQUIFER SYSTEMS	16
7	IDENTIFICATION OF ARTIFICIAL RECHARGE POINTS	19
8	CONCLUSION	21
9	REFERENCES	23

1. INTRODUCTION

Average annual water resources in our river basins are estimated as 1,869 billion cubic metres (BCM) of which utilizable resources are of the order of 1,086 BCM. Out of this, 690 BCM is available as surface water and the remaining 396 BCM as ground water. The source of all this water is rain or snow. The huge ground water storage of 396 BCM is the result of rain and snowmelt water percolating through various layers of soil and rocks. However, the amount of percolation varies greatly from region to region and within the same region from place to place depending upon the amount and pattern of rainfall (i.e. number and duration of rainy days, rainfall amount and intensity), characteristics of soils and rocks (i.e. porosity, cracks and loose joints in rocks etc.), the nature of terrain (i.e. hills, plateaus, plains, valleys etc.), and other climatic factors like temperature and humidity. As a result, availability of water from sub-surface storages varies considerably from place to place.

In most low rainfall areas of the country the availability of utilizable surface water is so low that people have to depend largely on ground water for agriculture and domestic use. Excessive ground water pumping in these areas, especially in some of the 91 drought prone districts in 13 states, has resulted in alarming lowering of the ground water levels. The problem has been further compounded due to large-scale urbanization and growth of mega cities, which has drastically reduced open lands for natural recharge. In hard rock areas there are large variations in ground water availability even from village to village. In order to improve the ground water situation it is necessary to artificially recharge the depleted ground water aquifers. The available techniques are easy, cost-effective and sustainable in the long term.

2. OBJECTIVES

- To understand the groundwater setup of the study area.
- To understand the principal aquifers of the study area.
- To identify the possible artificial recharge points in the study area.

CHAPTER 3

METHODOLOGY

3. METHODOLOGY

- The study has been initiated by the GIS approach; where, the various geomorphological observations were done.
- The geology of the study area was thoroughly studied to understand the variations in the rock type.
- The secondary data was then compared regarding the groundwater and aquifer systems.
- In field visits, possible sites were elected for the artificial recharge.

CHAYYAPUR
STUDY AREA

4. STUDY AREA

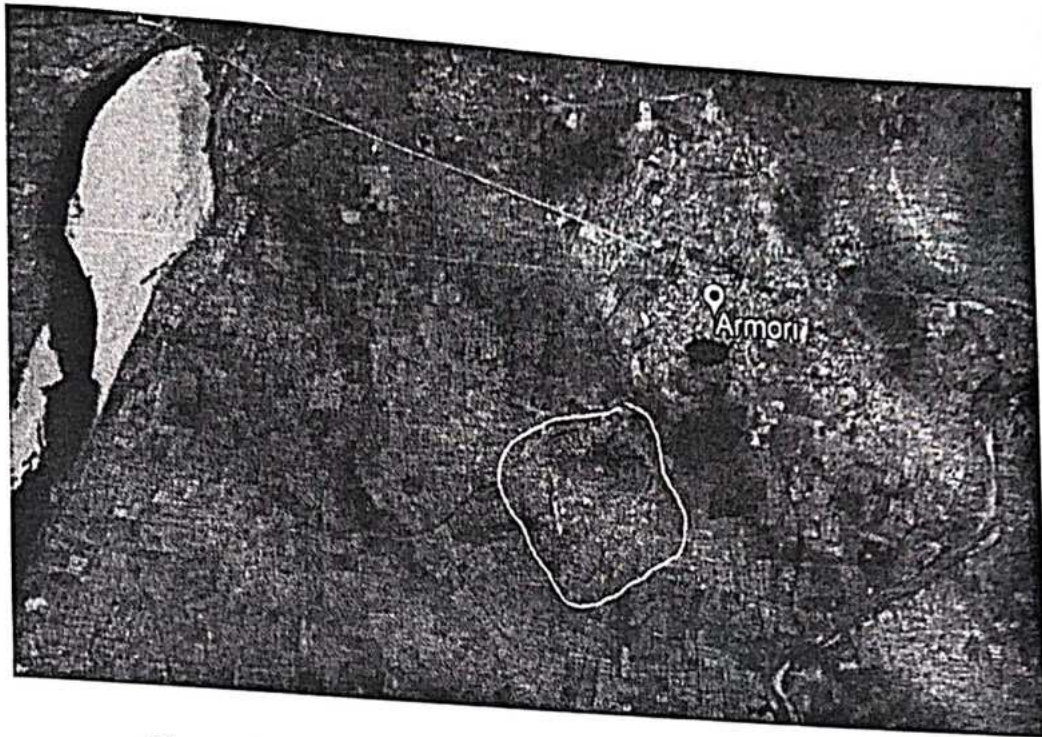


Figure 1 - Map of metamorphic terrain around study area.

5. BASIC CONCEPTS

The artificial recharge to ground water aims at augmentation of ground water reservoir by modifying the natural movement of surface water utilizing suitable civil construction techniques. Artificial recharge techniques normally address to following issues;

- To enhance the sustainable yield in areas where over-development has depleted the aquifer.
- Conservation and storage of excess surface water for future requirements, since these requirements often changes within a season or a period.
- To improve the quality of existing ground water through dilution.
- To remove bacteriological and other impurities from sewage and waste water so that water is suitable for re-use.

The basic purpose of artificial recharge of ground water is to restore supplies from aquifers depleted due to excessive ground water development. Basic requirements for recharging the ground water reservoir are:

- Availability of non-committed surplus monsoon runoff in space and time.
- Identification of suitable Hydrogeological environment and sites for creating subsurface reservoir through cost effective artificial recharge techniques.

Drainage basins are the fundamental units to understand geometric characteristics of fluvial landscape, such as topology of stream networks, quantitative description of drainage texture, pattern, shape and relief characteristics. Morphometric analysis is an important technique to evaluate and understand the behavior of hydrological system. It provides quantitative

6. LOCAL GEOLOGY AND AQUIFER SYSTEMS

Local Geology of the Study Area

- **Gneiss**

Metamorphic rock is also dominant in nearby area having gneissic texture. Foliation trending SSE – NNW was reported. Probably they are of meta-sedimentary in nature. At some places the gneiss is weathered and fractured which provides a great potential of groundwater storage.

- **Laterite Soil**

It is a Residual soil whose red color signifies oxidized iron content. These are the product of chemical degradation.

Along Wainganga River, we encountered planer relief of area. Within our grid pattern we are dealing with following rock type,

Aquifer Systems of the Study Area

The Groundwater Survey and Development Authority have issued a common principal aquifer map of the Gadchiroli district. There are few rock beds identified as the principal aquifer system in the Gadchiroli district.

Following are some;

- Sandstone
- Limestone
- Granite
- Schist
- Gneiss

7. **IDENTIFICATION OF ARTIFICIAL RECHARGE POINTS**

In field observation following geomorphic units were observed;

Hydrogeomorphic units	Description (Field observation)	Slope (degrees)	Drainage density	Groundwater potential/prospects
Hills and ridges	Acts as barrier as well as carrier for ground water flow represents areas of high runoff.	Moderate-Steep (15 - 21)	Low	Very poor to poor
Alluvial plain	Gently sloping tract produced by deposition of alluvial. Material consisting of gravel, sand, silt and clay of varying lithology.	Gentle (0 - 7)	Low	Good to moderate
Buried pediment	Unconsolidated alluvial materials fill irregularities on the sandstone surfaces. Mostly vegetated or cultivated lying at foot hills.	Gentle moderate (8 - 14)	Low moderate	Good to moderate

Proposed Structures

Proposed structure	Land use	Drainage order
Nala bund	Exposed rock	2nd
Percolation tank, Nala bund, check dam	Exposed rock, (open scrub), uncultivated land	1st or 2nd
Nala bund, check dam	uncultivated land	2nd or 3rd

A
PROJECT
ON

**“HYDROGEOCHEMICAL EVALUATION AROUND ARMORI AREA OF DIST.
- GADCHIROLI.”**



SUBMITTEDBY

JAYESH TULSHIRAM NANDANWAR

GUIDEDBY

Dr. P. S. GANVIR

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE

This is certified that **JAYESH TULSHIRAM NANDANWAR** has carried out project work on “**HYDROGEOCHEMICAL EVALUATION AROUND ARMORI AREA OF DIST. - GADCHIROLI**” under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori
Date- 06/04/2024



Dr. P. S. GANVIR
Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that JAYESH TULSHIRAM NANDANWAR has carried out project work on "HYDROGEOCHEMICAL EVALUATION AROUND ARMORI AREA OF DIST. - GADCHIROLI" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date-



Dr. L. H. Khalsa

Principal

M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli



Dr. C. P. Dorlikar

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College



(Ext)




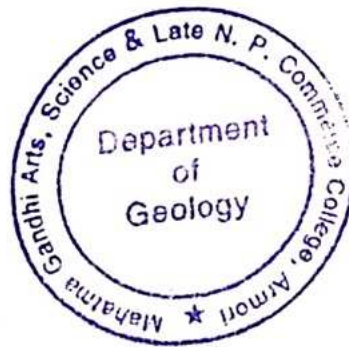
(Informed)

CERTIFICATE

This is certified that JAYESH TULSHIRAM NANDANWAR has carried out project work on "HYDROGEOCHEMICAL EVALUATION AROUND ARMORI AREA OF DIST. - GADCHIROLI" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


Internal Examiner
(Dr. C.P. Dorlikar)



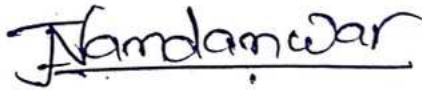

External Examiner

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **Dr. P. S. GANVIR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


JAYESH TULSHIRAM NANDANWAR

1. INTRODUCTION

The quality of the groundwater is one of the major issues in today's world. Most of the fresh water resources in any country is made up of groundwater and is easily accessible too. The high populous countries, especially like India depends on the groundwater in a great extent. Most of it is used directly for drinking and irrigation is next to it. This resource is one of the most important natural resources of all in any nation. The intake of fresh water is increasing in every upcoming day and its quality must be taken care of. The quality of groundwater has also become a serious issue for those regions where industrialization is at its peak but the rural areas can also not be avoided. It is a kind of essential need of the country's population to have access to the fresh water resources. Today, many researchers and scholars are working on the groundwater quality issue and the present work is an approach to interpret the results of groundwater quality by various means.

The Armori taluka is in Gadchiroli district along the border of Chandrapur and Gadchiroli in the north-western corner. The Armori taluka is outlined by the Wainganga river. The study area is rural in nature and the population is scares. The study is mostly covered by paddy fields, which needs frequent irrigation. The present study is on the interpretation of the groundwater quality of the Armori area in special concern to hydro-

2. OBJECTIVES

- To understand the type of the groundwater in the study area.
- To chalk out the various groundwater facies in the study area.
- To identify the controlling factors for the groundwater quality.
- To deduce general interpretations.

CHAPTER 3

METHODOLOGY

METHODOLOGY

- The data of the groundwater quality was opted from the various procedures done by the co-workers like, field visits, sample collections, sample analysis as per APHA.
- The opted data then plotted on Piper tri-linear plots and Gibbs plots.
- The plots were then interpreted by the standards norms.
- Once the interpretation is done, the observations were deduced.

4. STUDY AREA

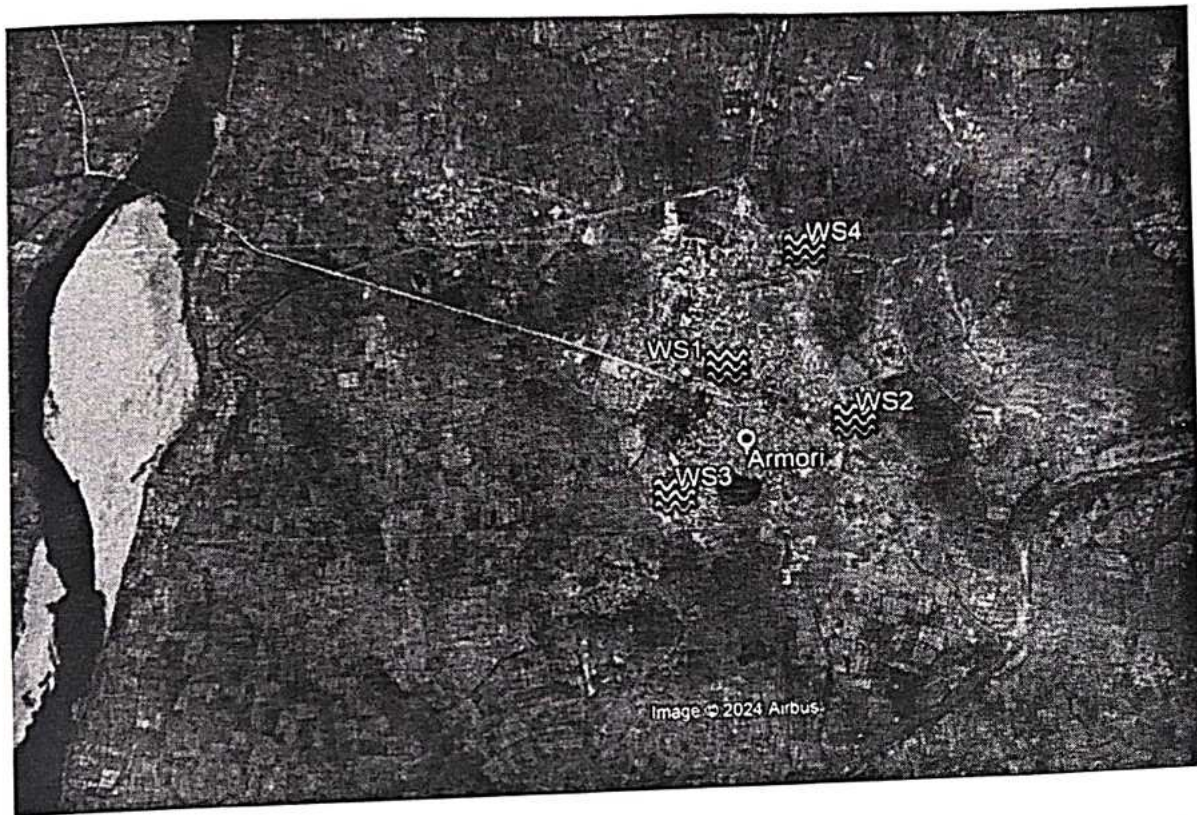


Figure 1 - Map of Armori with water sample locations

Sample Points

- WS1 - 20°28'12.63"N and 79°58'55.17"E
- WS2 - 20°27'59.91"N and 79°59'23.89"E
- WS3 - 20°27'39.51"N and 79°58'39.87"E
- WS4 - 20°28'38.93"N and 79°59'13.73"E

5. BASIC CONCEPTS

Before moving on the actual results and interpretations, a superficial review of the hydro-geochemical parameters is indeed;

5.1 Hydro-geochemical Parameters

The parameters that clarify the quality of the groundwater and also aids in understanding of geological influence are termed as hydro-geochemical parameters (Karanth 1997).

Physical:

- **Temperature –**

It is the foremost parameters one should take in the field. Temperature regulates a lot when hydrochemistry is concerned.

- **pH –**

Standard pH meter can be used on spot to measure the pH.

- **Colour –**

Colour of the sampled water tells much about the constitution of water.

- **Odour –**

It is the smell a samples gives in first encounter. Chemical impurities or biological components can give a specific smell to the sample.

- **Taste –**

Probably one should avoid tasting any water which seems contaminated in first look.

7.

CONCLUSION

Following are the can derived from the results;

- The Ca+Mg-HCO₃ type water is observed from the piper plot.
- No anion is dominant in the water samples.
- No cation is dominant in the water samples.
- The Gibbs plot has indicated that in general the rock water interaction is the major process responsible for the groundwater chemistry.
- No anomalous interpretation from the data set was observed.

**A
PROJECT
ON**

**“GEOLOGICAL STUDY OF KAMTHI FORMATION IN AN AROUND
ARMORI BLOCK GADCHIROLI DISTRICT MAHARASHTRA.”**



SUBMITTEDBY

KAJAL ASARAM BHAJANKAR

GUIDEDBY

Dr. C. P. Dorlikar

Head

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

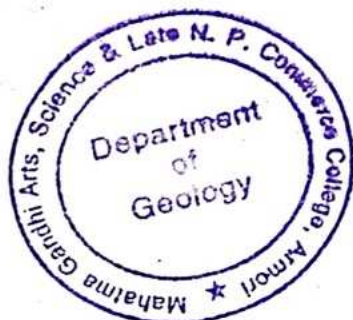
CERTIFICATE

This is certified that **KAJAL ASARAM BHAJANKAR** has carried out project work on “**GEOLOGICAL STUDY OF KAMTHI FORMATION IN AN AROUND ARMORI BLOCK GADCHIROLI DISTRICT MAHARASHTRA**” under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date-6/4/2024



Dr. C. P. DORLIKAR
Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that **KAJAL ASARAM BHAJANKAR** has carried out project work on “**GEOLOGICAL STUDY OF KAMTHI FORMATION IN AN AROUND ARMORI BLOCK GADCHIROLI DISTRICT MAHARASHTRA**” under the supervision of **Dr. C. P. DORLIKAR** for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

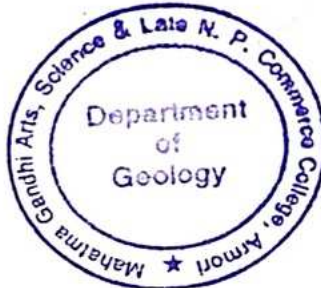
She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 6/4/2024


Dr. L. H. Khalsa

Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College


12/4/24

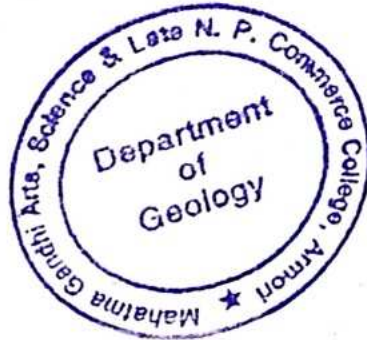

12/4/24

CERTIFICATE

This is certified that KAJAL ASARAM BHAJANKAR has carried out project work on "GEOLOGICAL STUDY OF KAMTHI FORMATION IN AN AROUND ARMORI BLOCK GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

[Signature] 12/04/24
Internal Examiner
(Dr. C. P. Dorlikar)



[Signature] 12/4/24
External Examiner
(Dr. B. G. Jaiswal)

DECLARATION

I hereby declare that the project report entitled "GEOLOGICAL STUDY OF KAMTHI FORMATION IN AN AROUND ARMORI BLOCK GADCHIROLI DISTRICT MAHARASHTRA" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. C. P. DORLIKAR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 6/4/2024

Place: Armori

K.A. BHAJANKAR
KAJAL ASARAM BHAJANKAR

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor and Head of the department **Dr. C. P. DORLIKAR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


KAJAL ASARAM BHAJANKAR

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	KAMTHI FORMATION: GENERAL	10
6	KAMTHI FORMATION: STUDY AREA	14
7	CONCLUSION	18
8	REFERENCES	20

CHAPTER I

INTRODUCTION

1. INTRODUCTION

The Kamthi formation is the well established part of the Gondwana supergroup. The Gondwana supergroup has been named after the ancient 'Gond' kingdom of Madhya Pradesh, the name having been used first by H.B. Medlicott in 1872. Geologically, the Gondwana group presents us with best example of subsidence along major trough faults amidst the older rocks. In fact, deposition and preservation of great accumulation of sediments could have been possible due to such sinking basins. The total thickness of Gondwana sediments is estimated to be around 6000 m or even more. The Gondwana Group of rocks form the most important – stratigraphically, geologically and economically—groups of India. Economically, the Gondwana rocks are the biggest source of COAL deposits in India. Besides this black gold, Gondwana have yielded good quality building stones, clays and iron ores of importance.

Stratigraphically, they form evidence of beginning of the end of a southern continent including present India, Australia, South America, South Africa, Madagascar and Antarctica that existed as a unit after Vindhyan times and has been named as Gondwanaland. Numerous streams, rivers, lakes and other shallow-water-bodies that existed during that period received sediments and continued to get depressed right through Triassic and Jurassic times. It was sometime during Cretaceous period that this great continent cracked and the resulting parts drifted through subsequent times to the present locations. During the period it remained together as a land mass, it accumulated huge volume of sediments along with remains of great variety of life that existed during that period and migrated very freely. Peninsular India bears great evidence of these accumulations that are spread over vast

2. OBJECTIVES

- To study the sedimentary terrain in general around the study area.
- To identify the various rocks available in these sedimentary terrain.
- To identify the Kamthi rock formations available in the sedimentary terrain of study area.
- To deduce the characteristics of the rocks belonging to Kamthi formation.

CHAPTER

METHODOLOGY

3. METHODOLOGY

- The study area first observed by using the GIS tools.
- All the possible locations of the rock exposures were identified.
- The sedimentary terrain was again scrutinized form them.
- The field visit was planned to observe the sedimentary terrain and to collect the sample.
- The observations done in the field was then compared with the literature to develop an acceptable inference.

4. STUDY AREA

The Armori are was mapped and few sedimentary rock exposures were observed;

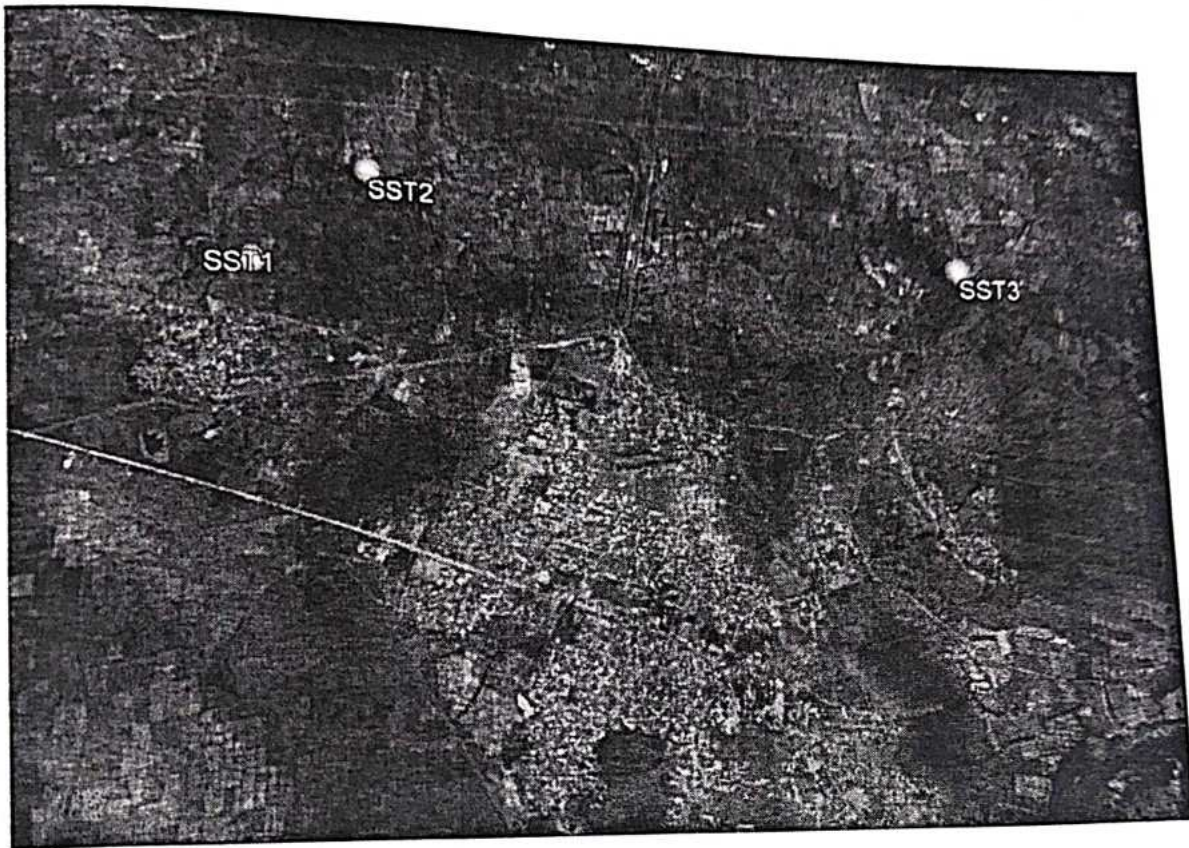


Figure 1 - Map of Armori indicating Mafic exposures.

- SST1 - $20^{\circ} 29' 10''$ N and $79^{\circ} 57' 57''$ E
- SST2 - $20^{\circ} 29' 30''$ N and $79^{\circ} 58' 15''$ E
- SST3 - $20^{\circ} 29' 12''$ N and $79^{\circ} 00' 03''$ E

5. KAMTHI FORMATION: GENERAL

The Kamthi Formation, in the intracratonic Pranhita-Godavari Gondwana rift basin, bore signatures of climate change from a warm humid climate in Late Permian to hot arid during the Early Triassic. Sedimentation took place mainly under fluvial conditions. Following are the three well known basins of the Gondwana Supergroup in the India;

- Son-Damodar Valley
- Mahanadi valley
- Parnhita-Godavari Valley

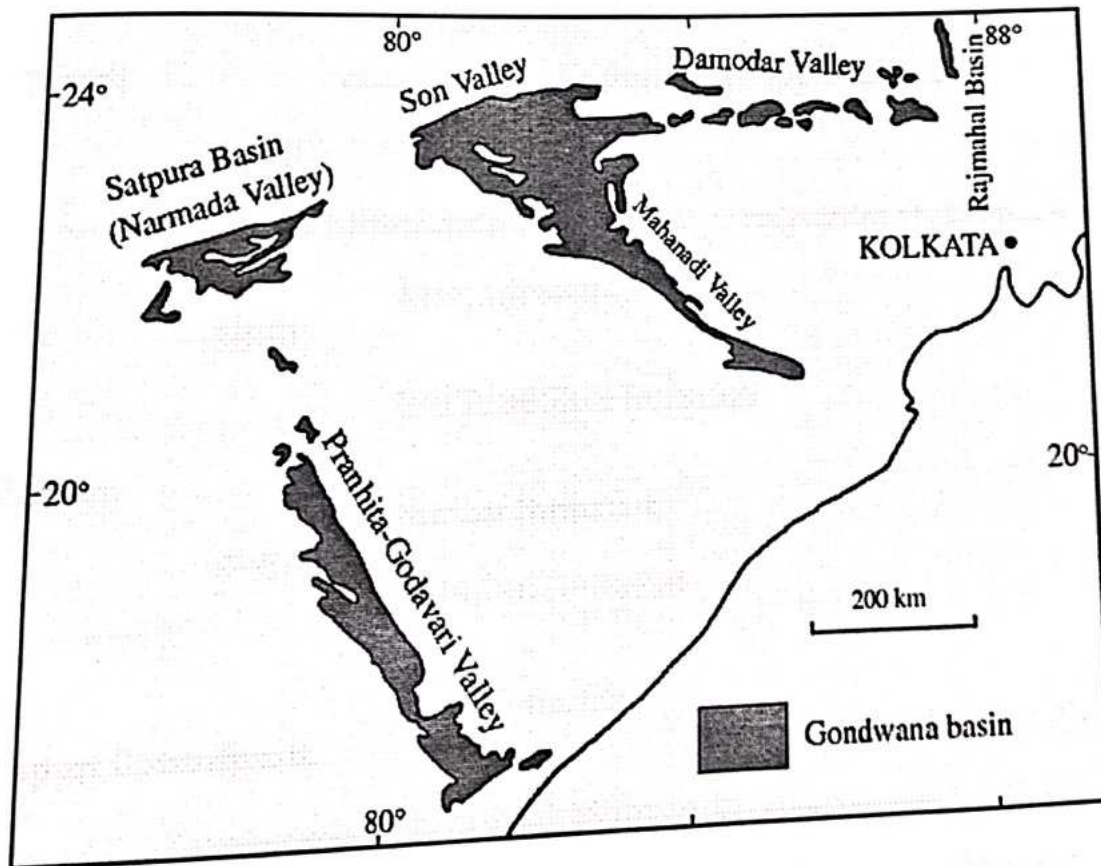


Figure 2: The geographical extent of the Gondwana supergroup.

6. KAMTHI FORMATION: STUDY AREA

The red and pink sandstone around Armori was selected for the study. It is varying from coarse to fine grains at various locations. Following are the description of various observations;

6.1 SST1:

- **Colour** - red to pink due to the Feldspar
- **Grain size** - fine indicating high transportation
- **Sorting** - good again indicating the maturity of the sediment
- **Grain shape** - rounded to sub-rounded



Figure 4: SST1

7. CONCLUSION

Following are the conclusion derived from the results;

- The sedimentary rock selected around study area belongs to the Kamthi formation of Gondwana supergroup.
- The sandstone varies from fine grains to the coarse grains in texture.
- The pink or red color in of the rock is due to the presence of feldspar and iron at some locations.
- The variance of the grain size clearly explains the variation in the depositional environment.

Jackson, Julia A., ed. (1997). "mafic". *Glossary of geology* (Fourth ed.). Alexandria, Virginia: American Geological Institute. ISBN 0922152349.

Le Bas, M. J.; Streckeisen, A. L. (1991). "The IUGS systematics of igneous rocks". *Journal of the Geological Society*. 148 (5): 825–833. Bibcode:1991JGSoc.148..825L. CiteSeerX 10.1.1.692.4446. doi:10.1144/gsjgs.148.5.0825. S2CID 28548230.

Philpotts, Anthony R.; Ague, Jay J. (2009). *Principles of igneous and metamorphic petrology* (2nd ed.). Cambridge, UK: Cambridge University Press. p. 137. ISBN 9780521880060.

Cross, Whitman; Iddings, Joseph P.; Pirsson, Louis V.; Washington, Henry S. (September 1902). "A Quantitative Chemico-Mineralogical Classification and Nomenclature of Igneous Rocks". *The Journal of Geology*. 10 (6): 555–690.

Philpotts, Anthony R.; Ague, Jay J. (2009). *Principles of igneous and metamorphic petrology* (2nd ed.). Cambridge, UK: Cambridge University Press. p. 137.

Singh P. (2010) Engineering and General Geology, S. K. Kataria and Sons.

Bangar K (2020) Principals of Engineering Geology, Standard Publisher Distributor.

www.google.com

www.wikipedia.com

Certificate

**A DETAILED REPORT ON SYSTEMATIC STUDIES ON
OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS
OF W GK-1 WATERSHED DISTRICT GADCHIROLI,
MAHARASHTRA, INDIA.**

**THESIS SUBMITTED TO GONDWANA UNIVERSITY, GADCHIROLI
FOR DESSEERTATION**

**MASTER OF SCIENCE IN GEOLOGY
(FACULTY OF SCIENCE)**

**SUBMITTED BY
KAJAL DADILAL CHAUDHARI**



**DR. A.P. DHARASHIVKAR
GROUNDWATER SURVEY AND DEVELOPMENT AGENCY
GADCHIROLI**

CERTIFICATE

This is a certified that KAJAL DADILAL CHAUDHARI has carried out project work on "SYSTEMATIC STUDIES ON OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED DISTRICT GADCHIROLI, MAHARASHTRA, INDIA". Under supervision of DR. A.P. DHARASHIVKAR for the partial fulfillment of the post-graduate degree in geology. She has carried out project work in laboratory of the department of geology, M.G Arts, Science & Late N.P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M.G. Arts, Science and Late N.P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place : Armori

Date : 06/08/24

Dr. L.H. Khaissa

Principal

M.G. College Armori




Dr. C.P. Dorlikar

Head of Department of Geology

M. G. College Armori




Internal


12/4/24
External
(Dr. S.G. Jhane)

CERTIFICATE

THIS TO CERTIFY THAT THE WORK PRESENTED HERE IN THE THESIS TITLED AS "SYSTEMATIC STUDIES ON OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED FROM KHOBRAGADI RIVER BASIN OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" IS THE OWN WORK OF MS. KAJAL DADILAL CHAUDHARI CONDUCTED IN POSTGRADUATE DEPARTMENT OF GEOLOGY, MG ARTS, COMMERCE AND SCIENCE COLLEGE, ARMORI UNDER MY SUPERVISION.

THIS WORK HAS NOT BEEN SUBMITTED EARIES TO ANY UNIVERSITY OF INSTITUTIONN FOR ANY DIPLOMA OR DEGREE.

DATE: 31.03.2024



DR. A.P. DHARASHIVKAR

Senior Geologist

Senior Geologist, G.D.A. Gadchiroli

CERTIFICATE

DECLARATION/UNDERTAKING

I, hereby declare that the work presented in this thesis entitled "Systematic studies on occurrences and movement of groundwater in parts of WGK-1 watershed Dist. Gadchiroli, Maharashtra India" was carried out by me and under the supervision of Dr. Abhijit P. Dharashivkar. This work or any part of this work is based on original data collection and Research and has not been submitted by me to any University/ Institution for the award of any diploma or degree.

Date : 06/04/24



KAJAL DADILAL CHAUDHARI

M.G.Arts, Commerce and

Science College, Armori

ACKNOWLEDGEMENTS

I express my deepest sense of gratitude to my supervisor, Dr. A.P. Dharashivkar, Senior Geologist, Groundwater Survey and Development Agency, Gadchiroli for his valuable and inspiring guidance. His constructive criticism, interest and immense help in the preparation of manuscript as well as interpretation of data need profuse thanks!

I like to express my sincere that to Dr. C.P. Dorlikar, Professor Head, Post Graduate Department of Geology, MG College of Arts, Commerce and Science College, Armori, for his valuable help rendered during the present studies. I am grateful to Prof. Ganvir, senior Faculty form PG Department of Geology, MG Arts, Commerce and Science College, Armori for their constant encourgament, inspiring guidance and help extended from time to time during this study.

My sincere thanks are also extended to concerned authorities and staff members of office of Senior Geologist, Groundwater Survey and Development agency (GSDA), Gadchiroli District, for providing me the most needed analytical database of drinking water samples from my study area and allied GIS data.

I am also thankful to Ms. Diksha Wanmali and Mr. Pranay Fulzele, Faculty in Geology, PG Department of Geology, MG Arts, Commerce and Science College, Armori for their help in actual working on this thesis.

My special thanks to our Principal Dr. Khalsa sir for providing me the systematic environment for the said work and continuous encouragement.

My sincere gratitude towards the management of MG Arts, Commerce and Science College Armori for their encouragements and enthusiasm during actual tenure of work.

ORGANISATION OF THESIS

The thesis incorporates the various integrated investigation carried out around the groundwater survey and development agencies has denoted this watershed as WGK-1. The entire watershed mainly fall in Armori, Dhanora and Gadchiroli taluka in Gadchiroli district.

The thesis is divided into 8 chapter followed by list of references. The smaller figures are placed in continuation with the next while large map follows coming pages.

Tables are positioned in continuation with the text while plates and annexures exhibiting photographs. Respectively are located at the end of thesis.

The chapter in this thesis are organized as follows the:

In second chapter details regarding work already carried out by various organization like GSDA, CHWB, GSI is given.

In third chapter Drainage Patterns is described very briefly.

In fourth chapter Geomorphological feature identified in study as per data provided by MRSAC is discussed.

In fifth chapter Geological setting with stratigraphy is discussed in detail.

In sixth chapter is Rainfall.

In seventh chapter hydrogeology.

In eighth chapter Discussion and Conclusion.

Content

1. Introduction

1.1 study area

- 1.1.1** Physiography
- 1.1.2** Drainage
- 1.1.3** Climate
- 1.1.4** Rainfall
- 1.1.5** Wind
- 1.1.6** Humidity
- 1.1.7** Flora and Fauna

2. Previous work

2.1 Scope of adopted methodology

- 2.1.1** Collection of data
- 2.1.2** Reconnaissance survey
- 2.1.3** Database generation
- 2.1.4** Field work and data compilation
- 2.1.5** Rainfall distribution
- 2.1.6** Depth of water levels

3. Drainage

4. Geomorphology set up

4.1 Geomorphological map

5. Geology

5.1 Geological map

6. Rainfall analysis

7. Hydrogeology

7.1 Previous work

7.2 Present work

8. Discussion

CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

Groundwater is the main key resource for human beings for living hence it has got immense value. So, in the present study the seasonal and temporal variation in occurrence and movement of groundwater is undertaken. The Dist. Gadchiroli is known as the Aspirational District by Government of India. Even 76 years after Independence the systematic studies on occurrence and movement of groundwater is very little done. So, taking that in consideration the present study is taken.

In the present study Rainfall and its variation with respect to time is taken as it is the sole source of groundwater recharge. The Watershed is taken as the study unit as the surface water flow is controlled by watershed boundaries or morphologic boundaries. The study is limited to parts of GSDA watershed WGK-1.

1.2 STUDY AREA

WGK-1 area covers 104.692 Sq Km area of Gadchiroli district and is located 170 KM south-east of Nagpur city. It included in the Survey of India toposheet number 55P/15 between (Watershed Map, table 1) Longitude $20^{\circ}16'15''$ and Latitudes $79^{\circ}59'20''$ (Fig 1.2), Table.1. The area experiences a tropical dry sub-humid climate. The summer months are much hotter (maximum temperature 43.4°C) while, winter is mild (minimum temperature 14.4°C). The GSDA has categorized the watershed as WGK-1. In WGK-1 area having 49 villages and there are 36 villages from Armori, 5 villages from Dhanora and 8 villages from Gadchiroli.

In our studies I have selected a central part of WGK-1 watershed area and selected study area covers 7766.09 Ha area of WGK-1. In my study area having

CHAPTER 2: PREVIOUS WORK

Dharashivakar and Nandini Gedam(2021) unpublished report have worked on Drainage morphometry of the study area. In which they given stream order relationships 74.19% first order, 19.35 second order, and 05% third order and 1% fourth order. In this report they carried out work on the various morphometric parameters of the study area.

In our studies I have utilized the database received from State Groundwater Survey and Development Agency, District Office. In which GIS data is processed in Arc GIS10.4.1 platform and various kinds of maps have been generated which we are adding here as an attachment.

3. Methodology

The main aim of the present study is to identify the impact of actual rainfall on occurrence and movement of groundwater in specific arc of WGK-1 watershed.

In the present investigation exhaustive database on surface and subsurface water resources, geology, geological structures, geomorphology and demography has been collected. The methodology adopted in the present study involves the following steps.

- i. Collection of historical data
- ii. Previous work carried out in aspects like
 - Geology
 - Geomorphology
 - Hydrogeology
- iii. Preparation of various thematic maps
 1. Geological Map
 2. Geomorphological Map
 3. Drainage Map
 4. Existing Water Conservation Structures
 5. Land use and Land Cover.

3.1 Collection of Data

3.1.1 Collection of historical data

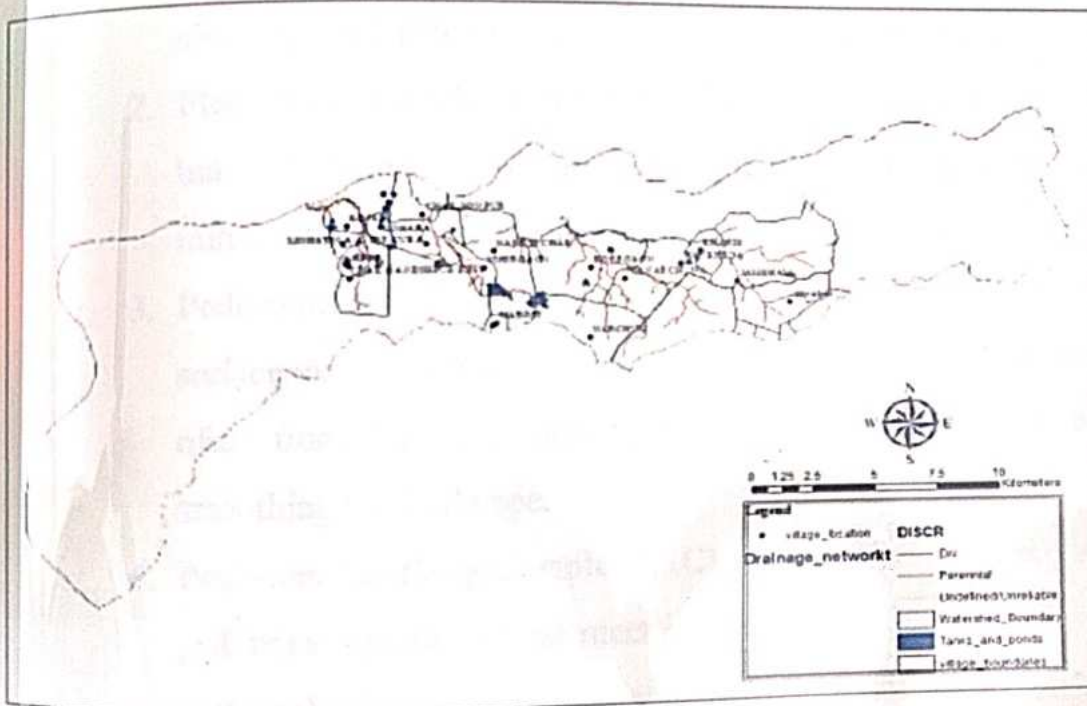
In relation to these studies, the historical data like demographic details, rainfall, static water levels, Drainage, village settlement, roads, geomorphology, geology land use etc. by collected by various Government organizations like GSDA, MRSAC and Local Gram Panchayat.

4. Drainage System

The WGK-1 Watershed is comprising of various Dendritic to Sub dendritic drainage patterns. Mostly drainage is flowing in majority toward North-to-North west. Major river is Khobragadi River and the total rainfall runoff is contributed to Khobragadi River. The Drainage is in majority seasonal one only perennial drainage is Khobragadi River.

A major fourth order stream is flowing in majority towards northwest to west and meeting khobragadi river near chak sonapur.

The watershed WGK-1 could be divisible into 1-6 mini watershed that is 1/1, 1/2, 1/3, 1/4, 1/5, 1/6.



5. Geomorphology

The geomorphology of the area influences the quality and availability of groundwater. It determines the surface flow direction and controls the amount and rate of infiltration. The geomorphological features that play a great role in groundwater availability and quality include slope, elevation, drainage density, lineament density, soil, land use and land cover (LULC).

The geomorphic features given in front can be seen in our study area.

1. **Flood Plain (Moderate) FPM** :- These are relatively flat areas adjacent to rivers or streams that experience periodic flooding. The moderate flood plain is characterized by occasional inundation, allowing for fertile soil deposition and supporting vegetation.
2. **Flood Plain (Shallow) FPS** :- Similar to the moderate flood plain, but with shallower inundation during floods. These areas are still influenced by river dynamics and sediment deposition.
3. **Pediment (PD)** :- A gently sloping, erosion-resistant bedrock surface that extends from the base of a mountain or hill. Pediments often form due to weathering and erosion processes, gradually smoothing the landscape.
4. **Pediment Inselberg Complex (PIC)** :- This refers to an area where pediments (gentle slopes) meet inselberg (isolated rocky hills or outcrops). The complex landscape results from differential erosion, with the inselbergs standing out against the surrounding pediment.
5. **Pediplain (Moderate) PPM** :- A broad, gently undulating plain formed by the erosion and weathering of bedrock. These moderately weathered surfaces are often covered with soil and support vegetation.

Geology

In the study area watershed WGK-1, contain mainly Amgaon Gneissic complex, Dongargarh Granite, Laterite and Kamthi Sandstone Formation. The geological map is shown in below.

Generalized Geological Sequence

	Formation	Lithology
Recent	Alluvium	Soil, Laterite
Upper Gondwana	Chikhiala Formation	Grey to black ferruginous sandstones Ferruginous conglomerate and sandstones
	Kota Formaton	Ferruginous Conglomerates and Sandstones Calcareous sandstones and Limestones
Lower Gondwana	Kamthi Formation	Friable, ferruginous, medium to coarse grained sandstones and ferruginous conglomerates
Pre-Cambrian	Pakal (Cuddapahs)	Limestone with intercalated shales, Conglomerates, Breccias, Quartzites and Sandstones
Archeans	Gneissic Complex	Basic Intrusive and Quartz Pegmatite veins, Granite Gneisses, Banded Magnetite Quartzite and other unclassified metamorphics

6. Rainfall and its Deviation

The Monsoon Rainfall database of last 24 years for Armori, and Dhanora Taluka is taken from the government web site services.maharain.maharashtra.gov.in and is utilized for understanding the behavior pattern of rainfall. Monsoon rainfall data is collected, and the data is analyzed. Taking normal rainfall values from IMD, variation of rainfall was calculated. Accordingly, percentage deviation with respect to normal rainfall is calculated and it is utilized for knowing the cyclicity and trend of rainfall.

The rainfall data is collected on a monthly basis with actual rainy days, and it is well known fact that actual rainfall is directly proportional to ground water levels. In this report static water levels were observed on monthly basis hence to study the impact of rainfall on static water levels of observation wells the measurement cycle is taken on monthly basis.

Here in this chapter the monsoon rainfall data for Taluka Armori, and Dhanora is attached separately. And the deviation from standard is also studied to establish the facts regarding rainfall and its monthly behavioral pattern.

The Monthly rainfall data of Armori and Dhanora for 24 years when studied and analyzed in detail, it is observed that the rainfall is showing vast variation with respect to normal rainfall. Hence for easy understanding and interpretation purposes, the classification of rainfall was done, and the 4 classes were made i.e. 0-10%, 10% – 30%, 30% -50% and > 50% on both side of zero means positive and negative side.

7. Hydrogeology

The district is unique in Maharashtra in the sense that the entire area of the district is mainly occupied by metamorphic and igneous rocks along with sedimentary rocks in southern part. My study area is underlain by oldest Granites and Gneiss of the Archean.

The occurrence and movement of ground water depends upon the rock formation of the area. It is generally influenced by the following factors.

- Inter-granular primary porosity and permeability.
- Thickness and extent of weathered zones.
- Topographic setting of an area.
- Surface water bodies influencing ground water recharge.
- Development of joints, fractures, lineaments constituting secondary porosity and permeability.

Hard Rock Formation

Archean:- Archean consisting of granite gneisses, schist, etc. occupies my all-study area. These un-weathered rocks do not have inter granular porosity and permeability. Occurrence of ground water in this formation is controlled by the degree of weathering, jointing, and fracturing. These crystalline rocks due to prolonged weathering has produced layer of unconsolidated saprolite material which forms favorable and important source of ground water. The thickness of weathering varies considerably and at times it is more than 20 m. The weathering in coarse grained hard rocks imparts good porosity and permeability and the ground water structures constructed in these rocks give good yields. Laterite is commonly found as capping the weathered rocks at some places. These Laterites have generally low permeability and tends to impede infiltration. The ground water abstraction structures constructed in these rocks have poor yields. Un-



Discussion

The important observations and findings from the study area are discussed and concluded in the following pages.

1. WGK 1 is comprising of various dendritic to subdendritic drainage pattern. Major river is khobragadi river and the total rainfall runoff is contributed to khobragadi river. The drainage is in majorily seasonal one only pernnial drainage is khobragadi river.
2. Good Groundwater Potential Zone is mainly dominated by geomorphic units like deep pediplain as well as shallow pediplain. Such favourable hydrogeological conditions in the zone are suitable for groundwater exploitation.
3. Moderate Groundwater Potential Zone is dominated by pediment unit. A gently sloping, erosion-resistant bedrock surface that extends from the base of mountain or hills.
4. At places, shallow and Moderate pediplain also covers this zone. The zone is mostly confined to erosion and weathered Of bedrocks. Thes area may still exhibit gentle slopes and are conducive to agriculture.
4. Structural hill result from geological processes such as faulting and folding or uplift. Their formation is closely tied to the underlying rock structures.
5. Due to favorable slope conditions and surface characteristics, this zone is ideal for runoff generation. The groundwater recharge conditions are either limited or moderate. The depth of weathering is also very shallow and not

The findings on the basis of 24 years rainfall data for **Armori** indicate that there are 11 positive rainfall years and 13 negative rainfall years for total monsoonal rainfall.

The findings on the basis of 24 years rainfall data for **Dhanora** indicate that there are 11 positive rainfall years and 13 negative rainfall years for Total monsoon rainfall.

Hydrographs generated through collected static water level data are showing a declining trend, that indicates the groundwater withdrawal during the post monsoon season.

References

In India-vision-2005 Tenth Indian Geological Congress foundation lecture series, Karnatak University, Dharwar, Feb 4, 2006, 24p.

Deshpande G. G. (1998) Geology of Maharashtra Published by Geological Society of India, pp7-12

Deshpande A. S. (2003) A geomatics approach in established of methodology for watershed eco-development system, Eco. Env. & Cons, Vol 9 (1), pp 91-94

Dhar, D., Deskar, R. K., Malpe, D.B., Khare, Y.D. and Joshi. S (2007) A realistic assessment of ground water potential in deccan traps; A remote Sensing and GIS approach In: Recent Development in Groundwater Resources of Central India. Spl. Vol.11, pp,35-40

DRM (2001) District Resource Map Nagpur District, Maharashtra Geological survey of India, Central Region.

Demers, M. N. (2000) Fundamentals of geographic information system. John Willy and Sons Publication, pp-9

A
PROJECT
ON

**“GEOLOGICAL STUDIES OF MAFIC DYKES OF PORLA-WADADHA AREAS
OF GADCHIROLI DISTRICT MAHARASHTRA.”**



SUBMITTEDBY

KALYANI SADANAND KUTHE

GUIDEDBY

Dr. C. P. Dorlikar

Head

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE

This is certified that KALYANI SADANAND KUTHE has carried out project work on "GEOLOGICAL STUDIES OF MAFIC DYKES OF PORLA-WADADHA AREAS OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/24


Dr. L. H. Khalsa


Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College


12/4/24
(Exk)


12/4/24
(Intang)

DECLARATION

I hereby declare that the project report entitled "GEOLOGICAL STUDIES OF MAFIC DYKES OF PORLA-WADADHA AREAS OF GADCHIROLI DISTRICT MAHARASHTRA" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. C. P. DORLIKAR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 05/04/2024

Place: Armori


KALYANI SADANAND KUTHE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor and Head of the department **Dr. C. P. DORLIKAR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.



KALYANI SADANAND KUTHE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASICS OF GEOLOGICAL INVESTIGATION	10
6	MAFIC DYKES: GENERAL AND STUDY AREA SPECIFIC	21
7	CONCLUSION	30
8	REFERENCES	32

1. INTRODUCTION

Present dissertation is a part fulfillment of the degree of Master of Science in Geology in Faculties of Science of M. G. College Armori, Gondwana University, "GEOLOGICAL STUDIES OF MAFIC DYKES OF PORLA-WADADHA AREAS OF GADCHIROLI DISTRICT MAHARASHTRA" is chosen by candidate for dissertation. The general geology of the Gadchiroli district is wide and versatile. Right from the archean basements to the quaternary sediments are available in the Gadchiroli district. Many of the locations are well-known for the the mafic intrusions like that of dyke and sill. Some observations classify them as a part of Craton. The Porla-Wadadha area is also a part and parcel of the Gadchiroli district Geology mainly comprises the rocks of Archean, Gondwana supergroup, Lateritic soil, Alluvium. The study area is basically weathered and eroded plain due to presence of dominant fluvial systems. Some mounts of hard rocks are present near by the Armori area representing hard rock terrain. They are mostly are relict type, i.e. they represent the survival of harder masses of rocks which escaped from weathering and erosion. The Waingnaga river along with her multiple minor tributaries forms the main dendritic drainage of the area.

A dyke or dyke in geological usage is a sheet of rock that is formed in a fracture of a pre-existing rock body. Dykes can be either magmatic or sedimentary in origin. Magmatic dykes form when magma flows into a crack then solidifies as a sheet intrusion, either cutting across layers of rock or through a contiguous mass of rock. Clastic dykes are formed when sediment fills a pre-existing crack. They are often tabular or sheet like igneous body that is often oriented vertically or steeply

2. OBJECTIVES

- To study the general topographic setup of the study area.
- To perform the general geological study of the study area.
- To understand the individual rock unit of the study area.
- To identify the mafic rocks around study area and to understand their origin.

3. METHODOLOGY

- The study area was first observed from the Google earth to identify the probable outcrops.
- The field visits has been conducted to mark the sample locations.
- The representative samples were collected by standard procedure.
- The collected samples were then studied in the laboratory.
- The interpretations are drawn from the megascopic study.

4. STUDY AREA

The study area was mapped and few mafic rock exposures were observed;

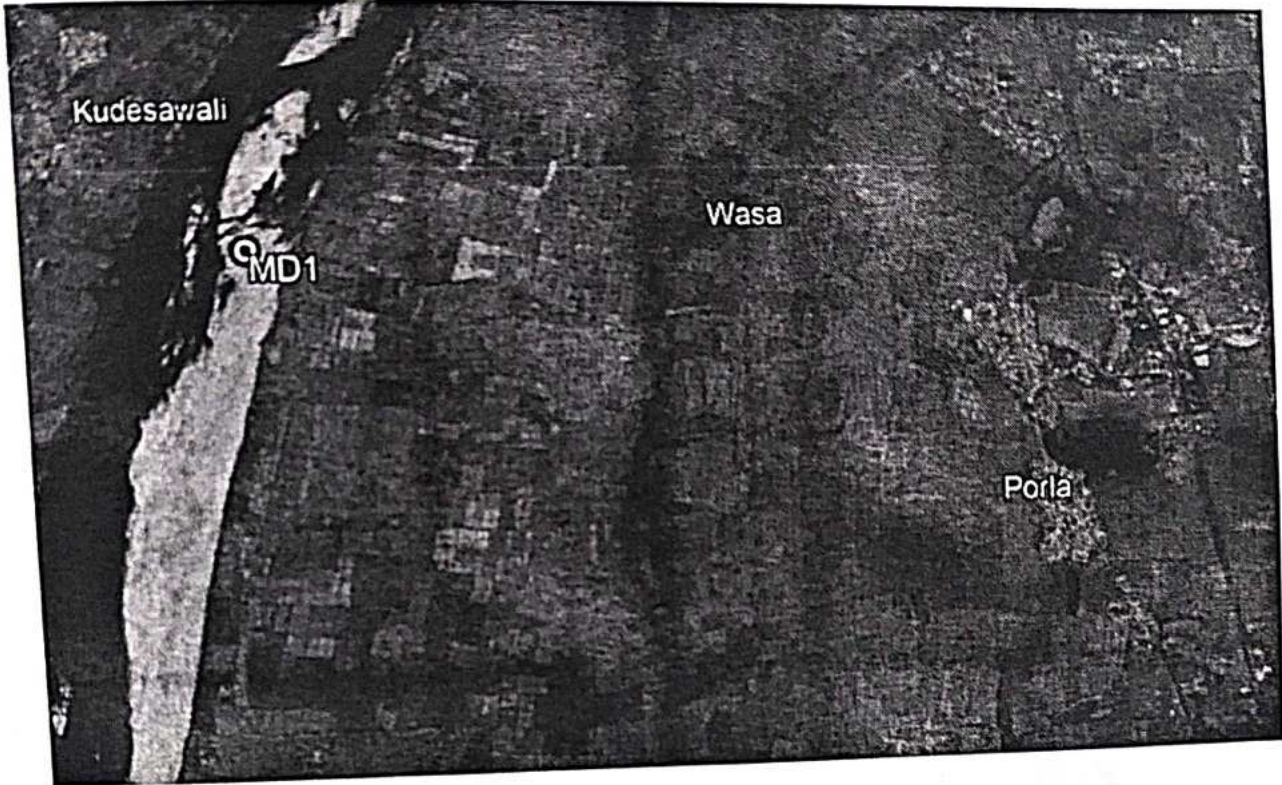


Figure 2 - Map of study area indicating Mafic exposures.

Sample Point

- MD1 - $20^{\circ}19'3.35''\text{N}$ and $79^{\circ}56'53.70''\text{E}$

5. BASICS OF GEOLOGICAL INVESTIGATION

The geological field work is carried out to search mineral deposits and to explore ground for many civil engineering works. During the geological survey sufficient data are gathered to prepare geologic maps and reports about a particular area of interest.

5.1 Field Equipment

The equipment that are commonly required for doing a geological field work are as follows.

- Topographic map.
- Compass.
- Hammer
- Haversack
- Altimeter
- Measuring Tape
- Field Notebook

5.2 Method of field work

5.2.1 Preliminary Survey

Before doing field mapping one should first undertake a rapid reconnaissance of the target area by taking topographical map. This will help in choosing suitable mapping procedures and in getting the general idea about the geological problems. The reconnaissance traverses should be planned in such a manner as to come across the different rock types present

6. MAFIC DYKES: GENERAL AND STUDY AREA SPECIFIC

6.1 Types of Dykes

The dykes can be classified on many basis. Following are some of the types based on certain criterions;

- Magmatic Dykes

An intrusive dike is an igneous body with a very high aspect ratio, which means that its thickness is usually much smaller than the other two dimensions. Thickness can vary from the sub-centimeter scale to many meters, and the lateral dimensions can extend over many kilometers. A dike is an intrusion into an opening cross-cutting fissure, shouldering aside other pre-existing layers or bodies of rock; this implies that a dike is always younger than the rocks that contain it. Dikes are usually high-angle to near-vertical in orientation, but subsequent tectonic deformation may rotate the sequence of strata through which the dike propagates so that the dike becomes horizontal. Near-horizontal, or conformable intrusions, along bedding planes between strata are called intrusive sills. The term "sheet" is the general term for both dikes and sills. Sometimes dikes appear in swarms, consisting of several to hundreds of dikes emplaced more or less contemporaneously during a single intrusive event. The world's largest dike swarm is the Mackenzie dike swarm in the Northwest Territories, Canada (Figure 4).

7. CONCLUSION

Following are the can derived from the results;

- The study area is geologically stable and does not possess any crucial mineral deposit.
- Most of the study area is covered by the alluvial deposits but some patches are also covered by the igneous and metamorphic rocks.
- The dark minerals band over the rock of felsic nature justifies the mafic intrusion.
- The mafic intrusive rock has been observed at the Wainganga river bed. It is black and fine grained granular in nature. It is possibly an intrusive rock termed as Dyke.
- The observed dyke is a part and parcel of the Dykes system in Bastar Craton.

A

PROJECT

ON

**“EXPLORATION AND EXPLOITATION METHODS: A CASE STUDY FROM
DEULGAON MINES OF DIST. - GADCHIROLI.”**



SUBMITTEDBY

KARISHMA SHOBHARAY KODAP

GUIDEDBY

Dr. P. S. GANVIR

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE

This is certified that **KARISHMA SHOBHARAY KODAP** has carried out project work on “**EXPLORATION AND EXPLOITATION METHODS: A CASE STUDY FROM DEULGAON MINES OF DIST. - GADCHIROLI**” under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori
Date- 06-04-2024



Dr. P. S. GANVIR
Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that **KARISHMA SHOBHARAY KODAP** has carried out project work on "EXPLORATION AND EXPLOITATION METHODS: A CASE STUDY FROM DEULGAON MINES OF DIST. - GADCHIROLI" under the supervision of **Dr. P. S. GANVIR** for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

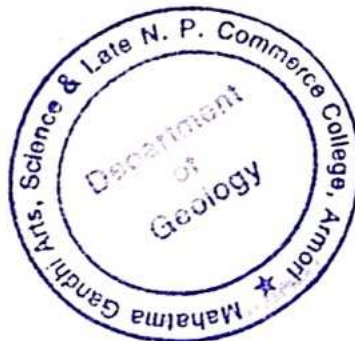
She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/24


Dr. L. H. Khalsa

Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College



12/4/24
fernal

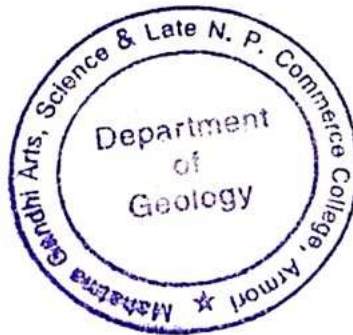

12/4/24
(Inhand)

CERTIFICATE

This is certified that **KARISHMA SHOBHARAY KODAP** has carried out project work on “**EXPLORATION AND EXPLOITATION METHODS: A CASE STUDY FROM DEULGAON MINES OF DIST. - GADCHIROLI**” under the supervision of **Dr. P. S. GANVIR** for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


Internal Examiner




External Examiner

DECLARATION

I hereby declare that the project report entitled "EXPLORATION AND EXPLOITATION METHODS: A CASE STUDY FROM DEULGAON MINES OF DIST. - GADCHIROLI" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. P. S. GANVIR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 05-04-2024

Place: Armori



KARISHMA SHOBHARAY KODAP

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **Dr. P. S. GANVIR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


KARISHMA SHOBHARAY KODAP

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASICS OF EXPLORATION AND EXPLOITATION	10
6	CONCLUSION	26
7	REFERENCES	28

1. INTRODUCTION

Geological exploration is the process of finding commercially viable mineral resource and the objective is to locate it in the shortest possible time and at the lowest possible cost. The development of exploration technology over a century is briefed along with the emerging challenges for the exploration. Exploration approach design and the myriad activities of exploration cycle are described. The important ingredients of a successful exploration are

- (1) Selection of right geological terrain,
- (2) Optimum level of funding, and
- (3) Keeping pace with the state-of-the-art exploration technology.

Adoption of right combination of techniques is warranted to conduct exploration in a cost-effective manner. The Quality Control/Quality Assurance validated exploration data are integrated to generate 3D models for better interpretation and predictive targeting. Expected net present value and the risks involved in the discovery of a resource are touched upon. A combined R&D effort of University, Industry, and Government agencies will help to achieve the desired result of better success rate in future exploration efforts.

Geological exploration for natural resources is expensive with high risk. However, it opens new challenges and opportunities. Governments and multinational companies are key players. Geological exploration follows a sequence of multidisciplinary activities: reconnaissance, discovery, prospecting, and economic mining. The exploration concept looks for a package of unique stratigraphic age, promising favorable rocks, and type structure to host certain groups of minerals.

2. OBJECTIVES

- To review the exploration methods in geology.
- To review the exploitation methods in geology.
- To correlate the same with the Deulgaon mines of the study area.

CHAPTER 3

METHODOLOGY

3. METHODOLOGY

- The study has been carried out completely on secondary data and was referred from various sources to achieve the objectives and considered as a prime source for conclusion drawn.
- Various online materials (research article, books, etc.) were studied to collect the appropriate secondary data.
- The observations were then compared with the mines located in the study area.

4. STUDY AREA

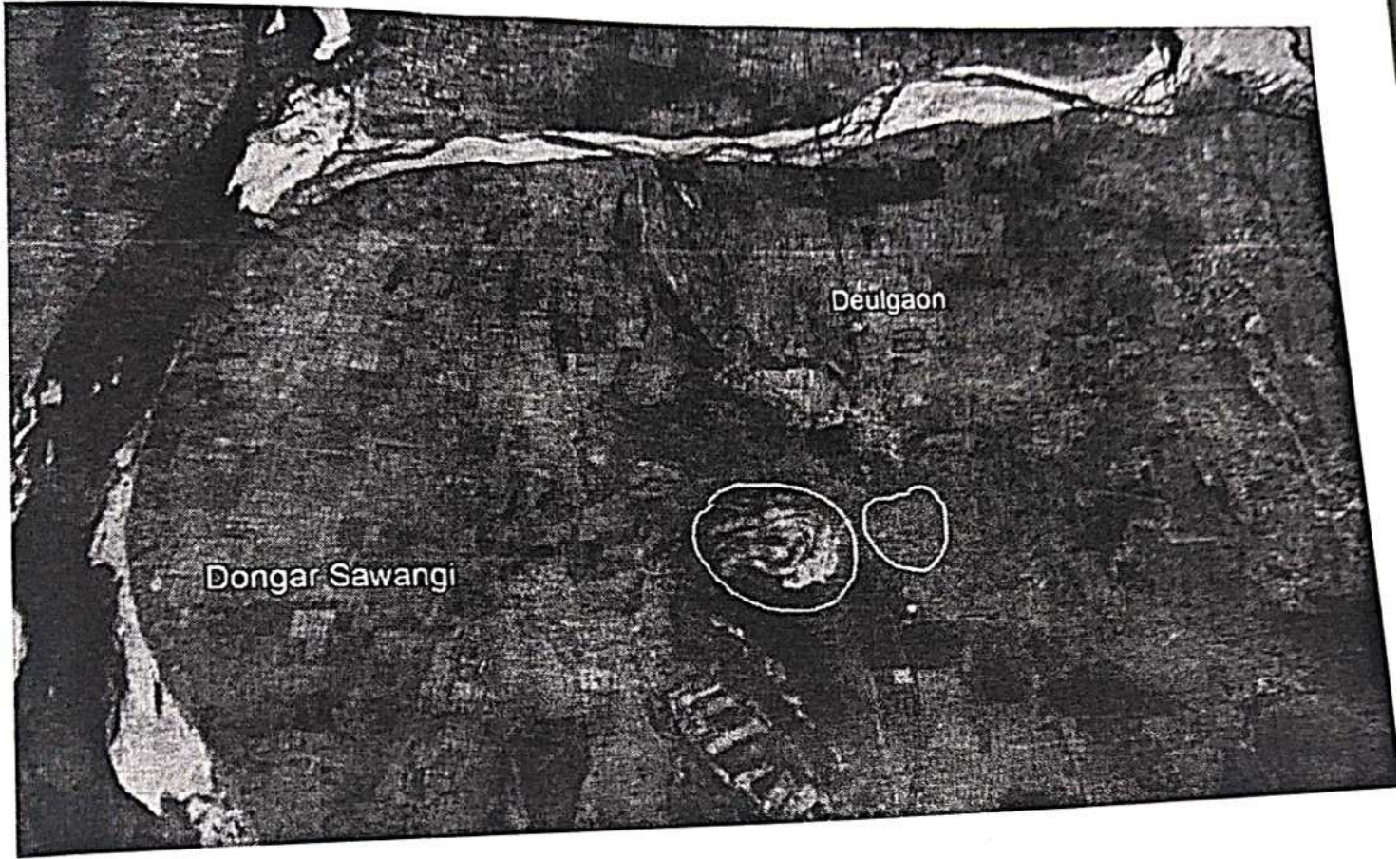


Figure 1 - Deulgaon mines in the study area.

5. BASICS OF EXPLORATION AND EXPLOITATION

Exploration Method

5.1 Rock Sampling

The rock sampling is the collection of representative sample from the bulk of rock, to understand the character like, mineralogy, texture, genetic aspects, etc. There are two types of fundamental importance

- **Grab Sampling**

It is a random sample collection of rock fragments, along the line of traverse. It generally represents the bulk of rock body.

- **Channel Sampling**

It is done by sample collection along small trenches and Pits in accordance with the dip and across the strike of ore body. Intervals of specific distance are maintained.

5.2 Geochemical Sampling

Geochemical sampling involves collecting and analyzing various earth materials such as rocks, soils, sediments, water, vegetation, and gasses. Various geochemical sampling methods have traditionally been some of the most efficient of any methods used in mineral exploration. These methods have also been applied, however, to geological and environmental studies. Variations in chemical compositions of certain earth materials are descriptors of the environment in which those materials occur or from which they were derived. For studying certain environments, it may be obvious

6. CONCLUSION

Following conclusions can be drawn from the observation;

- The mining sites of the Deulgaon are of two categories; Quartzite query and BIF field.
- The quartzite is a metasedimentary compact rock, which is mined for the construction, industrial and metallurgical purposes.
- The exploration and exploitation of quartzite is a low profile mining and does not need any special exploration and exploitation engagements.
- The BIF on the other side is a strategic mineral deposit and must be explored by the sophisticated techniques and proper mining technique should be engaged for its exploitation.

Post Graduate Department of Geology
Distribution of Dissertations
2023-24

Sr. No.	Name of students	Dissertation topic	Name of Supervisor
1	KAJAL DADILAL CHAUDHARY	Hydrogeological Parameters of Kadholi Area in Kurkheda Taluka Dist. Gadchiroli	Dr. Dharashivkar
2	SHRUTI NARESH KASEWR	Geological Studies of & Mapping of Shioni Area of Armori Taluka Dist. Gadchiroli	Dr. Dharashivkar
3	DIVYA NANAJI NAGOSE	Techniques in Hydrogeochemical studies: Traditional and contemporary approach	Dr. P. S. Ganvir
4	ANCHAL RAJENDRA KOKODE	Hydrogeological Parameter of Jogisakhari Area of Armori Taluka , Dist. Gadchiroli	Dr. Dharashivkar
5	PRAJAKT NARENDRA KHEOLE	Groundwater Prospecting: A case study from Armori area of Dist. Gadchiroli	Dr. P. S. Ganvir
6	TANNU LOKAMITRA BARSAGADE	Geological studies of Vairagad area with special reference to the Diamond Bearing Conglomerate Formations of Armori block of Dist. Gadchiroli, Maharashtra	Dr. C. P. Dorlikar
7	KAJAL ASARAM BHAJANKAR	Mineralogy of iron ore formations in and around area of Deulgaon area, Armori block of Gadchiroli district , Maharashtra	Dr. C. P. Dorlikar
8	SHEJAL HIRALAL BHAJANKAR	Geological study of Gondwana rock formation in and around area of Armori block of Dist. Gadchiroli, Maharashtra	Dr. C. P. Dorlikar
9	MAYURI HARIHAR JAKKANWAR	A brief study of outcrops of Sedimentary rock formations exposed in and around Armori Town	P.G. Fulzele
10	AMIT ANANDRAO KALE	A geological study of Banded Iron Formations (BIF) in and around Armori, Dist. Gadchiroli	P.G. Fulzele
11	SHRUTI SUNIL PAL	Geological studies of Quartzite and associated rock formations Dongartam,ashi area of Armori block of Dist. Gadchiroli, Maharashtra	Dr. C. P. Dorlikar
12	KALYANI SADANAND KUTHE	Geological studies of mafic dykes of Porla-Wadadha area of Gadchiroli district, Maharashtra	Dr. C. P. Dorlikar

13	JAYESH TULSIRAM NANDANWAR	Hydrogeochemical evaluation around Armori area of Dist. Gadchiroli	Dr. P. S. Ganvir
14	TWINKLE SURESH RAUT	Hydrogeological Parameters of Shivani Area of Armori Taluka, Dist. Gadchiroli	Dr. Dharashivkar
15	GAURAV BHAGWAN PENDAM	Identification of artificial groundwater recharge points in metamorphic terrain around Armori area of Dist. Gadchiroli	Dr. P. S. Ganvir
16	MEHUL ANAND DHAKATE	A study of principal aquifer system in Desaiganj area, Dist. Gadchiroli	D. P. Wanmali
17	KARISHMA SHOBHARAY KODAP	Exploration and exploitation methods : A case study from Deulgaon mines of Dist. Gadchiroli	Dr. P. S. Ganvir
18	RAHUL RAMESH FARANDE	Petrological studies around Desaiganj area , Dist. Gadchiroli	D. P. Wanmali



(Signature)

HEAD
HEAD
DEPARTMENT OF GEOLOGY
M. G. College Armori

**A BRIEF STUDY OF OUTCROPS OF SEDIMENTARY
ROCK FORMATION EXPOSED IN AND AROUND
ARMORI TOWN**

**A Dissertation Thesis Submitted to
Gondwana University, Gadchiroli
As a part fulfillment for the award of
The Degree of**

Master of Science in Geology
Under The
Faculty of science & Technology

**Submitted By
MAYURI H. JAKKANWAR
M. sc. Final Year (Geology)**

**Supervisor
Mr. Pranay Fulzale
Department of Geology**



**POST GRADUATE DEPARTMENT OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE N. P.
COMMERCE COLLEGE
ARMORI. DIST. GADCHIROLI (M.S.) 441208
2023-24**

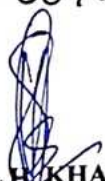
Certificate

This is certified that MAYURI H. JAKKANWAR has carried out Project work on "A BRIEF STUDY OF OUTCROPS OF SEDIMENTARY ROCK FORMATION EXPOSED IN AND AROUND ARMORI TOWN" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N.P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N.P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli

Place – Armori

Date- 06/04/2024


Dr. L.H. KHALSA
M. G. Arts, Science
& Late N. P. Commerce
College Gondwana
University, Gadchiroli




Dr. C.P. Dorlikar (HOD)
P.G. Department of Geology
M. G. Arts, Science
& Late N. P. Commerce
College

Guided by



Prof. P.G. Fulekar


12/4/24
(Ext-)


12/4/24
(Internal)


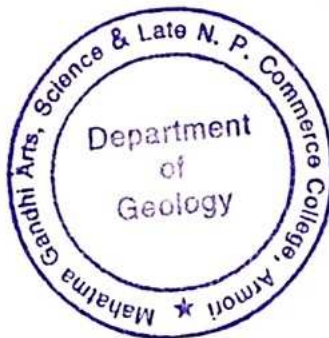
Certificate

This is certified that MAYURI H. JAKKANWAR has carried out project work on "A BRIEF STUDY OF OUTCROPS OF SEDIMENTARY ROCK FORMATION EXPOSED IN AND AROUND ARMORI TOWN "under the supervision of Dr, C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology.

He has carried out project work in laboratory of the Post Graduate Department of Geology, M.G. Arts, Science & Late N, P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli. He has fulfilled all the necessary requirements of the Regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M.G. Arts, Science & Late N. P, Commerce College Armori. affiliated to Gondwana University, Gadchiroli.



Internal Examiner
(Dr. C. P. Dorlikar)



External Examiner
(Dr. S. G. Juvekar)

DECLARATION

I hereby declare that the project report entitled "SEDIMENTS AND SEDIMENTARY ROCKS STUDY AROUND ARMORI AREA TALUKA ARMORI DISTRICT GADCHIROLI " submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M.G. Arts, Science & Late N.P. Commerce College Armori, Affiliated to Gondwana University have been carried out by me under the Guidance of Dr. C. P. DORLIKAR.(HOD)

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.



Mayuri H. Jakkanwar

(M.Sc. Geology Sem-IV)

Armori:

Date: 06/04/2024

Acknowledgements

It is with respect that I acknowledge the support, critical supervision and encouragement of my supervisor Mr. Pranay Fulzale Asst. Prof. who provided valuable guidance inspiration and moral support during the entire period of this dissertation work.

I express my special thanks Principal of college Dr. Lalsingh Khalsa sir for constant support and providing necessary facilities. Who provided necessary facilities in the Department for this dissertation.

I am also thankful to My Colleagues Dvya Nagose M.sc IV Sem Post Graduate Department of Geology, Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori, for help me in various ways.

I wish to extend my gratitude to Dr. C.P. Dorlikar. Head of The Department , Mahatma Gandhi Arts, Science & Late N. P. Commerce College Armori for his suggestion and guidance regarding the study area.

I am indebted to my parents for all they have done. I am thankful to all my family members, teachers and non teaching staff of the department and friends who are directly or indirectly involved in this dissertation work.

Date: 6/4/2024

Place: Armori


Mayiri Jakkannwar
M.Sc. IV Sem

CONTENTS

Sr. No.	Chapter Name	Page No.
I	INTRODUCTION	1
II	GEOLOGY OF THE STUDY AREA	4
	a) Regional Geology	4
	b) Geology of the study area	5
	c) Description of Litho-section	6
III	METHODOLOGY	15
IV	PETROGRAPHY	24
V	DISCUSSION AND CONCLUSION	25
	REFERENCES	

CHAPTER 1

INTRODUCTION

The area around the Armori is a part of Gadchiroli District of Maharashtra state in which the geological fieldwork and systematic sampling was undertaken to analyse the petrography of the sedimentary rocks of the Gondwana Supergroup.

1.1 AIM: -

The present study aims to study the petrography of the Kamthi Formation of the Gondwana Supergroup exposed in the study area in order to access their origin and source rocks. Further the objectives of research work are as follows.

1.2 OBJECTIVES:-

- To carry out geological mapping of sedimentary rocks.
- To collect the rock samples from study area.
- To prepares thin section for identification of minerals and to know their source.

1.3 Location and extent

- The study area is located at a distance of about 4 km Northeast from Gadchiroli city around Armori Taluka of Gadchiroli district.
- The area falls under Survey of India Toposheet No. 55P/10 and Falls between latitude $79^{\circ} 55'$ and longitude $20^{\circ} 55'$ covering an area of about 78.69.sq. km.

1.4 Accessibility

- The study area is situated around Armori of Gadchiroli district, Maharashtra.
- Bus or Taxi service is available there.
- Nearest railway station is Wadsa to Bramhapuri.
- Only 18.5 kms. Railway route passes through the district.

CHAPTER 2

GEOLOGY OF THE STUDY AREA

a) REGIONAL GEOLOGY

Gadchiroli district is situated in the eastern most part of Maharashtra and covers an area of 15433 sq. km. It is included in the survey of India degree sheet no. 55P, 56M, N, 64D, 65A and B between latitude 18°40' - 20° 50' and longitude 79° 45' - 80° 54'. The district is bounded by Bhandara district in the north, Chandrapur district in the west, Adilabad and Karimnagar district of Andhra Pradesh in the west and south respectively. Rock formations ranging from Archean to Quaternary are exposed in the district. Eastern Ghat Supergroup and Bengpal group of Archean age (4000-2500 m.y.) occupy the southern part. Amgaon Gneissic Complex of Archean to palaeo proterozoic age (2500-2200 m.y.) occupies the north western, northern and north eastern part. Bailadila group of Palaeo Proterozoic age (3500-3100m.y.), is exposed in the south eastern part, Nandgaon group of Paleo to Meso - Proterozoic age (2500-1600m.y.) occupies north eastern part, Gundal and Maspur Formation of Abujmar group of Paleo to Meso Proterozoic age are exposed in the south eastern part, Sakoli group of Paleo-Meso -Proterozoic age is exposed in the north western parts and Khairagarh group of Paleo-Meso-Proterozoic age occurs between 8 km to 32 km SE of Dhanora village. Pakhal group of Meso - Proterozoic age (2000-1600m.y.) overlying the gneisses occupies the southern part. Gondwana Supergroup in the district is classified into Kamthi, Kota and Chikhiala Formations. Isolated outcrops of laterite found over meta basalt of Abujmar group.

Table No. 1 Lithological Succession of Gadchiroli District (Deshpande, 1998)

Lithology	Stratigraphic status		Age
Alluvium			Quaternary
Laterite			Cainozoic
Ferruginous sandstone, conglomerate, Pebbly Sandstone, Clay and Ironstone	Chikhala Formation	Gondwana Supergroup	Jurassic
Sandstone, Grit, Clay, Limestone	Kota Formation		
Sandstone, Ferruginous sandstone	Kamthi formation		Permian to Triassic

CHAPTER 3

METHODOLOGY

The methodology adopted for present dissertation work involves fieldwork for collection of samples, taking dip and strikes of the lithology present in the area, describing the sedimentary structures observed in the field and mapping the area. For the said purpose a fieldwork of fifteen days was carried out in the month of November. The instruments used for the fieldwork involves brunton compass, hammer, handlens, camera, field diary etc.

After preliminary investigation of the area under study the probable locations of the sedimentary rocks were marked on the toposheet and later on mapping, sample collection, measurement of attitudes of beds and observation and description of sedimentary structures were done. Sampling was done from eight different locations around the Armori taluka. Lithosections were prepared in the field diary with respect to definite scale and sample positions were marked on it. Samples were properly marked with sample No. and kept in polythene sample bags. Field photographs were also taken from the respective locations.

The collected samples (hand specimens) were described megascopically. Thin sections of the selected rock samples from the studied lithosections were prepared to study texture, sorting, mineralogy, diagenesis and cementing material.

Method of thin section preparation:-

Following steps are involved in the preparation of thin section.

- 1) Sowing of a section of rock bounded by parallel planes faces.
- 2) Polishing of one side by using abrasive moisture with water or kerosene.
- 3) Canada Balsam or synthetic resin is used as an adhesive to glue the side to coverslip which acts as a mount.
- 4) The other side is warmed, till the slides become transparent.
- 5) Balsam or resin then used to cover the rock slide with cover slip (0 – 1 mm).
- 6) Microphotography of the thin sections was also done.

CHAPTER 4

PETROGRAPHY

The samples collected from the study area are described megascopically and microscopically in order to study the petrography. The descriptions of these samples are as follows:

1. Specimen No. : AS1-1 (ACP1, ACP2)

Locality: 1. Itiadoh Channel of Armori

Megascopic:

The rock is brownish pink in colour. It shows medium to very coarse grained texture. The rock is poorly sorted. The medium to coarse material shows pebbles of quartz and feldspar cemented by ferruginous and silicious cement. The angular to subangular quartz grain is 0.5 cms in length (Plate 5e) whereas the pebbles of quartz are nearly 1 cms in length (Plate 5f). Mineralogically the rock is composed of quartz, feldspar, jasper, amphibolites and mica (Plate 5g).

Microscopic:

The thin section of the rock shows coarse grains of quartz (colourless, rounded, low relief, birefringes- low with first order greys), polycrystalline quartz, Albite (simple twinning, colourless, two sets of cleavage, birefringes- low with first order greys), Microcline (cross hatch twinning, colourless, two sets of cleavage, birefringes- low with first order greys), amphibolites (anthophyllite) and muscovite (colourless, perfect cleavage, birefringes- high, upper third order colour). All these grains are binded by silicious and ferruginous cementing material (Plate 7a, b, c and d).

Name: Conglomerate

2. Specimen No. : AS2-1 (ASP1, ASP2)

Locality: 2. Devi Temple of Armori 4 kms from Armori Village

Megascopic:

The rock is brownish pink in colour. It shows fine to medium grained texture (Plate 6 b and d). The mineral grains are rounded to sub rounded and good sorting. The cementing material in the rock is silicious and ferruginous. Mineralogically, the rock is composed of quartz, feldspar, mica and

Chapter 5

Discussion and Conclusion

On the basis of detailed field observations, following two major lithounits of the Kamthi Formation of Gondwana Supergroup have been identified in the study area,

- i) Cross bedded sandstone lithounit: This lithounit constitute lower part of the succession and is represented by 3 to 3.5 m thick beds of medium to coarse grained compact, pinkish to brownish sandstone showing cross beddings.
- ii) Conglomerate-grit lithounit: The topmost 0.5m to 1.3 m succession is represented by pinkish to brownish colored rock showing subrounded to subangular pebbles of quartz and feldspar. At a few places with reduction of grain size, gritty appearance is well marked.

DIAGENESIS IN SANDSTONE:

The changes which sediments undergo between deposition and lithification under low pressure temperature conditions are called diagenesis. Diagenesis involves mineralogic and textural changes. (Dapples, 1967), recognized sequential modifications reflecting passage through characteristic depth or time related alteration stages. It involves compaction and cementation.

COMPACTION:

The compaction or volume reduction of sand is predominantly caused by overburden loading, though the degree to which it occurs is a function of many small and large scale interdependent factors, such as pore pressure, grain shape and size, sorting, packing, mineral dissolution and tectonism. In general the greater the loading and grain to grain stresses, the greater are the compaction hence porosity is reduced (Greensmith, 1989).

CEMENTATION:

The thin section of sandstone of the study area, it has been observed that the quartz is usually cemented by secondary overgrowth around detrital quartz grain (Plate 7 and 8) The problem of origin of secondary or authigenic quartz cement has been discussed in detailed but there is little general agreement. Some suggest that the new quartz can be produced quite

A
PROJECT
ON

**“A STUDY OF PRINCIPAL AQUIFER SYSTEM IN DESAIGANJ AREA, DIST. -
GADCHIROLI.”**



SUBMITTEDBY

MEHUL ANAND DHAKATE

GUIDEDBY

PROF. D. P. WANMALI

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE

This is certified that **MEHUL ANAND DHAKATE** has carried out project work on "A STUDY OF PRINCIPAL AQUIFER SYSTEM IN DESAIGANJ AREA, DIST. - GADCHIROLI" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date-



PROF. D. P. WANMALI

Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that MEHUL ANAND DHAKATE has carried out project work on "A STUDY OF PRINCIPAL AQUIFER SYSTEM IN DESAIGANJ AREA, DIST. - GADCHIROLI" under the supervision of PROF. D. P. WANMALI for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

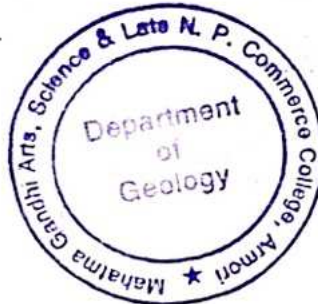
Place- Armori

Date- 12/04/2024


Dr. L. H. Khalsa

Principal

M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College


12/4/24


12/4/24

CERTIFICATE

This is certified that MEHUL ANAND DHAKATE has carried out project work on "A STUDY OF PRINCIPAL AQUIFER SYSTEM IN DESAIGANJ AREA, DIST. - GADCHIROLI" under the supervision of PROF. D. P. WANMALI for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

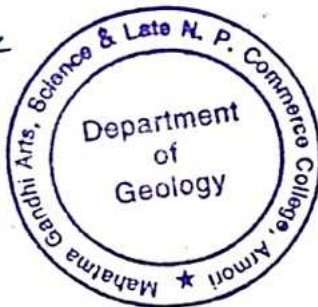
D. P. Wanmali
12/04/24

Internal Examiner

C.D.S. C.P. Dorkhale

M. G. Arts, Science & Late N. P. Commerce College Armori
12/04/24

External Examiner



DECLARATION

I hereby declare that the project report entitled "A STUDY OF PRINCIPAL AQUIFER SYSTEM IN DESAIGANJ AREA, DIST. - GADCHIROLI" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of PROF. D. P. WANMALI.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 10/04/2024

Place: Armori



MEHUL ANAND DHAKATE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **PROF. D. P. WANMALI**, who always stood as a pillar, advisor and towering inspiration. Without her this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


MEHUL ANAND DHAKATE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
4	BASIC CONCEPTS	10
5	RESULTS	19
6	CONCLUSION	23
7	REFERENCES	25

CHAPTER I

INTRODUCTION

1. INTRODUCTION

The project work taken is for the partial fulfillment of the M.Sc. Degree in Geology in the Science and Technology Faculty from Gondwana University, Gadchiroli. The title of the project is "A STUDY OF PRINCIPAL AQUIFER SYSTEM IN DESAIGANJ AREA, DIST. - GADCHIROLI". The aquifer system of any area is the rock basements below the soil zone where, the water is stored and can easily be accessed. The aquifer is the most important source of the groundwater and is a common point under study in hydrogeology. The water below the earth surface is the groundwater. It is the most easily accessible source of fresh water. At the same time, it is also prone to the degradation and depilation with much ease. The aquifer system is an environment dependent system, where the entire surrounding factor affects it. The study executed in the project is about the characterization of the aquifer system in and around Armori area.

The area selected is the Desaiganj town which is a taluka place in the Gadchiroli district of Maharashtra. The river nearby is the Wainganga river, which is a tributary of the Godawari. The major source of water in the Desaiganj town is of Waingangā river but the groundwater resources are also exploited with an equal rate. The underestimation of the aquifer system of

2. OBJECTIVES

- To identify the principal aquifer system in the study area.
- To characterize the principal aquifer system in the study area.
- To understand the influence of the aquifer's characters on the groundwater scenario in study area.
- To suggest any measures for aquifer management.

3. METHODOLOGY

- The secondary data regarding the aquifer characterization was referred for study point of view.
- The secondary data related to the aquifer system with special reference to study area was studied.
- The field visits were planned to observe the common geology of the study area.
- The aquifer rocks were identified and its potential was estimated in general sense.

4. STUDY AREA

Following is the general description of the study area;

- Political location - Gadchiroli District of Maharashtra
- Nearest railway station - Wadsa
- Lat. and Long. - $20^{\circ}37'10.80''\text{N}$, $79^{\circ}57'42.18''\text{E}$
- Major crop - Rice
- Nearest major river - Wainganga

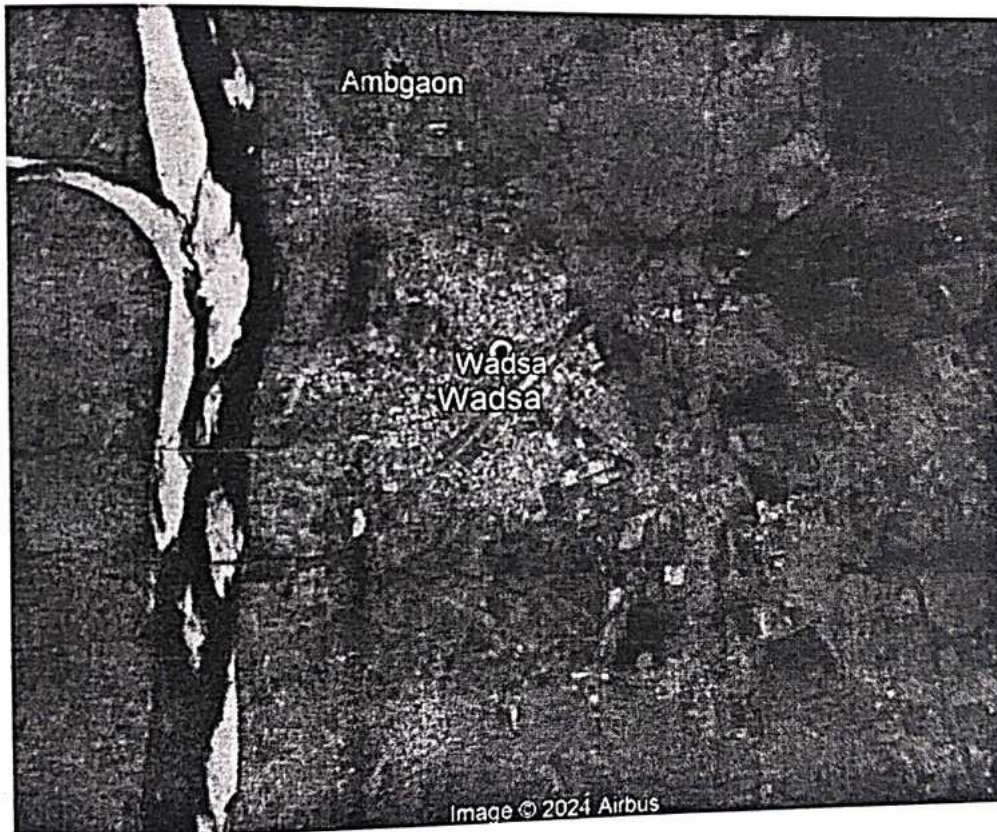


Figure 2: Desaiganj (Wadsa) town.

5. BASIC CONCEPT

Aquifer

The name for a rock or soil which contains or transmits water and thus is a source of groundwater is referred to as aquifers. 'aqua' means water and 'fer' means to yield. Therefore an aquifer is an underground zone or layer which is the source of water. It may be underground zone of gravel, sandstone. Limestone is a good example of aquifer.

- **Unconfined aquifer** - An unconfined aquifer is one in which water table varies in undulating form and in slope, depending on area of recharge and discharge, pumping from well and permeability, contour map and profile of the water table can be prepared from elevation of water in well that tap the aquifer to determine the quantities of water available and their distribution and movement.
- **Confined aquifer** - Confined aquifers are also known as artesian or pressure aquifers. Groundwater here is confined under pressure greater than atmospheric by overlying relatively impermeable strata. Water enters a confined aquifer in an area where the confining bed rises to the surface. The aquifer becomes unconfined. A region supplying water to a confined aquifer is known as recharge area.

6. OBSERVATION

The Groundwater Survey and Development Authority have issued a common principal aquifer map of the Gadchiroli district. There are few rock beds identified as the principal aquifer system in the Gadchiroli district. Following are some;

- Sandstone
- Limestone
- Granite
- Schist
- Gneiss

Of them the granite and gneiss is the dominant one. The Desaiganj taluka is located in the north region of the Gadchiroli district and it is shown in the map that the principal aquifer is the Sandstone. Apart from the town area, the Desaiganj taluka also have granite and schist exposure; but the sandstone is the best aquifer so far. Let us see some fundamental properties of the said aquifers in Armori area;

- Sandstone -

It is the well-known aquifer with a great capacity of water storage and high permeability. It is basically a sedimentary rock, which is formed by the clastic formation and deposition process. The major mineral component is the quartz along with feldspar as second in major.

7. CONCLUSION

Following conclusions are drawn;

- The principal aquifer around and in the Desaiganj is the Sandstone rock.
- The well-established aquifer is the sandstone. This is purely a sedimentary rock with well-defined porosity and permeability.
- A large amount of grain size variation has been observed, where the coarser grains are more suitable as aquifer.
- The groundwater level is directly controlled by these aquifers and also influenced by the nearby rivers and lakes.
- The adjoining Wainganga river act as an recharger to the aquifer systems of the Desaiganj area.

Post, V. E. A.; Groen, J.; Kooi, H.; Person, M.; Ge, S.; Edmunds, W. M. (2013). "Offshore fresh groundwater reserves as a global phenomenon". *Nature*. 504 (7478)

Pettijohn, Francis; Potter, Paul; Siever, Raymond (1987). *Sand and Sandstone*. New York: Springer Science+Business Media.

"What is Groundwater? International Groundwater Resources Assessment Centre". www.un-igrac.org. Retrieved 2022-03-14.

Encyclopædia Britannica, 1911 and 1989 editions

Society, National Geographic (2019-07-30). "Aquifers". National Geographic Society. Retrieved 2021-09-17.

Bethke, Craig M.; Johnson, Thomas M. (May 2008). "Groundwater Age and Groundwater Age Dating". *Annual Review of Earth and Planetary Sciences*. 36 (1): 121–152.

www.google.com

www.wikipedia.com

A
PROJECT
ON

**“GROUNDWATER PROSPECTING: A CASE STUDY FROM ARMORI AREA
OF DIST. - GADCHIROLI.”**



SUBMITTEDBY

PRAJAKT NARENDRA KHEOLE

GUIDEDBY

Dr. P. S. GANVIR

P.G. DEPT. OF GEOLOGY

**MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI
PANJAWANI COMMERCE COLLEGE, ARMORI**

2023-24

CERTIFICATE

This is certified that **PRAJAKT NARENDRA KHEOLE** has carried out project work on "**GROUNDWATER PROSPECTING: A CASE STUDY FROM ARMORI AREA OF DIST. - GADCHIROLI**" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 06/04/24



Dr. P. S. GANVIR
Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that PRAJAKT NARENDRA KHEOLE has carried out project work on "GROUNDWATER PROSPECTING: A CASE STUDY FROM ARMORI AREA OF DIST. - GADCHIROLI" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date-06/04/24


Dr. L. H. Khalsa

Principal

M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College



12/4/24
(T.K.)


12/4/24
(Inkone)


CERTIFICATE

This is certified that PRAJAKT NARENDRA KHEOLE has carried out project work on "GROUNDWATER PROSPECTING: A CASE STUDY FROM ARMORI AREA OF DIST. - GADCHIROLI" under the supervision of Dr. P. S. GANVIR for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


Internal Examiner




External Examiner

DECLARATION

I hereby declare that the project report entitled "GROUNDWATER PROSPECTING: A CASE STUDY FROM ARMORI AREA OF DIST. - GADCHIROLI" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. P. S. GANVIR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 05/04/24

Place: Armori



PRAJAKT NARENDRA KHEOLE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **Dr. P. S. GANVIR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.



PRAJAKT NARENDRA KHEOLE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASIC CONCEPT	12
5	WELL INVENTORY DATA	23
6	CONCLUSION	32
7	REFERENCE	34

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

Water is an essential part of biotic lifecycle including all fauna and flora too. However, its poor management had raised various issues related to water availability for drinking and agricultural purpose. Even animals are diversely affected by this situation. A populous country like India; where, the population is dense and diverse with agricultural profession as a major occupation, must review the groundwater studies. The groundwater is contributes majorly in the fresh water resources of India. Our country is having the largest users of groundwater around the world. The quality and quantity of the groundwater are the two sides of the same coin. No side can be avoided or neglected. In the modern world prominent workers are attentive on the quality issue of the groundwater and the present work evaluates the factors controlling this quality and quantity.

Considering the importance and necessity of groundwater, our department has given me this "GROUNDWATER PROSPECTING: A CASE STUDY FROM ARMORI AREA OF DIST. - GADCHIROLI" Present dissertation is a part of fulfillment of the degree of master in Geology, Faculty of science of M.G. College, Armori, affiliated to Gondwana University, Gadchiroli. Looking forward to diverse needs, selection of study area for dissertation was a tedious task. The present dissertation includes detail description of groundwater, its occurrence and conclusion.

Gadchiroli district is situated in the easternmost parts of Maharashtra and covers an area of 15433sq. km. Armori taluka is in Gadchiroli district. It is bordered by Winganga river, which also act as groundwater recharger. Armori is about 135 km from Nagpur. The study area lies towards north of Gadchiroli at a distance of about 40 km. Bharmapuri and Wadsa are the

2. OBJECTIVES

- To understand the various sources of groundwater in the study area.
- To understand the various characteristics of the groundwater hosting rocks in the study area.
- To understand the movement of the groundwater through aquifer in the study area.
- To comprehend some selective but effective methods of groundwater prospecting in the study area.

3. METHODOLOGY

- The study has been majorly done on the secondary data opted from various sources.
- The various techniques of hydro-geochemical data generation have been referred from the APHA guidelines.
- The hydro-geochemical interpretation techniques are also referred from the various sources.
- Finally a cumulative observation was made to predict some of the crucial outcomes.

2. STUDY AREA

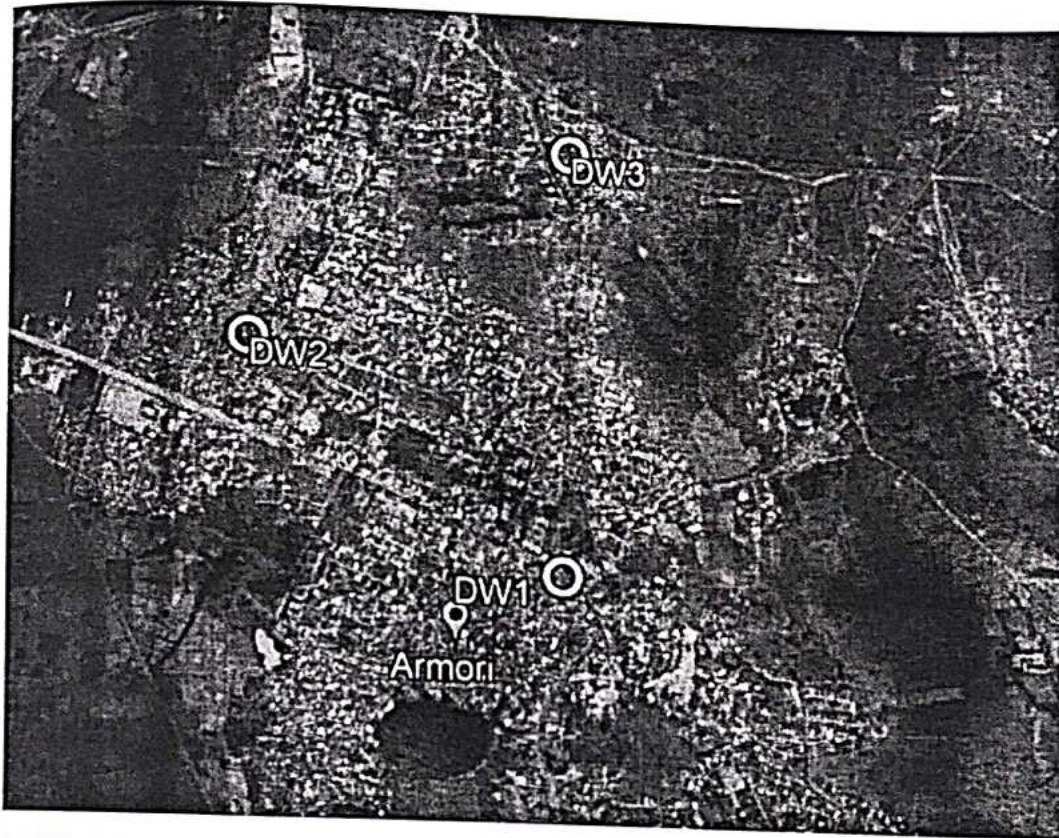


Figure 1 - Sample locations of Dug well in study area

Sample Points

DW1 - $20^{\circ}28'3.11''\text{N}$ and $79^{\circ}59'9.07''\text{E}$

DW2 - $20^{\circ}28'23.18''\text{N}$ and $79^{\circ}58'40.01''\text{E}$

DW3 - $20^{\circ}28'41.16''\text{N}$ and $79^{\circ}59'10.25''\text{E}$

LOCAL GEOLOGY

Rocks ranging from Archean to quaternary are major rock formations exposed in Gadchiroli district. The southern parts occupy eastern ghat supergroup and Bengal group of Archean age (4000- 2500 m.y.). The eastern ghat supergroup is characterized by grey, red, foliated garnet, sillimanite schist with numerous brownish red garnets. The Bengal group is characterized by greenish grey to dull white, fine to medium grained, crudely to highly schistose rock and Amgaon gneissic complex shows pale brown to dark reddish brown, fine grained, hard compact, highly schistose rock. The Amgaon gneissic complex from archean to palaeo- proterozoic age (2500- 2200 m.y.) occupies the northwestern, northern and northeastern and this Amgaon gneissic complex is characterized by pale brown to dark reddish brown, fine grained, hard compact, highly sheared and brecciated rock.

In southeastern part of Gadchiroli district, bilabial group of palaeoproterozoic age is exposed and the age of this group is (3500- 3100 m.y.). This group is characterized by light grey to white, very fine grained, hard, compact with well- developed and grains of garnet. After bikabial group, Nagpur group is of palaeo to mesoproterozoic age (2500- 1600 m.y.) is also exposed in southern part of Gadchiroli district. This group is characterized by grey to dark grey, granular, hard and compact sandstone. Pink Dongargarh granite of palaeo to mesoproterozoic age occupies large portion of eastern and northern part of the district and is traversed by numerous quartz and pegmatite veins and intruded by dykes and sills of basic and ultra- basic rocks.

5. BASIC CONCEPTS

As we know, water exists on Earth in three forms: gaseous, liquid and solid. The gaseous water is a part of the atmosphere that surrounds the Earth and is present in it up to a height of 10 – 15 km. the liquid water is spread over 70% surface of the globe forming water occurring as an easily transferable part in plants and other types of vegetation. Similarly, liquid water present in the pores, crevices and variety of opening of soil and rocks below the surface also makes an important part of this group. Solid water occurs in the form of extensive ice – bodies, the glaciers and the snowfields covering millions of square kilometers in polar and mountainous regions.

5.1 Types of ground water:

Groundwater is somewhat equivalent to lifeline for all flora and fauna including human beings. It has diverse use like use in irrigation, industries and most important for domestic purposes. The water which occurs beneath the earth's surface is called groundwater or sub-surface water or underground water. Groundwater is generally a more dependable source of affixation water than other surface sources. Groundwater derives primarily from surface and meteoritic water, but contribution is also received from mantle source i.e., magnetic water. Most of the groundwater is derived from one of the following.

Meteoric water

Meteoric water is derived from the atmospheres. It constitutes the great body of atmospheric, surface and sub-surface water which has accumulated during geologic time.

6. **WELL INVENTORY DATA**

WELL INVENTORY DATA SHEET 1

1. Village: **Armori**
2. Taluka: **Armori**
3. District : **Gadchiroli**
4. Toposheet No: **Quadrant:**
6. Altitude: **164 meters (M.S.L.)** 7. Date: **10.01.24** 8. Time: **11.00 am**
9. Location:...
10. Owner's Name (In full): **Gram Panchayat**
11. Address:
12. Type of well: **Dug Well** 13. Height of Parapet: **1.2 m.**
14. Diameter of well top: **1.6 m.** 15. Bottom: _____
16. Depth of well: **14 m.** 17. Dimension of the Bore: _____
18. Dug cum bore well: _____ 19. Depth of lining: _____ m
20. Nature of lining: _____ 21. Condition of lining: _____
22. S W L Summer /winter: **7.2 m.** 23. Draw Down Summer/Winter:
24. Use of water: **For Domestic** 25. Quality of water: **Fresh**
26. Geological Formation: **Weathered Gneiss**
27. Trajectory: _____
28. Rate: _____

7. CONCLUSION

- The river Wainganga is the major river nearby and recharger of the groundwater.
- The study area is a terrain is of mixed rock type.
- **The rock Sandstone is a major rock and same act as an aquifer.**
- **The weathered gneiss also act as an aquifer at certain location**
- The bore and dug wells got enriched water table.
- The average static water level is approximately 7.1 m.

**A
PROJECT
ON**

**“PETROLOGICAL STUDIES AROUND DESAIGANJ AREA, DIST. -
GADCHIROLI.”**



SUBMITTEDBY

RAHUL RAMESH FARANDE

GUIDEDBY

PROF. D. P. WANMALI

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE


This is certified that RAHUL RAMESH FARANDE has carried out project work on "PETROLOGICAL STUDIES AROUND DESAIGANJ AREA, DIST. - GADCHIROLI" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 6-9-2024




PROF. D. P. WANMALI

Assistant Professor
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that RAHUL RAMESH FARANDE has carried out project work on "PETROLOGICAL STUDIES AROUND DESAIGANJ AREA, DIST. - GADCHIROLI" under the supervision of PROF. D. P. WANMALI for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 6-4-2024


Dr. L. H. Khalsa

Principal

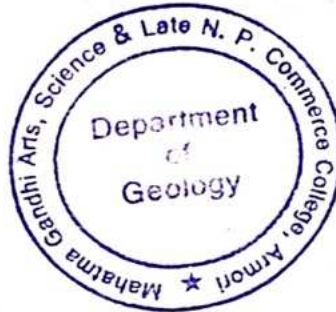
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli



Dr. C. P. Dorlikar

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College




12/4/24


12/4/2024


CERTIFICATE

This is certified that RAHUL RAMESH FARANDE has carried out project work on "PETROLOGICAL STUDIES AROUND DESAIGANJ AREA, DIST. - GADCHIROLI" under the supervision of PROF. D. P. WANMALI for the partial fulfillment of the Post-Graduate degree in Geology. He has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

He has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.



Internal Examiner



External Examiner


DECLARATION

I hereby declare that the project report entitled "PETROLOGICAL STUDIES AROUND DESAIGANJ AREA, DIST. - GADCHIROLI" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of PROF. D. P. WANMALI.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 6-9-2024

Place: - Armori



RAHUL RAMESH FARANDE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor, **PROF. D. P. WANMALI**, who always stood as a pillar, advisor and towering inspiration. Without her this, could not have been completed. I also forward my thanks to **Dr. C. P. Dorlikar**, Head Department of Geology, for his valuable support.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


RAHUL RAMESH FARANDE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASICS OF GEOLOGICAL INVESTIGATION	10
6	STUDY AREA: GENERAL GEOLOGY	21
7	CONCLUSION	25
8	REFERENCES	27

CHAPTER I

INTRODUCTION

1. INTRODUCTION

The general geology of the Gadchiroli district is wide and versatile. Right from the archean basements to the quaternary sediments are available in the Gadchiroli district. Many of the locations are well-known for the mafic intrusions like that of dyke and sill. Some observations classify them as a part of Craton. The Porla-Wadadha area is also a part and parcel of the Gadchiroli district. Geology mainly comprises the rocks of Archean, Gondwana supergroup, Lateritic soil, Alluvium. The study area is basically weathered and eroded plain due to presence of dominant fluvial systems. Some mounts of hard rocks are present near by the Armori area representing hard rock terrain. They are mostly relict type, i.e. they represent the survival of harder masses of rocks which escaped from weathering and erosion. The Waingnaga river along with her multiple minor tributaries forms the main dendritic drainage of the area.

Petrology utilizes the fields of mineralogy, petrography, optical mineralogy, and chemical analysis to describe the composition and texture of rocks. Petrologists also include the principles of geochemistry and geophysics through the study of geochemical trends and cycles and the use of thermodynamic data and experiments in order to better understand the origins of rocks. There are three branches of petrology, corresponding to the three types of rocks: igneous, metamorphic, and sedimentary, and dealing with experimental techniques:

- Igneous petrology focuses on the composition and texture of igneous rocks (rocks such as granite or basalt which have crystallized from

2000-2001

- 1. 2000-2001
- 2. 2000-2001
- 3. 2000-2001

3. **METHODOLOGY**

- The study area first observed by using the GIS tools.
- All the possible locations of the rock exposures were identified.
- The geology of the study area was again scrutinized.
- The observations done in the field was then compared with the literature to develop an acceptable inference.

CHAPTER
STUDY AREA

4. STUDY AREA

The study area was mapped and few rock formations were observed;

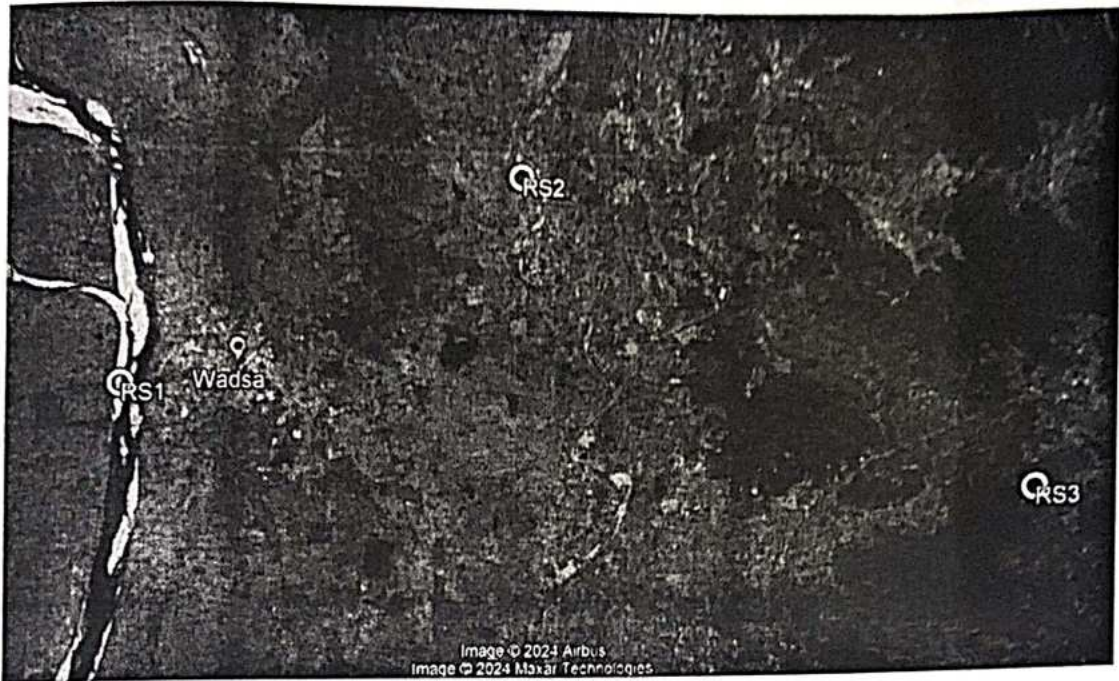


Figure 1 - Map of Desaiganj indicating rock exposures.

- RS1 - $20^{\circ}37'9.93''\text{N}$ and $79^{\circ}56'17.86''\text{E}$
- RS2 - $20^{\circ}39'26.64''\text{N}$ and $80^{\circ}1'2.48''\text{E}$
- RS3 - $20^{\circ}35'50.16''\text{N}$ and $80^{\circ}7'9.15''\text{E}$

5. BASICS OF GEOLOGICAL INVESTIGATION

The geological field work is carried out to search mineral deposits and to explore ground for many civil engineering works. During the geological survey sufficient data are gathered to prepare geologic maps and reports about a particular area of interest.

5.1 Field Equipment

The equipment that are commonly required for doing a geological field work are as follows.

- Topographic map.
- Compass.
- Hammer
- Haversack
- Altimeter
- Measuring Tape
- Field Notebook

5.2 Method of field work

5.2.1 Preliminary Survey

Before doing field mapping one should first undertake a rapid reconnaissance of the target area by taking topographical map. This will help in choosing suitable mapping procedures and in getting the general idea about the geological problems. The reconnaissance traverses should be planned in such a manner as to come across the different rock types present

6. STUDY AREA: GENERAL GEOLOGY

There are few rock strata identified as the in the study area Following are some;

- Sandstone
- Granite
- Schist

- Sandstone -

It is a sedimentary rock of clastic origin and is the well-known aquifer with a great capacity of water storage and high permeability. The deposition of the sandstone is essentially marine or fluvial of which the observed sandstone is of fluvial type. The colour is pink indicating high feldspar percentage and grains varies from coarse to fine indicating change in depositional environment.

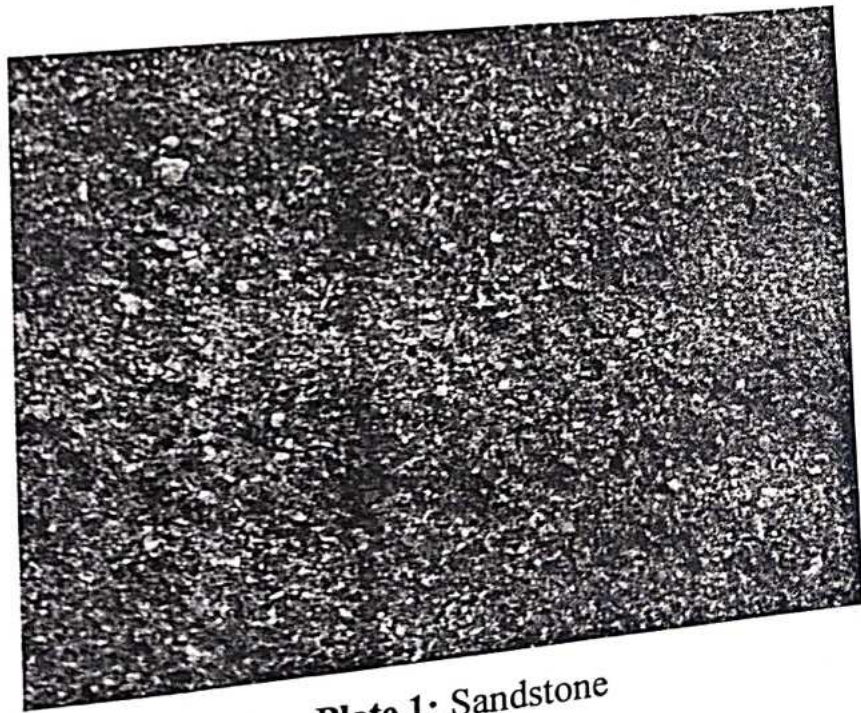


Plate 1: Sandstone

7. CONCLUSION

Following are the conclusion derived from the results;

- The majority of the observed study area shows to the rock strata of Archean Schist, Pakhal sandstone and Dongargad Granite.
- The Sandstone is of sedimentary origin; that to of fluvial.
- The schist is of metamorphic origin and mostly composed of flaky minerals.
- The granite is a part and parcel of the Dongargad granite and is of light coloured with felsic mineral assemblage.
- Among all, the sandstone is the well-known stratum for groundwater potential.

A

PROJECT

ON

**“GEOLOGICAL STUDIES OF GONDWANA ROCK FORMATIONS IN AND
AROUND THE AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT
MAHARASHTRA.”**



SUBMITTEDBY

SHEJAL HIRALAL BHAJANKAR

GUIDEDBY

Dr. C. P. Dorlikar

Head

P.G. DEPT. OF GEOLOGY

MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI

PANJAWANI COMMERCE COLLEGE, ARMORI

2023-24

CERTIFICATE

This is certified that SHEJAL HIRALAL BHAJANKAR has carried out project work on "GEOLOGICAL STUDIES OF GONDWANA ROCK FORMATIONS IN AND AROUND THE AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date-6/4/2024



Dr. C. P. DORLIKAR

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that SHEJAL HIRALAL BHAJANKAR has carried out project work on "GEOLOGICAL STUDIES OF GONDWANA ROCK FORMATIONS IN AND AROUND THE AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date-6/4/2024


Dr. L. H. Khalsa

Principal

M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli




Dr. C. P. Dorlikar

Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College


12/4/24


12/4/24

CERTIFICATE

This is certified that SHEJAL HIRALAL BHAJANKAR has carried out project work on "GEOLOGICAL STUDIES OF GONDWANA ROCK FORMATIONS IN AND AROUND THE AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.



Internal Examiner

(Dr. C. P. Dorlikar)




12/4/24
External Examiner

(Dr. S. G. Juve)


12/4/24

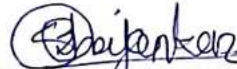
DECLARATION

I hereby declare that the project report entitled "GEOLOGICAL STUDIES OF GONDWANA ROCK FORMATIONS IN AND AROUND THE AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of **Dr. C. P. DORLIKAR**.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 6/4/2024

Place: Armori



SHEJAL HIRALAL BHAJANKAR

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor and Head of the department **Dr. C. P. DORLIKAR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


SHEJAL HIRALAL BHAJANKAR

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	4
3	METHODOLOGY	6
4	STUDY AREA	8
5	BASICS OF GEOLOGICAL INVESTIGATION	10
6	GONDWANA ROCKS: STUDY AREA	21
7	CONCLUSION	28
8	REFERENCES	30

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

The Gondwana supergroup has been named after the ancient 'Gond' kingdom of Madhya Pradesh, the name having been used first by H.B. Medlicott in 1872. Geologically, the Gondwana group presents us with best example of subsidence along major trough faults amidst the older rocks. In fact, deposition and preservation of great accumulation of sediments could have been possible due to such sinking basins. The total thickness of Gondwana sediments is estimated to be around 6000 m or even more. The Gondwana Group of rocks form the most important – stratigraphically, geologically and economically—groups of India. Economically, the Gondwana rocks are the biggest source of COAL deposits in India. Besides this black gold, Gondwana have yielded good quality building stones, clays and iron ores of importance.

Peninsular India bears great evidence of these accumulations that are spread over vast areas of Bengal, Bihar, Orissa, Madhya Pradesh and Maharashtra. The rocks form a composite group, in stratigraphical sense, rather than a single system, in as much as it contains rocks belonging to more than one true system, that is, of Triassic system, Jurassic system and Cretaceous system.

The Gondwana rocks are traced along three large tracts in Peninsular and Central India: In Bengal along the valley of Damodar.; In Maharashtra along the Godavari River; In Madhya Pradesh, parallel to Mahanadi Valley. Some isolated tracts of Gondwana rocks are also found in extra Peninsula, especially in Himalayan foot-hills in Nepal, Bhutan, and Assam and in the middle Himalayas of Kashmir.

2. OBJECTIVES

- To study the sedimentary terrain in general around the study area.
- To identify the various rocks available in these sedimentary terrain.
- To identify the Gondwana rock formations available in the sedimentary terrain of study area.
- To deduce the characteristics of the few rocks belonging to Gondwana supergroup.

3. METHODOLOGY

- The study area first observed by using the GIS tools.
- All the possible locations of the rock exposures were identified.
- The sedimentary terrain was again scrutinized form them.
- The field visit was planned to observe the sedimentary terrain and to collect the sample.
- The observations done in the field was then compared with the literature to develop an acceptable inference.

4. STUDY AREA

The Armori area was mapped and few sedimentary rock exposures were observed;



Figure 2 - Map of Armori indicating rock exposures.

- GR1 - 20°29'30.60"N and 79°57'54.97"E
- GR2 - 20°30'14.25"N and 79°59'6.51"E
- GR3 - 20°28'35.74"N and 79°59'37.00"E
- GR4 - 20°28'0.36"N and 80° 0'33.42"E

5. BASICS OF GEOLOGICAL INVESTIGATION

The geological field work is carried out to search mineral deposits and to explore ground for many civil engineering works. During the geological survey sufficient data are gathered to prepare geologic maps and reports about a particular area of interest.

5.1 Field Equipment

The equipment that are commonly required for doing a geological field work are as follows.

- Topographic map.
- Compass.
- Hammer
- Haversack
- Altimeter
- Measuring Tape
- Field Notebook

5.2 Method of field work

5.2.1 Preliminary Survey

Before doing field mapping one should first undertake a rapid reconnaissance of the target area by taking topographical map. This will help in choosing suitable mapping procedures and in getting the general idea about the geological problems. The reconnaissance traverses should be planned in such a manner as to come across the different rock types present

6. GONDWANA ROCKS: STUDY AREA

The Kamthi Formation, in the intracratonic Pranhita-Godavari Gondwana rift basin, bore signatures of climate change from a warm humid climate in Late Permian to hot arid during the Early Triassic. Sedimentation took place mainly under fluvial conditions. Following are the three well known basins of the Gondwana Supergroup in the India;

- Son-Damodar Valley
- Mahanadi valley
- Parnhita-Godavari Valley

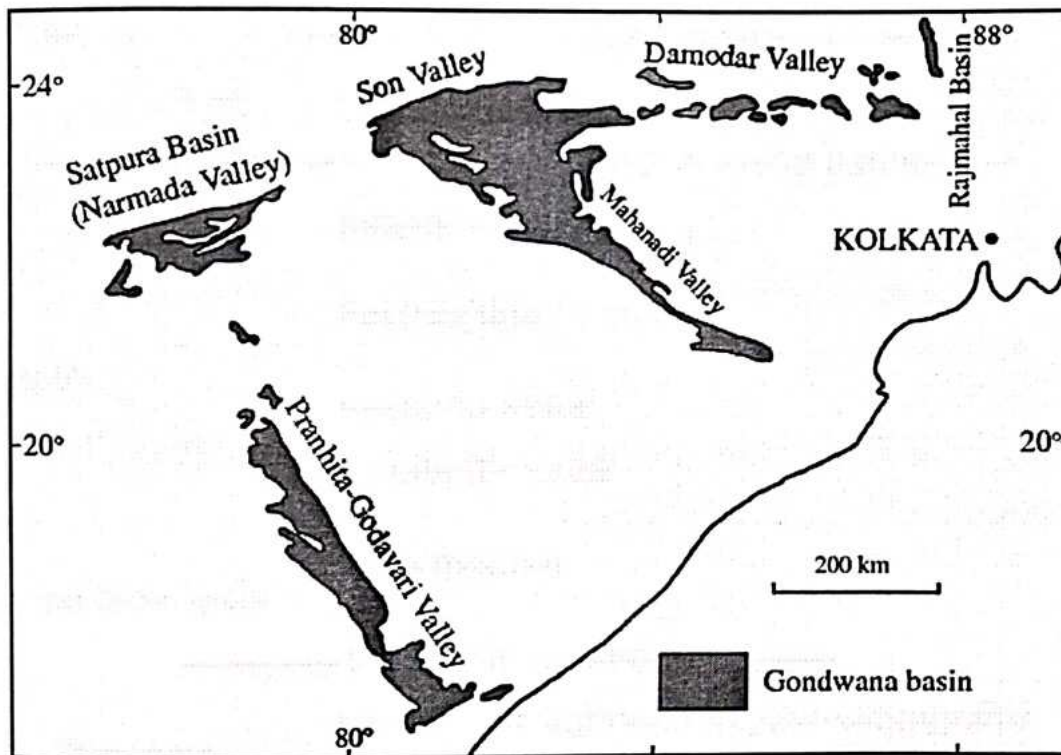


Figure 4: The geographical extent of the Gondwana supergroup.

7. CONCLUSION

Following are the conclusion derived from the results;

- The sedimentary rock observed around study area belongs to the strata of Gondwana supergroup.
- The sandstone varies from fine grains to the grains of pebble size in texture.
- The variance of the grain size clearly explains the drastic variation in the depositional environment.
- The multiple colour of the rocks explains the variation in mineralogical composition.
- The dominance of pink and red colour indicates the abundance of feldspar and iron respectively.

**THE REPORT ON IMPACT OF GEOMORPHOLOGICAL
FEATURE OVER OCCOURANCE AND MOVEMENT OF
GROUNDWATER ON LEFT HAND SIDE OF WAINGANGA
RIVER IN GANDCHIROLI DISTRICT, MAHARASHTRA,
INDIA**

THESIS SUBMITTED TO GONDWANA UNIVERSITY, GADCHIROLI

FOR DESSERTAION

MASTER OF SCIENCE IN GEOLOGY

(FACULTY OF SCIENCE)

SUBMITTED BY

SHRUTI NARESH KASEWAR

M. Sc. Final Year

Geology



SUPERVISED BY

DR. A. P. DHARASHIVKAR SIR

SENIOR GEOLOGIST OF

GROUND WATER SURVEY AND DEVELOPMENT AGENCY

DISTRICT GADCHIROLI



POST GRADUATE DEPARTMENT OF GEOLOGY

**MAHATMA GANDHI ARTS, SCIENCE & LATE N. P. COMMERECE
COLLEGE ARMORI, DIST. GADCHIROLI (M.S.) 441208
2023-2024**

Dr. C. P. Dorlikar
H.O.D
Department of Geology
Mo No:- 9423422989
Email id : Chandrakantdorlikar@gmail.com

CERTIFICATE

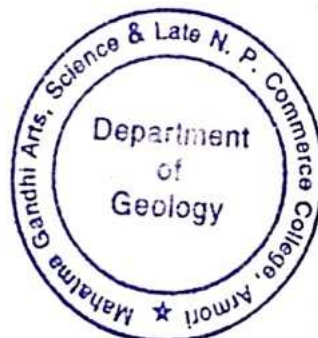
This is a certificate that **SHRUTI NARESH KASEWAR** has carried out project work on **"THE REPORT ON IMPACT OF GEOMORPHOLOGICAL FEATURE OVER OCCURANCE ANMOVEMENTF GROUNDWATER ON LEFT HAND SIDE OF WAINGANGA RIVER DIST. GADCHIROLI, MAHARASHTRA, INDIA"**. Under the supervision of **Dr. A. P. Dharashivkar Sir** for the partial fulfilment of the **POST GRADUATE DEGREE IN GEOLOGY**. She has carried out project work in laboratory of the Department of Geology, Mahatma Gandhi Art's & Science and Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post Graduation in Post Graduate Department of Geology, Mahatma Gandhi Art's & Science and Late N. P. Commerce College Armori, Affiliated to Gondwana University, Gadchiroli.


Place: Armori

Date: 26/04/24

Dr. L. H. Khalsa Sir
Principal




Dr. C. P. Dorlikar Sir
Head of Department of Geology


(I &) 14/4/24



12/4/24
(EXT)

CERTIFICATE

THIS TO CERTIFY THAT THE WORK PRESENTED HERE IN THE THESIS TITLED AS "THE REPORT ON IMPACT OF GEOMORPHOLOGICAL FEATURE OVER OCCURANCE AND MOVEMENT OF GROUNDWATER ON LEFT HAND SIDE OF WAINGANGA RIVER DIST. GADCHIROLI, MAHARASHTRA, INDIA". IS THE OWN WORK OF MIS. SHRUTI NARESH KASEWAR CONDUCTED IN POST GRADUATE DEPARTMENT OF GEOLOGY, MHATMA GANDHI ART'S & SCIENCE AND LATE N. P COMMERECE COLLEGE, ARMORI UNDER MY SUPERVISION.

THIS WORK HAS NOT BEEN SUBMITTED EARIES TO ANY UNIVERSITY OF INSTITUTIONN FOR ANY DIPLOMA OR DEGREE.


DATE: 31-03-2024

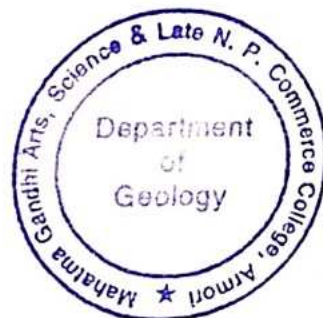

DR. A.P. DHARASHIVKAR
Senior Geologist
G.S.D.A. Gadchiroli
Senior Geologist, G.S.D.A. Gadchiroli


CERTIFICATE

This is a certified that **SHRUTI NARESH KASEWAR** has carried out project work on **“THE REPORT ON IMPACT OF GEOMORPHOLOGICAL FEATURE OVER OCCURANCE AND MOVEMENT OF GROUNDWATER ON LEFT HAND SIDE OF WAINGANGA RIVER DIST. GADCHIROLI, MAHARASHTRA, INDIA”** Under the supervision of **PROF. DR.A.P. DHARASHIVKAR** for the partial fulfillment of the Post Graduate degree of Geology. She has carried out project work on Laboratory of the Department of Geology, Mahatma Gandhi Art's & Science and Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post Graduation in Post Graduate Department of Geology, Mahatma Gandhi Arts & Science and Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.


12/11/24
Internal Examiner




12/11/24
External Examiner

DECLARATION / UNDERTAKING

I, hereby declare that the work presented in this thesis entitled “**THE REPORT ON IMPACT OF GEOMORPHOLOGICAL FEATURE OVER OCCURANCE ANIMOVEMENT^DE GROUNDWATER ON LEFT HAND SIDE OF WAINGANGA RIVER DIST. GADCHIROLI, MAHARASHTRA, INDIA**” was carried out by me and under the supervision of **Dr. Abhijit P. Dharashivkar**. This work or any part of this work is based on original data collection and Research and has not been submitted by me to any University/ Institution for the award of any diploma or degree.

Date: 06/04/2024



SHRUTI NARESH KASEWAR
M. G. Art's, & Science and Late N. P.
Commerce College, Armori

ACKNOWLEDGEMENTS

I express my deepest sense of gratitude to my supervisor, Dr. A.P. Dharashivkar Sir, Senior Geologist, Groundwater Survey and Development Agency, Gadchiroli for his valuable and inspiring guidance. His constructive criticism, interest and immense help in the preparation of manuscript as well as interpretation of data need profuse thanks!

I like to express my sincere that to Dr. C.P. Dorhlikar Sir, Professor Head, Post Graduate Department of Geology, M. G. College of Art's & Science and Late N. P. Commerce College, Armori, for his valuable help rendered during the present studies. I am grateful to Prof. Dr. Ganvir Sir, M. G. College of Art's & Science and Late N. P. Commerce College, Armori, senior Faculty form PG Department of Geology, for their constant encouragement, inspiring guidance and help extended from time to time during this study.

My sincere thanks are also extended to concerned authorities and staff members of office of Senior Geologist, Groundwater Survey and Development Agency (GSDA), Gadchiroli District, for providing me the most needed analytical database of drinking water samples from my study area and allied GIS data.

I am also thankful to Ms. Diksha Wanmali mam and Mr. Pranay Fulzele Sir, Faculty in Geology, PG Department of Geology, M. G. College of Art's & Science and Late N. P. Commerce College, Armori, for their help in actual working on this thesis.

My special thanks to our Principal Dr. Khalsa Sir for providing me the systematic environment for the said work and continuous encouragement.

My sincere gratitude towards the management of Mahatma Gandhi Art's & Science and Late N. P. Commerce College Armori for their encouragements and enthusiasm during actual tenure of work.

I am thankful to my colleagues Achal Kokode, Kajal Chaudhary and Twinkle Raut for their active and enthusiastic support in database sorting, database, arrangement and thesis writing.

I express my thanks to Shri. Jitendra Bodele Sir, Laboratory assistant, PG Department of Geology, M. G. College of Art's & Science and Late N. P. Commerce College, Armori, for providing us Laboratory Facilities during actual tenure of work.

My immense sense of gratitude towards my parents for their constant encouragement, patience, unstinted support and kind blessing enabled me to complete the thesis. Finally, I am forever indebted to all my colleges and those who have directly or indirectly supported me in this endeavor.

Place: Armori

Date: 06/04/2024


(Shrutika N. Kasewar)

ABBREVIATIONS

- AMSL - Above Mean Sea Level
- BCM - Billion Cubic Meter
- CGWB - Central Ground Water Board
- MBGL - Meters Below Ground Level
- DRM - District Resources Map
- GIS - Geographic Information System
- GPS - Global Positioning System
- GSDA - Ground Water Survey and Development Agency
- Ha - Hectare
- Ham - Hectare meter
- Km/km - Kilometer
- Lph - Liters per hour
- Lpd - Liters per day
- Max - Maximum
- Min - Minimum
- M. S. - Maharashtra State
- NWP - National Water Policy
- RGNDWM - Rajiv Gandhi National Drinking Water Mission
- RS - Remote Sensing
- SOI - Survey of India
- SWL - Static Water Level
- MSL - Mean Sea Level

CONVERSIONS

❖ ha (Hectare) = 100 meter × 100 meter
= 10000 m²
= 10 sq.km.

❖ Ham (Hectare meter) = 100 meter × 100 meter × 100 meter
= 100000 m³

❖ 1 m³ of water = 1000 liter

❖ 1 Million = 10 lack

❖ 1 Billion = 1000 lack

ORGANISATION OF THESIS

The thesis incorporates the various integrated investigations carried out regarding the Groundwater Occurrence and Movement by Groundwater Survey and Development Agency. The study area occurs in under 4 watershed WG-13, WGG-9, WGK-1, WGPA which denoted by GSDA. The entire study area mainly covering parts of Desaiganj, Armori, and Gadchiroli taluka in Gadchiroli district.

The thesis is divided into 9 chapter followed by list of references. The smaller figures are placed in continuation with the next while large map follows coming pages.

Tables are positioned in continuation with the text while plates and annexures exhibiting photographs. Respectively are located at the end of thesis.

The chapter in this thesis are organized as follows the:

In first chapter brief outline regarding the study area is given.

In second chapter details regarding work already carried out by various organization like GSDA, CHWB, GSI is given.

The third chapter is scope of work and adopted methodology for actual work, data collection, generating of various kinds of thematic maps is also added.

In fourth chapter Drainage Patterns is described very briefly.

In fifth chapter Geomorphological feature identified in study as per data provided by MRSAC is discussed.

In sixth chapter Geological setting with stratigraphy is discussed in detail.

CONTENTS

Sr No	CHAPTER NAME	Page No.
Chapter 1	INTRODUCTION 1.1 Preamble 1.2 Study area 1.2.1 Physiography 1.2.2 Drainage 1.2.3 Climate 1.2.4 Rainfall 1.2.5 Wind 1.2.6 Humidity 1.2.7 Flora and Fauna	14
Chapter 2	PREVIOUS WORK 2.1 Introduction 2.2 Previous study on water table	21
Chapter 3	SCOPE OF WORK AND ADOPTED METHODODOLOGY	22
Chapter 4	DRAINAGE	27
Chapter 5	GEOMORPHOLOGY	29
Chapter 6	GEOLOGY	33
Chapter 7	RAINFALL ANALYSIS	37
Chapter 8	HYDROGEOLOGY	47
Chapter 9	RESULT AND DISCUSSION	67
	REFERENCE	70

LIST OF TABLES

Sr No	TITLE	Page No
1	Table showing the location of study area of village occurring along the LHS of Wainganga River, district Gadchiroli	17
2	Table showing total monsoon rainfall for the last 24 years for taluka Desaiganj district Gadchiroli	38
3	Table showing total monsoon rainfall for the last 24 years for taluka Armori district Gadchiroli	41
4	Table showing total monsoon rainfall for the last 24 years for taluka Gadchiroli district Gadchiroli	44
5	Table showing the location of observation water station in study area which are regularly monitoring by GSDA	47
6	Table showing the static water level and water level fluctuation of last 24 years of observation water station of GSDA	48
7	Table showing the location of the observation wells in study area which are real time water level monitoring along the LHS of Wainganga River district Gadchiroli	52
8	Table showing the static water level and water table fluctuation with average of observation wells in real time water level monitoring	54

CHAPTER: 1

INTRODUCTION

1.1 PREAMBLE

Groundwater is the main key resource for human being for living hence it has got immense value. So in the present study the seasonal and temporal variation in occurrence and movement of groundwater is undertaken combination of geologic, geophysical, hydrologic and chemical analysis is applied to characterize the quantity, quality and sustainability of ground water in aquifers. The Dist. Gadchiroli is known as the Aspirational District by Government of India. Even after 76 years after Independence the systematic studies on occurrence and movement of groundwater is very little done. So taking that in consideration the present study is taken.

In the present study Rainfall and its variation with respect to time is taken as it is the sole source of groundwater recharge. The river is taken as the study unit as the surface water flow is controlled by river boundaries or morphologic boundaries. The study is limited to parts of **LEFT-HAND SIDE OF WAINGANGA RIVER.**

1.2 STUDY AREA

Gadchiroli district is one of the eleven districts of Vidarbha Region. Maharashtra tapers in the east, where this district forms the south-east corner such that Gondia district forms the north-east corner to its north; others neighbouring comprise Chandrapur district to the west, Chhattisgarh state to the east, and Telangana state to the south and southwest. It was created on 26

CHAPTER 2

PREVIOUS WORK

2.1 INTRODUCTION

Dr. Dharashivkar and Pranali Kuthe, Dr. Dharashivkar and Kajal Kuthe (2021) have worked on drainage morphometry of study area. In which they given stream order relationship. 74.19% first order, 19.35 second order and 0.55% third order and 1% fourth order. In this report they carried out work on the various morphometric parameters of the study area.

The related work which has been already carried out by different geoscientists has been presented in the chapter. The present chapter has been divided in to two parts. viz. Detailed documentation on National work.

2.2 Previous study on water table:

In Desaiganj, Armori and Gadchiroli taluka situated along NW corner of Gadchiroli district. In this taluka our total 6 observation station established so far, which are regularly monitored by GSDA. (Desaiganj 2 OBW, Armori 2 OBW, Gadchiroli 2 OBW)

Historical data since 1982 was available for this observation station on fortunately none of the observation station from these 6 station is falling under present study area.

Geological and geomorphologically area is comprising of Gondwana supergroups and pre-cambrian metasediment with various kinds of igneous intrusives. Therefore, as such much more variation in occurrence and movement of groundwater could not be seen based on this assumption as the rainfall data collected was of last 24 years the water-level data is taken for the same period. The detailed study of water level is seen in upcoming chapter.

CHAPTER 3

SCOPE OF WORK AND ADOPTED METHODOLOGY

In the present investigation exhaustive database on surface and subsurface water resources, geology, geological structures, Geomorphology and demography has been collected.

1. Collection of data
2. Work carried out in the aspects like

I] Drainage

II] Geomorphology

III] Geology

IV] Rainfall analysis

V] Hydrogeology

VI] Water quality

3. Preparation of thematic maps

I] Geological Maps

3.1 COLLECTION OF DATA

The data collected by various Government institutions, agencies were given first thought. The study area delineated by GSDA was extrapolated on Survey of India Toposheet 55P/15 (1:50000 Scale). The satellite Imagery (IRS-IC LISS III) was collected from GSDA, Gadchiroli. Existing geological map prepared by Geological Survey of India was referred for mapping the different geological units. The data on observation wells available with the Ground Water Survey and Development Agency (GSDA), Gadchiroli were studied and new observation wells were fixed. The reconnaissance survey followed by the

CHAPTER 4

DRAINAGE

The entire study area is included in the drainage basin of wainganga river. At the North boundary of the area, near Gandhinagar, Wainganga river enters the Study area and flows Northward for along Southern boundary of the area. The major river Gadhvi and khobragadi enter to the south east boundary to the study area.

The study area is comprising of variation dendrite to sub-dendrite drainage pattern. The line along the wainganga river were taken for study in which to the observation well were fixed near the wainganga river, 1.5km onstream of wainganga river and 3 km onstream of wainganga river.

4.1 Dry Drainage:

If the uncropped area is large enough and evaporation from this area is fast enough. Then the necessary balance can be achieved without artificial drainage. This is the concept of dry drainage. The 80% area is covered by dry drainage.

4.2 Perennial Drainage:

A stream or reach of a stream that flows continuously during all of the calendar year as a result of ground water discharge or surface runoff.

CHAPTER 5

GEOMORPHOLOGY

The geomorphology of the area influences the quality and availability of groundwater. It determine the surface flow direction and control the amount and rate of infiltration. The geomorphological features that play a great role in groundwater availability and quality include slope, elevation, drainage density, lineament density, soil, land use and land cover.

The geomorphic features given in front can be seen in my study area is....

1.Flood Plain (Moderate) FPM:-

These are relatively flat areas adjacent to rivers or streams that experience periodic flooding. The moderate flood plain is characterized by occasional inundation, allowing for fertile soil deposition and supporting vegetation. In the study area the moderate flood plain mainly occupy the northern part of the area (Sawangi to Kitadi) in Desaiganj and Armori taluka block.

2.Flood Plain (Shallow) FPS:-

Similar, to the moderate flood plain, but with shallower inundation during floods. These areas are still influenced by river dynamics and sediment deposition.

3.Pediment (PD):-

A gently sloping, erosion-resistant bedrock surface that extends from the base of a mountain or hill, pediments often form due to weathering and erosion processes, gradually smoothing the landscape.

CHAPTER 6

GEOLOGY

1. Introduction

The left side of wainganga river is study area is unique in district in the sense that the entire area of the study area is mainly occupied by metamorphic and igneous rocks along with sedimentary rocks in southern part. The study area is underlain by various types of rock formations from the oldest Granites and Gneiss of the Precambrian to the Recent Alluvium. Geologically the district contains almost all geological formations except Deccan Trap. The distribution of geological formation can be described in the Table and the geological map is shown in Fig

Generalized Geological sequence of study area (left hand side of wainganga river)

	Formation	Lithology
Recent	Alluvium	Soil, Laterite
Upper Gondwana	Chikhiala Formation	Grey to black ferruginous sandstones
		Sandstones
	Kota Formation	sandstones
		Calcareous sandstones and Limestones
Lower Gondwana	Kamthi Formation	Friable, ferruginous, medium to coarse grained sandstones
Pre-Cambrian	Pakal (Cudappah)	Quartzites and Sandstone
Archeans	Gneissic Complex	Basic Intrusive and Quartz Pegmatite veins, granite
		Gneisses, Banded Magnetite Quartzite and other unclassified metamorphics

CHAPTER 7

RAINFALL ANALYSIS

The rainfall is a prominent source of groundwater and thus has a direct bearing on groundwater situation. The **Monsoon Rainfall database** of last 24 years for **Desaiganj (Wadsa), Armori, and Gadchiroli Taluka** is taken from the government web site services.maharain.maharashtra.gov.in and is utilized for understanding the behavior pattern of rainfall. Monsoon rainfall data is collected, and the data is analyzed. Taking normal rainfall values from IMD, variation of rainfall was calculated. Accordingly, percentage deviation with respect to normal rainfall is calculated and it is utilized for knowing the cyclicity and trend of rainfall.

The rainfall data is collected on monthly basis with actual rainy days and it is well known fact that actual rainfall is directly proportional to ground water levels. In this report the static water levels were observed on monthly basis hence to study the impact of rainfall on static water levels of observation wells the measurement cycle is taken on monthly basis.

The monthly rainfall data of Gadchiroli taluka for last 24 years is analyzed and studied in detail and it was observed that there is vast variation in actual rainfall with respect to normal rainfall. The variation is observed from -59.312% to +99.056%. Hence, it is essential to classify the rainfall data for easy understanding and interpretation. The classes made are given in upcoming details.

Here in this chapter the monsoon rainfall data for Taluka **Desaiganj (Wadsa), Armori, and Gadchiroli** is attached separately. And the deviation

CHAPTER 9

RESULTS AND DISCUSSION

1. The study area is included in the drainage basin of wainganga river. At the North boundary of the Gadchiroli district. In the study area is comprising of various dendritic to sub-dendritic drainage pattern.
2. The uncropped area is large enough and evaporation from the area is fast enough. The necessary balance can be achieved without artificial drainage. The 80% of the area covered in dry drainage.
3. Good Groundwater Potential Zone is mainly dominated by geomorphic units like deep Pedi-plain as well as shallow Pedi-plain. Such favorable hydrogeological conditions in the zone are suitable for groundwater exploitation.
4. Moderate Groundwater Potential Zone is dominated by pediment unit. A gently sloping, erosion-resistant bedrock surface that extends from the base of mountain or hills.
5. At places, shallow and Moderate Pedi-plain also covers this zone. The zone is mostly confined to erosion and weathered Of bedrocks. These area may still exhibit gentle slopes and are conducive to agriculture.
6. Structural hill result from geological processes such as faulting and folding or uplift. Their formation is closely tied to the underlying rock structures.
7. The area mark with yellow color is indicating a flood plain deposidts, laid down but, flowing wainganga river during the historical past. Generally, the flood plain are very productive with respect to groundwater.

A
PROJECT
ON

“GEOLOGICAL STUDIES OF QUARTZITE AND ASSOCIATED ROCK FORMATIONS IN DONGARTAMASHI AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA.”



SUBMITTEDBY

SHRUTI SUNIL PAL

GUIDEDBY

Dr. C. P. Dorlikar

Head

P.G. DEPT. OF GEOLOGY

**MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI
PANJAWANI COMMERCE COLLEGE, ARMORI**

2023-24

CERTIFICATE

This is certified that SHRUTI SUNIL PAL has carried out project work on "GEOLOGICAL STUDIES OF QUARTZITE AND ASSOCIATED ROCK FORMATIONS IN DONGARTAMASHI AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under my supervision for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori
Date- 6-4-2024



A handwritten signature in blue ink, appearing to read "Dr. C. P. Dorlikar".

Dr. C. P. DORLIKAR
Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that SHRUTI SUNIL PAL has carried out project work on "GEOLOGICAL STUDIES OF QUARTZITE AND ASSOCIATED ROCK FORMATIONS IN DONGARTAMASHI AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

Date- 6-4-2024


Dr. L. H. Khalsa

Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

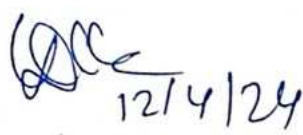




Dr. C. P. Dorlikar

Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College


12/4/24
(EX)


12/4/24
(Int)


CERTIFICATE

This is certified that SHRUTI SUNIL PAL has carried out project work on "GEOLOGICAL STUDIES OF QUARTZITE AND ASSOCIATED ROCK FORMATIONS IN DONGARTAMASHI AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfillment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.



Internal Examiner



External Examiner

DECLARATION

I hereby declare that the project report entitled "GEOLOGICAL STUDIES OF QUARTZITE AND ASSOCIATED ROCK FORMATIONS IN DONGARTAMASHI AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" submitted for fulfillment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. C. P. DORLIKAR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 6-4-2024

Place: Armori


SHRUTI SUNIL PAL

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor and Head of the department **Dr. C. P. DORLIKAR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.



SHRUTI SUNIL PAL

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	5
3	METHODOLOGY	7
4	STUDY AREA	9
5	FUNDAMENTALS OF GEOLOGICAL MAPPING	11
6	QUARTZITES: STUDY AREA	24
7	CONCLUSION	27
8	REFERENCES	29

1. INTRODUCTION

Present dissertation is a part fulfillment of the degree of Master of Science in Geology in Faculties of Science of M. G. College Armori, Gondwana University, "GEOLOGICAL STUDIES OF QUARTZITE AND ASSOCIATED ROCK FORMATIONS IN DONGARTAMASHI AREA OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" is chosen by candidate for dissertation. The area mainly comprises the rocks of, metamorphic rocks probably of Archean age, Sedimentary rocks, Granite outcrops and far apart dolerite dykes.

- **Location and Accessibility**

Gadchiroli district is situated in the easternmost parts of Maharashtra and covers an area of 15433 sq. km is the Survey of India degree sheet Nos. 55P, 56M,N 64D, 65A and B between latitudes $18^{\circ}40'$ N, $20^{\circ}50'$ N and longitudes $79^{\circ}45'E$ and $80^{\circ}09'E$. Dongartamashi area is in Armori Taluka of Gadchiroli District with approximate $20^{\circ}25'22.70"N$ and $80^{\circ} 8'5.60"E$.

- **Topography**

Distinct imprints upon landform are result of various geomorphic processes, and each geomorphic process develops its own characteristic landforms which manifests the topography of the area.

Maximum study area is penplain. Some hills of the area are relict type, i.e. they represent the survival of harder masses of rocks which escaped from weathering and erosion.

- **Drainage**

Khobragadi River forms the main drainage of the area. The drainage pattern is mainly dendritic.

1. OBJECTIVES

- To study the geology in general around the study area.
- To identify the various rocks available in study area.
- To identify the rocks of metasedimentary origin.
- To deduce the characteristics of the quartzite from the study area.

1. METHODOLOGY

- The study area first observed by using the GIS tools.
- All the possible locations of the rock exposures were identified.
- The geology of the study area was again scrutinized.
- The field visit was planned to observe rock exposures.
- The observations done in the field was then compared with the literature to develop an acceptable inference.

4. STUDY AREA

The Dongartamshi area was mapped and few quartzite rock exposures were observed;



Figure 1 - Map of Armori indicating Mafic exposures.

- S1 - $20^{\circ}25'2.84''\text{N}$ and $80^{\circ}8'34.56''\text{E}$
- S2 - $20^{\circ}24'39.19''\text{N}$ and $80^{\circ}8'13.08''\text{E}$

5. FUNDAMENTALS OF GEOLOGICAL MAPPING

FIELD ESSENTIALS

The geological field work is the most crucial instrument in any kind of geological research, which usually done to search mineral deposits and to explore the Geology. During the geological survey sufficient data are gathered to prepare geologic maps and reports about a particular area of interest.

- **Field Equipment**

The equipments that are commonly required for doing a geological field work are as follows.

- **Topographic map**

First the topographic map of the area to be investigated is procured. It is the most important tool of the geological field work. The map should show topographic details on a sufficiently large scale that is 1cm=2.5 km or 1: 50,000 it serves as a base map for systematic field work and geological mapping.

- **Compass**

A magnetic compass is used for finding directions, taking traverses and locating one's own position on the map. The magnetic needle of the compass always points towards the magnetic north. The chief compasses used by geologists for the field work are: (a) "clinometer compass", and (b) "Brinton compass". These compasses have some additional arrangements for measuring dips of bedding planes. Brinton is superior to clinometers as it can also be used as a hand level. It consists of three units:

- (a) a clinometers, used for measuring dip angles,
- (b) a compass, used for measuring directions, and

6. QUARTZITES: STUDY AREA

Following are the details of the rocks observed

S1:

The outcrop observed in the exposure consists of following characters;

- Colour - Grey
- Texture - Crystallized/Granular
- Structure - Cross bedding (metasedimentary structure)
- Possible minerals - Dominantly Quartz.
- Origin - Metasedimentary

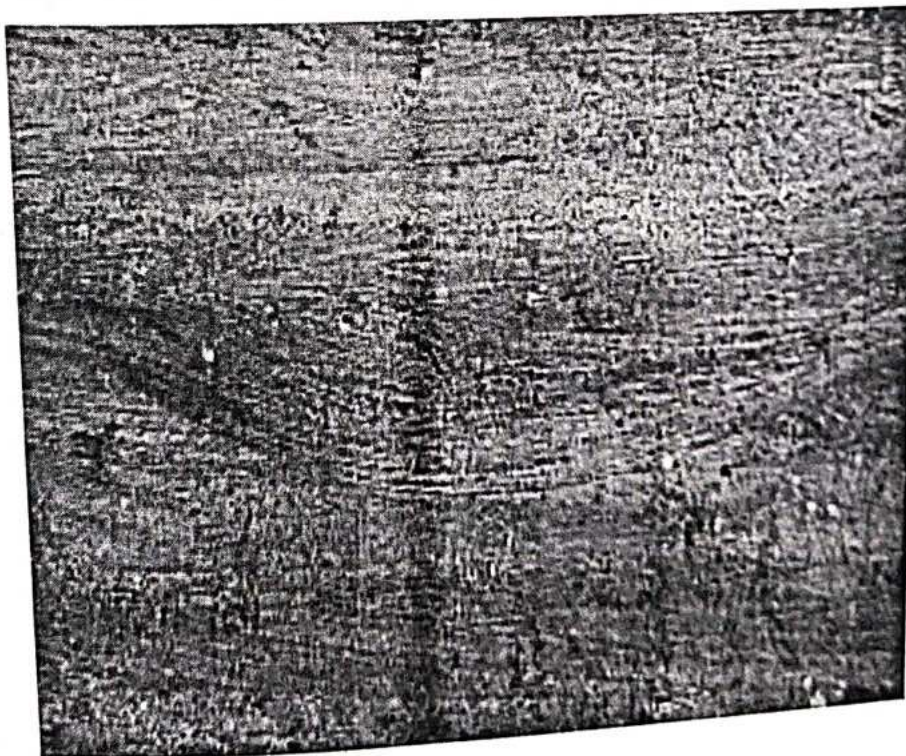


Plate 1 - S1

7. CONCLUSION

Following are the can derived from the results;

- The study area is geologically stable and does not possess any crucial mineral deposit.
- Most of the study area is covered by the alluvial deposits deposited by Khobragadi river but some patches highlights igneous (Granite) and Metasedimentary rocks.
- The observed rocks of quartzite are of metasedimentary in origin and shows remenant structures of sedimentary origin.
- The chief composition of the rock is dominated by quartz and few insignificant associated minerals.
- The quartzite is an hard rock and can be used for the local construction purposes.

A
PROJECT
ON
“GEOLOGICAL STUDIES OF VAIRAGAD AREA WITH SPECIAL REFERENCE TO THE
DIAMOND BEARING CONGLOMERATE FORMATIONS OF ARMORI BLOCK OF
GADCHIROLI DISTRICT MAHARASHTRA.”



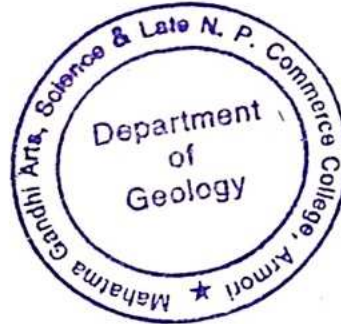
SUBMITTEDBY
TANNU LOKMITRA BARSAGADE
GUIDEDBY
Dr. C. P. Dorlikar
Head
P.G. DEPT. OF GEOLOGY
MAHATMA GANDHI ARTS, SCIENCE & LATE NASARUDDINBHAI
PANJAWANI COMMERCE COLLEGE, ARMORI
2023-24

CERTIFICATE

This is certified that TANNU LOKMITRA BARSAGADE has carried out project work on "GEOLOGICAL STUDIES OF VAIRAGAD AREA WITH SPECIAL REFERENCE TO THE DIAMOND BEARING CONGLOMERATE FORMATIONS OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under my supervision for the partial fulfilment of the Post-Graduate degree in Geology. She has carried out project work in the laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori
Date- 6-4-2024



Dr. C. P. DORLIKAR
Head

P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli

CERTIFICATE

This is certified that TANNU LOKMITRA BARSAGADE has carried out project work on "GEOLOGICAL STUDIES OF VAIRAGAD AREA WITH SPECIAL REFERENCE TO THE DIAMOND BEARING CONGLOMERATE FORMATIONS OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfilment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

Place- Armori

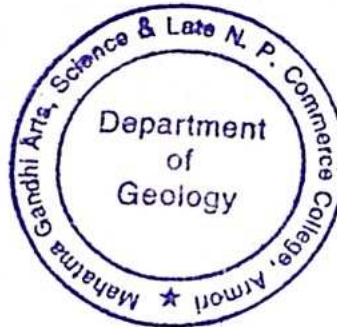
Date- 6-4-2024


Dr. L. H. Khalsa

Principal
M. G. Arts, Science and Late
N. P. Commerce College
Armori, Distt. - Gadchiroli


Dr. C. P. Dorlikar

Head
P.G. Department of Geology
M. G. Arts, Science and Late
N. P. Commerce College




12/4/24
External


12/4/24
(Internal)

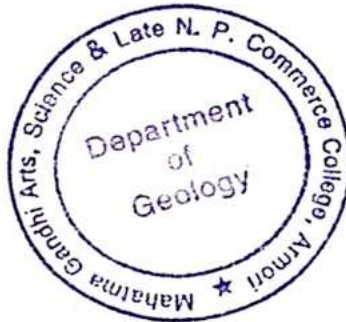
CERTIFICATE

This is certified that TANNU LOKMITRA BARSAGADE has carried out project work on "GEOLOGICAL STUDIES OF VAIRAGAD AREA WITH SPECIAL REFERENCE TO THE DIAMOND BEARING CONGLOMERATE FORMATIONS OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" under the supervision of Dr. C. P. DORLIKAR for the partial fulfilment of the Post-Graduate degree in Geology. She has carried out project work in laboratory of the Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.



Internal Examiner



Handwritten signature and date "12/4/24".

External Examiner

DECLARATION

I hereby declare that the project report entitled "GEOLOGICAL STUDIES OF VAIRAGAD AREA WITH SPECIAL REFERENCE TO THE DIAMOND BEARING CONGLOMERATE FORMATIONS OF ARMORI BLOCK OF GADCHIROLI DISTRICT MAHARASHTRA" submitted for fulfilment of Post-Graduation degree in Geology at Post Graduate Department of Geology, M. G. Arts, Science & Late N. P. Commerce College Armori, affiliated to Gondwana University have been carried out by me under the guidance of Dr. C. P. DORLIKAR.

I further declared that this project report work or any part thereof has not been previously submitted for any degree in any other university.

Date: 6-4-2024

Place: Armori



TANNU LOKMITRA BARSAGADE

ACKNOWLEDGMENT

I wish on record my deep gratitude and indebted to my supervisor and Head of the department **Dr. C. P. DORLIKAR**, who always stood as a pillar, advisor and towering inspiration. Without him this, could not have been completed.

I am also thankful to **Dr. L. H. Khalsa** Principal, M. G. Arts, Science & Late N. P. Commerce College Armori, for his valuable assistance during the period of our project work at the college. I would like to thankful all my family members for moral support and encouragement which they provided during my project work.

I also express my sincere thanks to all those who have directly or indirectly helped us to complete our project.


TANNU LOKMITRA BARSAGADE

INDEX

SR. NO.	CONTENT	PAGE NO.
1	INTRODUCTION	1
2	OBJECTIVES	5
3	METHODOLOGY	7
4	STUDY AREA	9
5	BASICS OF GEOLOGICAL INVESTIGATION	11
6	STUDY AREA: GENERAL GEOLOGY AND DIAMOND BEARING STRATA	22
7	CONCLUSION	28
8	REFERENCES	30

CHAPTER I

INTRODUCTION

1. INTRODUCTION

These primary deposits are known as pipes, also called "diatremes". They are the geological remains of large bodies of diamond-bearing magma that have cut through the earth's crust in volcanic eruptions. These diamond-bearing magmas are composed of diamond-bearing rocks, kimberlite, or, in rarer instances, lamproite. Diamond is a mineral composed of mainly of pure carbon, and the arrangement of carbon atoms within the crystal is almost perfectly symmetrical. Gem quality diamonds are typically 99.95% carbon and can be up to 99.99% pure. This makes diamond one of the purest of all gems found in nature.

The other 0.01% to 0.05% of a diamond's chemical composition can include other trace elements that are not a part of the diamond's essential chemistry. These trace elements can cause diamonds to be different colors, to fluoresce, or have other unique properties which we will explore in subsequent articles. Long before there was life on Earth, there were diamonds. The age of the Earth is estimated to be 4.543 billion years old, and the oldest diamonds crystallized around 3.5 billion years ago. Approximately 100 miles beneath the surface of the earth, in rare conditions, extreme temperatures and pressures bonded carbon atoms tightly together, resulting in the hardest natural mineral on Earth: diamond. Diamonds are the oldest thing most of us will ever hold or own. Most diamonds crystallized just below the Earth's crust in the upper mantle, between 70 and 120 miles (120 and 200 km) beneath the Earth's surface. The region where the pressures and temperatures are just right for diamonds to form is called the diamond stability field.

2. OBJECTIVES

- To study the geology in general around the study area.
- To identify the various rocks available in study area.
- To identify the rocks hosting the diamonds of study area.
- To deduce the characteristics of the rocks belonging to the diamond bearing formation.

CHAPTER 3

METHODOLOGY

3. METHODOLOGY

- The study area first observed by using the GIS tools.
- All the possible locations of the rock exposures were identified.
- The geology of the study area was again scrutinized.
- The field visit was planned to observe the diamond bearing rock formation and to collect the sample.
- The observations done in the field was then compared with the literature to develop an acceptable inference.

4. STUDY AREA

The study area was mapped and few rock formations were observed;



Figure 2 - Map of Vairagad indicating rock exposures.

- RS1 - $20^{\circ}27'1.92''\text{N}$ and $80^{\circ}4'49.27''\text{E}$
- RS2 - $20^{\circ}27'13.76''\text{N}$ and $80^{\circ}4'30.14''\text{E}$
- RS3 - $20^{\circ}27'39.01''\text{N}$ and $80^{\circ}4'51.19''\text{E}$

5. BASICS OF GEOLOGICAL INVESTIGATION

The geological field work is carried out to search mineral deposits and to explore ground for many civil engineering works. During the geological survey sufficient data are gathered to prepare geologic maps and reports about a particular area of interest.

5.1 Field Equipment

The equipment that are commonly required for doing a geological field work are as follows.

- Topographic map.
- Compass.
- Hammer
- Haversack
- Altimeter
- Measuring Tape
- Field Notebook

5.2 Method of field work

5.2.1 Preliminary Survey

Before doing field mapping one should first undertake a rapid reconnaissance of the target area by taking topographical map. This will help in choosing suitable mapping procedures and in getting the general idea about the geological problems. The reconnaissance traverses should be planned in such a manner as to come across the different rock types present

6. STUDY AREA: GENERAL GEOLOGY AND DIAMOND BEARING STRATA

The Wairagarh area exposes a narrow stretch of (-20 km x 6 km), NNW SSE trending, low grade, highly deformed metasedimentary belt within the terrain occupied by Archaean Amgaon Gneiss and occurs in the western part of the Bastar craton.

- The metasediments comprise framework- supported polymictic conglomerate, gritty and pebbly arenite, quartzite and quartz-mica schist.
- Polymictic conglomerate dominates the metasediments and is made up of mixed assemblage of clasts of different composition and size set in a well-foliated quartz- sericite matrix.
- Quartzite dominates the clast population accounting for nearly 80 %, and the remaining includes gneiss, vein quartz, banded ferruginous quartzite and meta-basic rock.
- The deformed clasts display high degree of flattening and shearing and the host rock records variable (subhorizontal to steep) stretching lineation.
- The conglomerate grades laterally in to gritty quartzite and mica schist. The ductile shear zone occurring along the eastern margin of Sakoli Fold Belt (SFB) (Roy et al. 1992) passes through the sediments resulting in strong deformation of the basement - cover rocks
- The Wairagarh metasedimentary unit appears to have been deposited over the gneissic basement. The basenlent gneisses also show evidence of intense deformation, which has resulted in the development of a strong mylonitic fabric.

7. CONCLUSION

Following are the conclusion derived from the results;

- The majority of the observed study area shows to the rock strata of Vairagad metasediments, Pakhal sandstone and Dongargad Granite.
- The Polymictic conglomerate dominates the metasediments.
- Wairagarh metasedimentary unit appears to have been deposited over the gneissic basement i.e. Amgaon Gneiss.
- The Wairagarh metasedimentary has already been explored for the diamonds along many on workings.
- The conglomerate has yielded an octahedral gem grade diamond.
- It is hence can be concluded that the area possesses a potential for diamond search in near future.

Certificate

**A DETAILED REPORT ON SYSTEMATIC STUDIES ON
OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS
OF WGK-1 WATERSHED DISTRICT GADCHIROLI,
MAHARASHTRA, INDIA.**

**THESIS SUBMITTED TO GONDWANA UNIVERSITY, GADCHIROLI
FOR DESSEERTATION**

**MASTER OF SCIENCE IN GEOLOGY
(FACULTY OF SCIENCE)**

**SUBMITTED BY
TWINKAL SURESH RAUT**



**DR. A.P. DHARASHIVKAR
GROUNDWATER SURVEY AND DEVELOPMENT AGENCY
GADCHIROLI**

CERTIFICATE

This is a certified that TWINKAL SURESH RAUT has carried out project work on "SYSTEMATIC STUDIES ON OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED DISTRICT GADCHIROLI ,MAHARASHTRA, INDIA".

Under supervision of DR. A.P. DHARASHIVKAR, Senior Geologist, G.S.D.A., Gadchiroli for the partial fulfillment of the post-graduate degree in geology. She has carried out project work in laboratory of the department of geology, M.G Arts, Science & Late N.P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the necessary requirements of the regulation to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M.G. Arts, Science and Late N.P. Commerce College Armori, affiliated to Gondwana University , Gadchiroli.

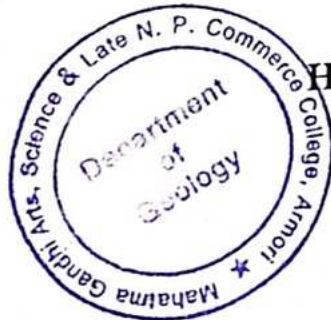
Place : Armori


Date :

Dr. L.H. Khalsa

Principal

M.G. College Armori




Dr. C.P. Dorlikar

Head, Department of Geology

M.G. College Armori


12/4/24
External


12/4/24
(Internal)

CERTIFICATE

THIS TO CERTIFY THAT THE WORK PRESENTED HERE IN THE THESIS TITLED AS" SYSTEMATIC STUDIES ON OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED FROM KHOBRAGADI RIVER BASINOF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" IS THE OWN WORK OF MS. TWINKAL SURESH RAUT CONDUCTED IN POSTGRADUATE DEPARTMENT OF GEOLOGY, MG ARTS, COMMERCE AND SCIENCE COLLEGE, ARMORI UNDER MY SUPERVISION.

THIS WORK HAS NOT BEEN SUBMITTED EARIES TO ANY UNIVERSITY OF INSTITUTIONN FOR ANY DIPLOMA OR DEGREE.

DATE: 31.03.2024




DR. A.P. DHARASHIVKAR
Senior Geologist
G.S.D.A. Gadchiroli
Senior Geologist, G.S.D.A. Gadchiroli


CERTIFICATE

This is a certified that TWINKAL SURESH RAUT has carried out project work on "DETAIL REPORT ON SYSTEMATIC STUDIES ONN OCCURANCES AND MOVEMENT OF GROUNDWATER IN PARTS OF WGK-1 WATERSHED DIST. GADCHIROLI, MAHARASHTRA, INDIA. Under the supervision of PROF. DR.A.P. DHARASHIVKAR for the partial fulfillment of the Post-Graduate degree of Geology. She has carried out project work on Laboratory of the Department of Geology, M.G. Arts, Science and Late N.P. Commerce College Armori, affiliated to Gondwana University, Gadchiroli.

She has fulfilled all the requirements of the regulation related to the prescribed period of work as per rules required under the ordinance related to the Post-Graduation in Post Graduate Department of Geology, M.G. Arts, Science and Late N.P. Commerce College Armori, affiliated to Gondwana University , Gadchiroli.



Internal Examiner

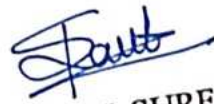


External Examiner

DECLARATION/UNDERTAKING

I, hereby declare that the work presented in this thesis entitled "Systematic studies on occurrences and movement of groundwater in parts of WGK-1 watershed Dist. Gadchiroli, Maharashtra India" was carried out by me and under the supervision of Dr. Abhijit P. Dharashivkar. This work or any part of this work is based on original data collection and Research and has not been submitted by me to any University/ Institution for the award of any diploma or degree.

Date :


TWINKAL SURESH RAUT
M.G.Arts, Commerce and
Science College, Armori

ACKNOWLEDGEMENTS

I express my deepest sense of gratitude to my supervisor, Dr. A.P. Dharashivkar, Senior Geologist, Groundwater Survey and Development Agency, Gadchiroli for his valuable and inspiring guidance. His constructive criticism, interest and immense help in the preparation of manuscript as well as interpretation of data need profuse thanks!

I like to express my sincere that to Dr. C.P. Dorlikar, Professor Head, Post Graduate Department of Geology, MG College of Arts, Commerce and Science College, Armori, for his valuable help rendered during the present studies. I am grateful to Prof. Ganvir, senior Faculty form PG Department of Geology, MG Arts, Commerce and Science College, Armori for their constant encouragement, inspiring guidance and help extended from time to time during this study.

My sincere thanks are also extended to concerned authorities and staff members of office of Senior Geologist, Groundwater Survey and Development agency (GSDA), Gadchiroli District, for providing me the most needed analytical database of drinking water samples from my study area and allied GIS data.

I am also thankful to Ms. Diksha Wanmali and Mr. Pranay Fulzele, Faculty in Geology, PG Department of Geology, MG Arts, Commerce and Science College, Armori for their help in actual working on this thesis.

ORGANISATION OF THESIS

The thesis incorporates the various integrated investigations carried out regarding the groundwater occurrence and movement by GSDA. GSDA denoted this part as watershed WGK-1. The entire watershed mainly covering Parts of Armori, Dhanora and Gadchiroli taluka in Gadchiroli district.

The thesis is divided into 8 chapter followed by list of references. The smaller figures are placed in continuation with the next while large map follows coming pages.

Tables are positioned in continuation with the text while plates and annexures exhibiting photographs. Respectively are located at the end of thesis.

The chapter in this thesis are organized as follows the:

In first chapter brief outline regarding the study area is given.

In second chapter details regarding work already carried out by various organization like GSDA, CHWB, GSI is given.

In third chapter Drainage Patterns is described very briefly.

In fourth chapter Geomorphological feature identified in study as per data provided by MRSAC is discussed.

In fifth chapter Geological setting with stratigraphy is discussed in detail.

In sixth chapter is Rainfall.

In seventh chapter hydrogeology.

In eighth chapter Discussion and Conclusion.

Contents

CHAPTER 1: INTRODUCTION.....	12
CHAPTER 2: PREVIOUS WORK AND PRESENT SCOPE OF WORK.....	17
CHAPTER 3: DRAINAGE NETWORK.....	21
CHAPTER 4: GEOMORPHOLOGICAL SET UP.....	22
CHAPTER 5. GEOLOGICAL FRAMEWORK.....	24
CHAPTER 6 :RAINFALL ANALYSIS.....	29
CHAPTER 7:HYDROGEOLOGY OF STUDY AREA.....	37
CHAPTER 8: DISCUSSION.....	51
REFERENCES.....	53

CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

Groundwater is the main key resource for human being for living hence it has immense value. So, in the present study the seasonal and temporal variation in occurrence and movement of groundwater is undertaken. The Dist. Gadchiroli is known as the Aspirational District by Government of India. Even after 77 years after Independence the systematic studies on occurrence and movement of groundwater is little done. So, taking that in consideration the present study is undertaken.

In the present study Rainfall and its variation with respect to time is taken as it is the sole source of groundwater recharge. The Watershed is taken as the study unit as the surface water flow is controlled by watershed boundaries or morphologic boundaries. The study is limited to parts of GSDA watershed WGK-1.

1.2 STUDY AREA

Study area covers 104.692 Sq Km area of Gadchiroli district and is located 170 KM south-east of Nagpur city (Fig.1 Location Map). It included in the Survey of India toposheet number 55P/15 between (Watershed Map, table 1) Longitude $20^{\circ}16'15''$ and Latitudes $79^{\circ}59'20''$ (Fig.2), Table.1. The area experiences tropical dry sub-humid climate. The summer months are much hot (maximum temperature 43.4°C) while, winter is mild (minimum temperature 14.4°C). The GSDA has categorized the watershed as WGK-1. The watershed details as given in Table 1. Study area is having 48 villages and there are 39 villages from Armori and 9 villages from Gadchiroli.

CHAPTER 2: PREVIOUS WORK AND PRESENT SCOPE OF WORK

Dharashivkar and Gedam (2021) have worked on drainage morphometry of study area in which they given stream order relationship. 74.19% first order, 19.35 second order and 05.5% third order and 1% fourth order. In this report they carried out work on the various morphometric parameters of the study area.

The related work which has been already carried out by different geoscientists has been presented in the chapter. The present chapter has been divided in to two parts. viz. International work in brief and detailed documentation on National work.

2.1 Scope of Work and Adopted Methodology

In the present investigation exhaustive database on surface and subsurface water resources, geology, geological structures and demography has been collected.

2.2 COLLECTION OF DATA

The data collected by various Government institutions; agencies were given first thought. The watershed delineated by GSDA was extrapolated on Survey of India Toposheet 55P/15 (1:50000 Scale). The satellite Imagery (IRS-IC LISS III) was collected from GSDA, Gadchiroli. Existing geological map prepared by Geological Survey of India was referred for mapping the different geological units. The data on observation wells available with the Ground Water Survey and Development Agency (GSDA), Gadchiroli were studied, and new observation wells were fixed. The reconnaissance survey followed by the extensive field traverses were taken-up to collect the data on geology, hydrogeology etc.

CHAPTER 3: DRAINAGE NETWORK

The WGK -1 watershed is comprising of residual dendritic to sub dendritic drainage pattern. Mostly drainage is flowing in majorly towards north or northwest.

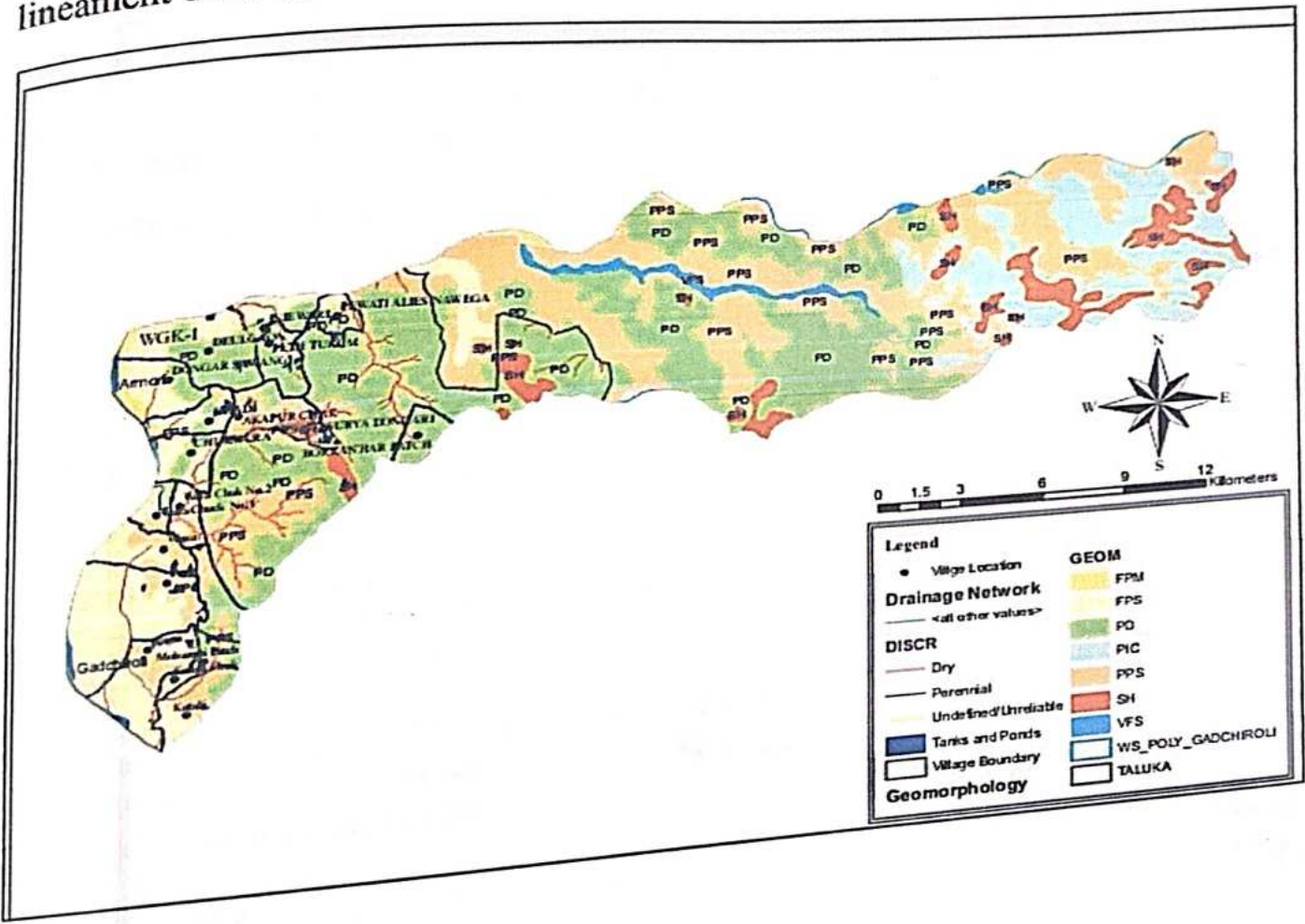
Major river is khobragadi river and the total rainfall runoff . It is contributed to khobragadi river. The drainage is in majorly seasonal one only perrinial drainage is khobragadi river.

The watershed WGK-1 could be divisible into 1-6 mini watershed that is 1/1, 1/2, 1/3, 1/4, 1/5, 1/6.

In further work drainage morphometry is delt in detail for understanding the role of drainage in groundwater occurrence and availability as well as its role in groundwater quality.

CHAPTER 4.: GEOMORPHOLOGICAL SET UP

The geomorphology of the area influences the quality and availability of groundwater. It determines the surface flow direction and controls the amount and rate of infiltration. The geomorphological features that play a great role in groundwater availability and quality include slope, elevation, drainage density, lineament density, soil, land use and land cover (LULC).



The geomorphic features given in front can be seen in our study area.

**Mahatma Gandhi Arts, Science and Late N. P.
Commerce College, Armori**

Department of Mathematics

Project Work

NAME: MISS. KIRAN RAJU BAMUR

CLASS: M.SC. SEM-II (SESSION 2023-24)

**TOPIC: TRANSPORTATION PROBLEMS AND ITS
APPLICATIONS**

GUIDED BY: Prof. A. A. KHARWADE SIR



P.A.K.
25/04/24
Submitted



MAHATMA GANDHI ARTS, SCIENCE AND LATE N. P.
COMMERCE COLLEGE, ARMORI, DIST:GADCHIROLI

CERTIFICATE

This is to Certify that Miss. Kiran Raju Bamur
of Class **M.Sc. Sem-II (SUMMER-24)** has Successfully Completed
his/her Project Work on the Topic Transportation Problems
And Its Applications Under the Guidance of
Prof. A. A. Kharwade for the course
'FIELD PROJECT' (Session 2023-24).


Dr. L. H. Khalsa

Head of Department
HEAD

Department of Mathematics
Mahatma Gandhi Arts,science
N.P.Commerce College,Armori

Index

Sr No.	Content	Page No.
1.	Introduction	3-4
2.	Transportation Problem	5
3.	Tabular formulation of transportation problem	6
4.	Some Definitions and Theorems	7-9
5.	Balanced and unbalanced Transportation problem	10
6.	Methods Of Finding Initial Basic Feasible Solution (IBFS)	11
7.	Application Problem	12-17

INTRODUCTION

Transportation is a fundamental aspect of human civilization, facilitating the movement of goods, people, and services from one place to another. However, ensuring efficient transportation systems presents a myriad of challenges, one of the most prominent being transportation problems.

Transportation problems represent a significant area of study within the field of Operations Research, a discipline that utilizes mathematical modeling and analytical methods to optimize decision-making processes. In the context of Operations Research, transportation problems involve determining the most efficient way to transport goods from multiple origins to multiple destinations, while minimizing costs or maximizing profits.

These problems are pervasive in various industries, including manufacturing, distribution, logistics, and supply chain management. They arise when companies need to allocate limited transportation resources, such as vehicles, routes, and capacities, to fulfill demand from customers or distribution centers.

The fundamental objective of addressing transportation problems in Operations Research is to find the optimal allocation of resources to minimize total transportation costs, which may include expenses

associated with fuel, labor, vehicle maintenance, and time.

Additionally, considerations such as delivery time constraints, vehicle capacities, and route efficiency further complicate the optimization process.

Mathematical models, such as linear programming, network optimization, and heuristic algorithms, are commonly employed to formulate and solve transportation problems in Operations Research. These models allow analysts to explore various scenarios, evaluate trade-offs, and identify the most cost-effective transportation strategies.

By applying Operations Research techniques to transportation problems, businesses can streamline their logistics operations, enhance supply chain efficiency, reduce operational costs, and improve customer satisfaction. Furthermore, these methodologies enable decision-makers to make informed choices that balance competing objectives, such as minimizing transportation costs while maintaining service quality and sustainability.

TRANSPORTATION PROBLEM

Let there be m sources of supply S_i ($i = 1, 2, \dots, m$) having a_i ($i = 1, 2, \dots, m$) units of supply to be transported among n destinations D_j ($j = 1, 2, \dots, n$) with b_j ($j = 1, 2, \dots, n$) units of demand.

Also let c_{ij} = cost of transporting one unit of commodity from source i to destination j and x_{ij} = no. of units transported from source i to destination j .

Then the problem is to determine the transportation schedule so as to minimize the total transportation cost satisfying the supply and demand constraints is called as a transportation problem.

Mathematically, this problem may be stated as a linear programming problem as follows:

Minimize $z = \sum_{i=1}^m \sum_{j=1}^n x_{ij} c_{ij}$ subject to the constraints-

$$\sum_{j=1}^n x_{ij} = a_i, \quad i = 1, 2, \dots, m \quad (\text{Supply constraint})$$

$$\sum_{i=1}^m x_{ij} = b_j, \quad j = 1, 2, \dots, n \quad (\text{Demand constraint})$$

And $x_{ij} \geq 0$, for all i and j .

TABULAR FORMULATION OF TRANSPORTATION

PROBLEMS

Let there be m sources of supply S_i ($i = 1, 2, \dots, m$) having a_i ($i = 1, 2, \dots, m$) units of supply to be transported among n destinations D_j ($j = 1, 2, \dots, n$) with b_j ($j = 1, 2, \dots, n$) units of demand.

Also let c_{ij} = cost of transporting one unit of commodity from source i to destination j and x_{ij} = no. of units transported from source i to destination j .

	D_1	D_2	.....	D_n	
S_1	x_{11}	x_{12}	.....	x_{1n}	a_1
	c_{11}	c_{12}	.....	c_{1n}	
S_2	x_{21}	x_{22}	.....	x_{2n}	a_2
	c_{21}	c_{22}	.....	c_{2n}	
⋮	⋮	⋮	⋮	⋮	⋮
S_m	x_{m1}	x_{m2}	.....	x_{mn}	a_m
	c_{m1}	c_{m2}	.....	c_{mn}	
	b_1	b_2	.....	b_n	

SOME DEFINITIONS AND THEOREMS

Source: A source in transportation problems represents a point of origin where goods are available for transportation. Sources can include factories, warehouses, or distribution centers.

Destination: A destination in transportation problems represents a point of delivery where goods are to be transported. Destinations can include warehouses, retail outlets, or customer locations.

Supply: Supply refers to the quantity of goods available at each source for transportation to destinations. It represents the capacity or availability of goods at the source.

Demand: Demand refers to the quantity of goods required at each destination. It represents the requirement or consumption of goods at the destination.

Transportation Cost: Transportation cost is the cost associated with transporting one unit of goods from a source to a destination. It can vary depending on factors such as distance, mode of transportation, and handling fees.

Decision Variables: Decision variables in transportation problems represent the quantities of goods to be transported from each source to each destination. These variables are typically represented in a transportation matrix.

Objective Function: The objective function in transportation problems represents the total cost of transporting goods from sources to destinations. The goal is to minimize this cost while meeting supply and demand requirements.

Constraints: Constraints in transportation problems represent limitations or restrictions on the transportation process. These constraints include supply constraints, demand constraints, and capacity constraints at sources and destinations.

Feasible Solution: A feasible solution in transportation problems is a transportation plan that satisfies all supply and demand constraints. It represents a valid allocation of goods from sources to destinations.

Optimal Solution: An optimal solution in transportation problems is a feasible solution that minimizes the total transportation cost. It

represents the most cost-effective transportation plan among all feasible solutions

❖ **Important theorems**

i) A necessary and sufficient condition for the existence of a feasible solution to the transportation problem is $\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$.

ii) The number of basic variables in transportation problem are $m + n - 1$.

BALANCED AND UN-BALANCED TRANSPORTATION PROBLEMS

In transportation problems,

i) When total demand = total supply then the problem is said to be balanced transportation problem.

Mathematically, this can be expressed as: $\sum \text{Supply} = \sum \text{Demand}$

ii) When total demand \neq total supply then the problem is said to be unbalanced transportation problem.

Mathematically, an unbalanced transportation problem can be expressed as: $\sum \text{Supply} \neq \sum \text{Demand}$

METHODS OF FINDING INITIAL BASIC FEASIBLE SOLUTION (IBFS)

There are several methods for finding the initial basic feasible solution of a transportation problem. Here are three common approaches:

- 1) North-West corner rule**
- 2) Least cost method (Matrix minima method)**
- 3) Vogel's approximation method (VAM)**

❖ These methods provide initial feasible solutions, which can then be further optimized using various transportation algorithms such as the Modified Distribution Method (MODI) or the Stepping Stone Method.

APPLICATION PROBLEM

A toy manufacturing company has three factories located in different cities and four retail stores in various locations. The company needs to determine the most cost-effective way to transport its toys from the factories to the retail stores while minimizing transportation costs. The transportation costs (in Rs per unit) from each factory to each store are given in the following table:

	STORE-1	STORE-2	STORE-3	STORE-4
FACTORY – 1	5	6	8	7
FACTORY – 2	4	7	6	9
FACTORY – 3	6	5	7	8

Additionally, each factory has a limit on the number of toys it can produce, and each store has a demand requirement. The production capacities and demand requirements are as follows:

- Factory 1 can produce up to 1000 toys.
- Factory 2 can produce up to 800 toys.
- Factory 3 can produce up to 1200 toys.
- Store 1 requires 600 toys.
- Store 2 requires 500 toys.

- Store 3 requires 700 toys.
- Store 4 requires 900 toys.

Find the optimal transportation plan to the above transportation problem which minimizes the total transportation cost.

Solution:

First we construct the tabular formulation of above transportation problem as-

	STORE-1	STORE-2	STORE-3	STORE-4	SUPPLY
FACTORY-1	5	6	8	7	900
FACTORY-2	4	7	6	9	800
FACTORY-3	6	5	7	8	1000
REQUIREMENT	600	500	700	900	

Here, total supply = $\sum a_i = 900 + 800 + 1000 = 2700$

And total demand = $\sum b_j = 600 + 500 + 700 + 900 = 2700$

\Rightarrow total supply = total demand = 2700

\therefore The given transportation problem is balanced.

Hence, there exists an initial basic feasible solution to the given problem.

First, we find an initial basic feasible solution using Vogel's approximation method as follows:

	S-1	S-2	S-3	S-4		Row penalties
F-1				900	900	1 1 1 1 -
	5	6	8	7		
F-2	600		200		800	2 1 3 - -
	4	7	6	9		
F-3		500	500		1000	1 2 1 1 7
	6	5	7	8		
	600	500	800	900		
	1	1	1	1		
	-	1	1	1		
	-	-	1	1		
	-	-	1	1		
	-	-	7	-		

∴ The minimum transportation cost according to this plan is -

$$Z = 7 \times 900 + 4 \times 600 + 6 \times 200 + 5 \times 500 + 7 \times 500 = 15900 \text{ Rs.}$$

Here, the number of allocated cells = 5, which is one less than to $m + n - 1 = 3 + 4 - 1 = 6$

∴ This solution is degenerate.

To resolve degeneracy, we make use of an artificial quantity (ϵ).

The quantity ϵ is assigned to that unoccupied cell, which has the minimum transportation cost.

The quantity ϵ is assigned to the cell (1,1), which has the minimum transportation cost = 5.

	S-1	S-2	S-3	S-4	Supply
F-1	ϵ			900	900
	5	6	8	7	
F-2	600		200		800
	4	7	6	9	
F-3		500	500		1000
	6	5	7	8	
Demand	600	500	800	900	

Optimality test using MODI method

Allocation table is -

	S-1	S-2	S-3	S-4	Supply
F-1	ϵ			900	900
	5	6	8	7	
F-2	600		200		800
	4	7	6	9	
F-3		500	500		1000
	6	5	7	8	
Demand	600	500	800	900	

Iteration-1 of optimality test

❖ Find u_i and v_j for all occupied cells (i, j) , where $c_{ij} = u_i + v_j$

1. Substituting, $u_1 = 0$, we get

2. $c_{11} = u_1 + v_1 \Rightarrow v_1 = c_{11} - u_1 \Rightarrow v_1 = 5 - 0 = 5$

3. $c_{21} = u_2 + v_1 \Rightarrow u_2 = c_{21} - v_1 \Rightarrow u_2 = 4 - 5 = -1$

4. $c_{23} = u_2 + v_3 \Rightarrow v_3 = c_{23} - u_2 \Rightarrow v_3 = 6 + 1 = 7$

5. $c_{33} = u_3 + v_3 \Rightarrow u_3 = c_{33} - v_3 \Rightarrow u_3 = 7 - 7 = 0$

6. $c_{32} = u_3 + v_2 \Rightarrow v_2 = c_{32} - u_3 \Rightarrow v_2 = 5 - 0 = 5$

7. $c_{14} = u_1 + v_4 \Rightarrow v_4 = c_{14} - u_1 \Rightarrow v_4 = 7 - 0 = 7$

❖ Find d_{ij} for all unoccupied cells (i, j) , where $d_{ij} = c_{ij} - (u_i + v_j)$

1. $d_{12} = c_{12} - (u_1 + v_2) \Rightarrow d_{12} = 6 - (0 + 5) = 1$

2. $d_{13} = c_{13} - (u_1 + v_3) \Rightarrow d_{13} = 8 - (0 + 7) = 1$

3. $d_{22} = c_{22} - (u_2 + v_2) \Rightarrow d_{22} = 7 - (-1 + 5) = 3$

4. $d_{24} = c_{24} - (u_2 + v_4) \Rightarrow d_{24} = 9 - (-1 + 7) = 3$

5. $d_{31} = c_{31} - (u_3 + v_1) \Rightarrow d_{31} = 6 - (0 + 5) = 1$

6. $d_{34} = c_{34} - (u_3 + v_4) \Rightarrow d_{34} = 8 - (0 + 7) = 1$

Since all $d_{ij} \geq 0$, the initial basic feasible solution is an optimal solution.

	S-1	S-2	S-3	S-4	Supply
F-1	€			900	900
	5	6	8	7	
F-2	600		200		800
	4	7	6	9	
F-3		500	500		1000
	6	5	7	8	
Demand	600	500	800	900	

Hence, the optimal solution is given by -

$$x_{14} = 900, x_{21} = 600, x_{23} = 200, x_{32} = 500, x_{33} = 500$$

And the minimum transportation cost is -

$$\text{Min } Z = 7 \times 900 + 4 \times 600 + 6 \times 200 + 5 \times 500 + 7 \times 500 = 15900 \text{ Rs.}$$

**Mahatma Gandhi Arts, Science and Late N. P.
Commerce College, Armori**

Department of Mathematics

Project Work

NAME: MISS. PADMAVATI MAHADEO GAYKWAD

CLASS: M.SC. SEM-II (SESSION 2023-24)

**TOPIC: ASSIGNMENT PROBLEMS AND ITS
APPLICATIONS**

GUIDED BY: Prof. A. A. KHARWADE SIR



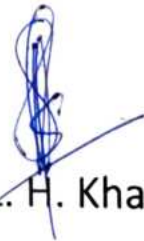
P.A.K.
25/04/24
Submitted



MAHATMA GANDHI ARTS, SCIENCE AND LATE N. P.
COMMERCE COLLEGE, ARMORI, DIST:GADCHIROLI

CERTIFICATE

This is to Certify that Miss. Padmawati Mahadeo Gayakwad
of Class **M.Sc. Sem-II (SUMMER-24)** has Successfully Completed
his/her Project Work on the Topic.....Assignment Problems
And Its Applications.....Under the Guidance of
Prof.....A. A. Kharwade Sir.....for the course
'FIELD PROJECT' (Session 2023-24).



Dr. L. H. Khalsa

Head of Department
HEAD

Department of Mathematics
Mahatma Gandhi Arts,science
N.P.Commerce College,Armori

Index

Sr No.	Content	Page No.
1.	Introduction	3-4
2.	Assignment Problem	5
3.	Some Definitions and Theorems	6-7
4.	Balanced and unbalanced assignment problem	8
5.	Hungarian method	9-10
6.	Application Problem	11-15
7.	Some other applications	16-17

INTRODUCTION

The assignment problem is a classic optimization challenge that falls within the realm of Operations Research, a field dedicated to applying mathematical and analytical methods to solve complex decision-making problems. It involves the optimal allocation of a set of resources to a set of tasks, with the objective of minimizing the total cost or maximizing the total benefit associated with the assignments.

In its simplest form, the assignment problem arises when there are a group of agents or resources available to perform a set of tasks, and each task must be assigned to exactly one agent, while each agent can handle at most one task. The goal is to determine the assignment that minimizes the total cost or maximizes the total benefit, taking into account various constraints and preferences.

The assignment problem has broad applications across diverse industries and domains. For instance, in manufacturing, it can be used to assign machines to production tasks to minimize production costs or maximize production output. In transportation and logistics, it can help assign vehicles to delivery routes to minimize transportation costs or maximize service efficiency. In project management, it can aid in assigning personnel to project tasks to optimize resource utilization and project completion time.

To address the assignment problem, various mathematical techniques and algorithms have been developed. These include the Hungarian algorithm, the auction algorithm, linear programming, integer programming, and network flow algorithms. These methods enable decision-makers to systematically evaluate assignment options, consider multiple criteria and constraints, and identify the most efficient allocation of resources to tasks.

The significance of the assignment problem lies in its ability to streamline operations, improve resource utilization, and enhance overall efficiency in a wide range of applications. By leveraging Operations Research techniques to solve assignment problems, organizations can achieve cost savings, productivity gains, and better decision-making outcomes, ultimately gaining a competitive edge in today's complex and dynamic business environment.

ASSIGNMENT PROBLEM

Let us consider a problem of assignment of n resources (workers) to n activities (jobs) so as to minimize the overall cost (or maximize profit) in such a way that each resource can associate with one and only one job. This type of problem is called as the assignment problem.

Let there are n workers ($i = 1, 2, \dots, n$) and n jobs ($j = 1, 2, \dots, n$).

Let c_{ij} be the cost of assigning i th person to j th job.

Let x_{ij} denote the assignment of i th person to j th job such that-

$$x_{ij} = \begin{cases} 1, & \text{if person } i \text{ is assigned to job } j \\ 0, & \text{otherwise} \end{cases}$$

Then mathematically the assignment problem can be formulated as:

Minimize $z = \sum_{i=1}^n \sum_{j=1}^n x_{ij} c_{ij}$ subject to the constraints-

$$\sum_{j=1}^n x_{ij} = 1, \quad i = 1, 2, \dots, n$$

$$\sum_{i=1}^n x_{ij} = 1, \quad j = 1, 2, \dots, n$$

And $x_{ij} = 0$ or 1 , for all i and j .

SOME DEFINITIONS AND THEOREMS

Task: A specific activity or job that needs to be completed. Each task is associated with a certain cost, time, or utility value.

Agent or Resource: An entity capable of performing tasks. Agents can be machines, workers, vehicles, or any other resource capable of completing tasks.

Assignment: The allocation of tasks to agents. An assignment specifies which agent is responsible for performing each task.

Cost Matrix: A matrix that represents the costs, times, or other relevant values associated with assigning each task to each agent. Each element of the matrix represents the cost or value of assigning a specific task to a specific agent.

Objective Function: The function that quantifies the total cost, time, or utility associated with a particular assignment. In minimization problems, the objective is to minimize this function, while in maximization problems, the objective is to maximize it.

Feasible Assignment: An assignment that satisfies all constraints and requirements of the problem. In the Assignment Problem, each task must be assigned to exactly one agent, and each agent can be assigned to perform at most one task.

Optimal Assignment: A feasible assignment that minimizes the total assignment cost is called an optimal assignment.

Constraints: Restrictions or limitations that must be satisfied in the assignment process. In the Assignment Problem, the main constraint is that each task must be assigned to exactly one agent, and each agent can be assigned to perform at most one task.

Optimal solution

A feasible solution to an assignment problem is said to be optimal if it minimizes the total assignment cost.

- **Important theorem**

In an assignment problem if we add (or subtract) a constant to every element of any row (or column) of the cost matrix $[C_{ij}]$ then an assignment that minimizes the total cost on one matrix will also minimize the total cost on the other matrix.

BALANCED AND UN-BALANCED ASSIGNMENT

PROBLEMS

In assignment problems,

- i) When the number of resources is equal to the number of activities then the assignment problem is called as balanced assignment problem.

- ii) When the number of resources is not equal to the number of activities then the assignment problem is called as an unbalanced assignment problem.

METHOD FOR SOLVING ASSIGNMENT PROBLEMS

Hungarian method

The Hungarian method for the optimal solution of assignment problem (minimization) involves following steps-

Step 1: i) If number of rows = number of columns then proceed to the next step.

ii) If the number of rows \neq number of columns, then a dummy row or dummy column must be added with zero cost elements to make the balanced problem.

Step 2: Find the smallest cost in each row of the cost matrix and subtract it from every element of the corresponding row to get the first reduced matrix.

Step 3: In the cost reduced cost matrix, find the smallest cost in each column of the cost matrix and subtract it from every element of the corresponding column. Each column and row will now have at least one zero.

Step 4: Assign single zero in each row by a square () and cross out (×) all other zeros in the corresponding row and column. Repeat the procedure for the columns. Repeat this step until all zeros are either assigned or crossed out.

Step 5: (i) If no of assignments = number of rows then the current assignment is optimal.

(ii) If no of assignments \neq number of rows then go to the next step.

Step 6: Draw the minimum number of horizontal and vertical lines to cover all the zeros as follows-

(i) Mark (✓) to those rows where no assignment has been made.

(ii) Mark (✓) to those columns which have zeros in the marked rows.

(iii) Mark (✓) rows (not already marked) which have assignments in marked columns.

(iv) The process may be repeated until no more rows or columns can be checked.

(v) Draw straight lines through all unmarked rows and marked columns.

Step 7: Select the smallest element among all elements not covered with lines. Subtract this element from all uncovered elements and add it to all elements lying at the intersection.

Step 8: Go to step 4 and repeat the procedure till an optimal assignment is obtained.

APPLICATION PROBLEM

A construction company has five construction projects (Project 1, Project 2, Project 3, Project 4, Project 5) to complete, and five construction teams (Team A, Team B, Team C, Team D, Team E) available to work on these projects. Each project requires different skills, and each team possesses different capabilities for each project. The company aims to assign teams to projects in a way that minimizes the total time required to complete all projects, where the time is determined by the efficiency of the team for each project.

The following table shows the time (in days) required by each team to complete each project:

Project	Team A	Team B	Team C	Team D	Team E
Project 1	4	5	6	7	8
Project 2	5	4	7	6	9
Project 3	6	7	5	8	4
Project 4	7	6	8	5	3
Project 5	8	9	4	4	6

Each team can only be assigned to one project, and each project must be assigned to exactly one team.

Find the optimal assignment schedule to this problem which minimizes the total time required to complete the projects.

Solution: Here, total no. of projects = total no. of teams

∴ The given assignment problem is balanced.

Now, let's find the optimal solution using Hungarian method.

i) Subtract the smallest element in each row from all the elements in that row.

Project	Team A	Team B	Team C	Team D	Team E
Project 1	0	1	2	3	4
Project 2	1	0	3	2	5
Project 3	2	3	1	4	0
Project 4	4	3	5	2	0
Project 5	4	5	0	0	2

ii) Subtract the smallest element in each column from all the elements in that column.

Project	Team A	Team B	Team C	Team D	Team E
Project 1	0	1	2	3	4
Project 2	1	0	3	2	5
Project 3	2	3	1	4	0
Project 4	4	3	5	2	0

Project 5	4	5	0	0	2
-----------	---	---	---	---	---

iii) Assigning single zero in each row.

Project	Team A	Team B	Team C	Team D	Team E
Project 1	[0]	1	2	3	4
Project 2	1	[0]	3	2	5
Project 3	2	3	1	4	[0]
Project 4	4	3	5	2	0
Project 5	4	5	[0]	0	2

Since, no. of assignments = 4 \neq 5 = no. of rows, the optimal assignment is not reached.

iv) Draw the minimum number of horizontal and vertical lines to cover all zeros in the matrix.

Project	Team A	Team B	Team C	Team D	Team E
Project 1	[0]	1	2	3	4
Project 2	1	[0]	3	2	5
Project 3	2	3	1	4	[0]
Project 4	4	3	5	2	0
Project 5	4	5	[0]	0	2

v) Selecting the smallest element among the cells not covered with the lines (1) and subtracting it from all the uncovered elements and adding it to all the elements lying at the intersection.

Project	Team A	Team B	Team C	Team D	Team E
Project 1	0	1	2	3	5
Project 2	1	0	3	2	6
Project 3	1	2	0	3	0
Project 4	3	2	4	1	0
Project 5	4	5	0	0	3

vi) Again assigning single zero in each row.

Project	Team A	Team B	Team C	Team D	Team E
Project 1	[0]	1	2	3	5
Project 2	1	[0]	3	2	6
Project 3	1	2	[0]	3	0
Project 4	3	2	4	1	[0]
Project 5	4	5	0	[0]	3

Since, no. of assignments = 4 \neq 5 = no. of rows, the optimal assignment has been reached.

Hence, an optimal assignment schedule is given by-

Projects	Teams
Project 1	Team A
Project 2	Team B
Project 3	Team C
Project 4	Team E
Project 5	Team D

And the minimum assignment days for completion of projects is-

$$\text{Min } Z = 4 + 4 + 5 + 3 + 4 = 20 \text{ days.}$$

SOME OTHER APPLICATIONS OF ASSIGNMENT PROBLEMS

Assignment problems have various practical applications across different fields. Some simple applications include:

- 1) **Workforce Assignment:** Assigning tasks to employees based on their skills and availability to optimize productivity and efficiency.
- 2) **Transportation Planning:** Determining the optimal assignment of vehicles to routes or deliveries to minimize transportation costs or time.
- 3) **Machine Assignment in Manufacturing:** Assigning jobs to machines in a factory to maximize throughput and minimize idle time.
- 4) **Project Allocation:** Allocating resources such as manpower, equipment, and budget to different projects to maximize overall project success.
- 5) **School Bus Routing:** Assigning students to buses and bus routes to minimize travel time and distance.
- 6) **Sports Scheduling:** Assigning teams to play against each other in sports leagues or tournaments to optimize fairness and minimize conflicts.
- 7) **Medical Staff Scheduling:** Assigning doctors and nurses to shifts in hospitals to ensure adequate coverage while minimizing overtime and fatigue.
- 8) **Inventory Management:** Assigning inventory items to different locations or warehouses to optimize stocking levels and minimize storage costs.

9) **Facility Location:** Assigning customers to service centers or facilities to minimize transportation costs or service time.

10) **Broadcasting and Telecommunication:** Assigning frequencies or channels to transmitters to minimize interference and maximize coverage.

**Mahatma Gandhi Arts, Science and Late N. P.
Commerce College, Armori**

Department of Mathematics

Project Work

NAME: MISS. NAMIRAKHANAM A. NASIM KHAN

CLASS: M.SC. SEM-II (SESSION 2023-24)

TOPIC: LPP USING GRAPHICAL AND SIMPLEX

METHOD

GUIDED BY: Prof. A. A. KHARWADE SIR



MAHATMA GANDHI ARTS, SCIENCE AND LATE N. P.
COMMERCE COLLEGE, ARMORI, DIST:GADCHIROLI

CERTIFICATE

This is to Certify that Miss. Namirakhanam A. Nasim Khan
of Class **M.Sc. Sem-II (SUMMER-24)** has Successfully Completed
his/her Project Work on the Topic LPP Using Graphical
And Simplex Method Under the Guidance of
Prof. A. A. Kharwade for the course
'FIELD PROJECT' (Session 2023-24).



Dr. L. H. Khalsa

Head of Department

HEAD

Department of Mathematics
Mahatma Gandhi Arts, Science
- N.P. Commerce College, Armori

Index

Sr No.	Content	Page No.
1.	Introduction	3-4
2.	General Form of LPP	5
3.	Solutions to LPP	6-7
4.	Methods of solving LPP	
a)	Simplex Method	8
b)	Graphical Method	9
5.	Application Problem	10-16

INTRODUCTION

Many business and economic situations are concerned with a problem of planning activity. In each case, there are limited resources at your disposal and your problem is to make such a use of these resources so as to yield the maximum production or to minimize the cost of production or to give the maximum profit, etc. Such problems are referred as the the problems of constrained optimization.

Linear programming (LP) is a mathematical method used for optimizing a linear objective function, subject to a set of linear equality and/or inequality constraints. It is a powerful tool in operations research, economics, engineering, and various other fields, providing a systematic approach to decision-making in situations where resources are limited.

At its core, linear programming seeks to find the values of decision variables that maximize or minimize an objective function, while satisfying all given constraints. The objective function represents the quantity to be maximized (or minimized), such as profit, revenue, cost, or efficiency. The decision variables are the factors that can be adjusted to achieve this optimization.

The constraints in a linear programming problem represent limitations or restrictions on the decision variables. These constraints

are typically linear equations or inequalities that reflect the available resources, capacities, or other requirements of the problem.

GENERAL FORM OF LPP

The general form of a linear programming problem can be expressed as follows:

$$\text{Maximize (or minimize) } Z = c_1x_1 + c_2x_2 + \dots + c_nx_n$$

Subject to constraints:

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \leq b_2$$

.....

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq b_m$$

where,

Z represents the objective function to be optimized.

c_1, c_2, \dots, c_n are coefficients of the decision variables x_1, x_2, \dots, x_n in the objective function.

a_{ij} are coefficients of the decision variables in the constraints.

b_1, b_2, \dots, b_m are the constraints' right-hand side values.

m is the number of constraints.

n is the number of decision variables.

SOLUTIONS TO LPP

Solution: A set of values of the decision variables x_1, x_2, \dots, x_n which satisfies the constraints of the LPP is called a solution of LPP.

Feasible Solution: A solution to LPP which satisfies the non-negativity restrictions of the problem is called a feasible solution of LPP.

Optimal Solution: A feasible solution to LPP which optimizes (Maximizes or minimizes) the objective function is called an optimal solution of LPP.

Basic solution: Consider a system of m simultaneous equations in n variables $AX = b$, where A is $m \times n$ matrix of rank m ($m < n$). Then a solution obtained by setting $(n - m)$ variables equal to zero and solving the resulting system is called a basic solution to the given system of equations.

Basic feasible solution:

A basic solution in which all the variables are non-negative is called a basic feasible solution.

i) Degenerate basic feasible solution: A basic feasible solution in which at least one of the basic variable is zero is called degenerate basic feasible solution.

ii) Non-degenerate basic feasible solution: A basic feasible solution in which all the basic variables are positive is called degenerate basic feasible solution.

METHODS OF SOLVING LPP

Simplex Method:

1. The simplex method is an iterative algorithm for solving linear programming problems. It starts at a feasible solution and moves along the edges of the feasible region towards the optimal solution.
2. At each iteration, the simplex method identifies an improving direction, which is a non-basic variable that can be increased (for maximization problems) or decreased (for minimization problems) to improve the objective function value.
3. The algorithm proceeds by pivoting, which involves exchanging a basic variable with a non-basic variable to move from one vertex (or extreme point) of the feasible region to another, where the objective function value is either increased (for maximization) or decreased (for minimization).
4. The process continues until no further improvement can be made, at which point the optimal solution is reached.
5. The simplex method efficiently solves large-scale linear programming problems and is widely used in practice due to its effectiveness and robustness.

Graphical Method:

1. The graphical method is a graphical representation technique used to solve linear programming problems with two decision variables.
2. In this method, the feasible region defined by the constraints is graphically represented on a coordinate plane. Each constraint is plotted as a line or boundary, and the feasible region is the intersection of these lines.
3. The objective function is then represented as a contour line or level curve on the same graph. The optimal solution is the point within the feasible region where the objective function contour line is tangent to or intersects the feasible region boundary.
4. The graphical method is intuitive and provides a visual understanding of the problem and its solution, making it useful for educational purposes and simple problems with few decision variables.

APPLICATION PROBLEM

A farmer has a total of 150 acres of land available for cultivation. The farmer can choose to plant two types of crops: corn and soybeans. Each acre of corn requires 3 units of water and 4 units of fertilizer, while each acre of soybeans requires 4 units of water and 2 units of fertilizer. The farmer has 600 units of water and 400 units of fertilizer available. Additionally, the farmer estimates that the profit from selling each acre of corn is 30 k, while the profit from selling each acre of soybeans is 20 k. Formulate a linear programming problem to help the farmer determine how many acres of each crop to plant in order to maximize profit.

Solution:

MATHEMATICAL FORMULATION OF THE PROBLEM

Let x be the number of acres of corn to be planted

And y be the number of acres of soybeans to be planted.

Objective Function: Maximize $Z = 30x + 20y$ (where, Z represents the total profit from planting corn and soybeans)

Constraints:

i) Water constraint , $3x + 4y \leq 600$

ii) Fertilizer constraint , $4x + 2y \leq 400$

iii) Land constraint, $x + y \leq 150$

And $x, y \geq 0$.

Here, our goal is to optimize the allocation of land for corn and soybeans to maximize profit while considering the available resources and constraints imposed by water, fertilizer, and land availability.

BY USING GRAPHICAL METHOD

First we draw the lines of the constraint equations $3x + 4y = 600$, $4x + 2y = 400$ and $x + y = 150$.

i) For the equation $3x + 4y = 600$:

x	y	(x, y)
0	150	(0, 150)
200	0	(200, 0)

i) For the equation $4x + 2y = 400$:

x	y	(x, y)
0	200	(0, 200)
100	0	(100, 0) (100, 0)

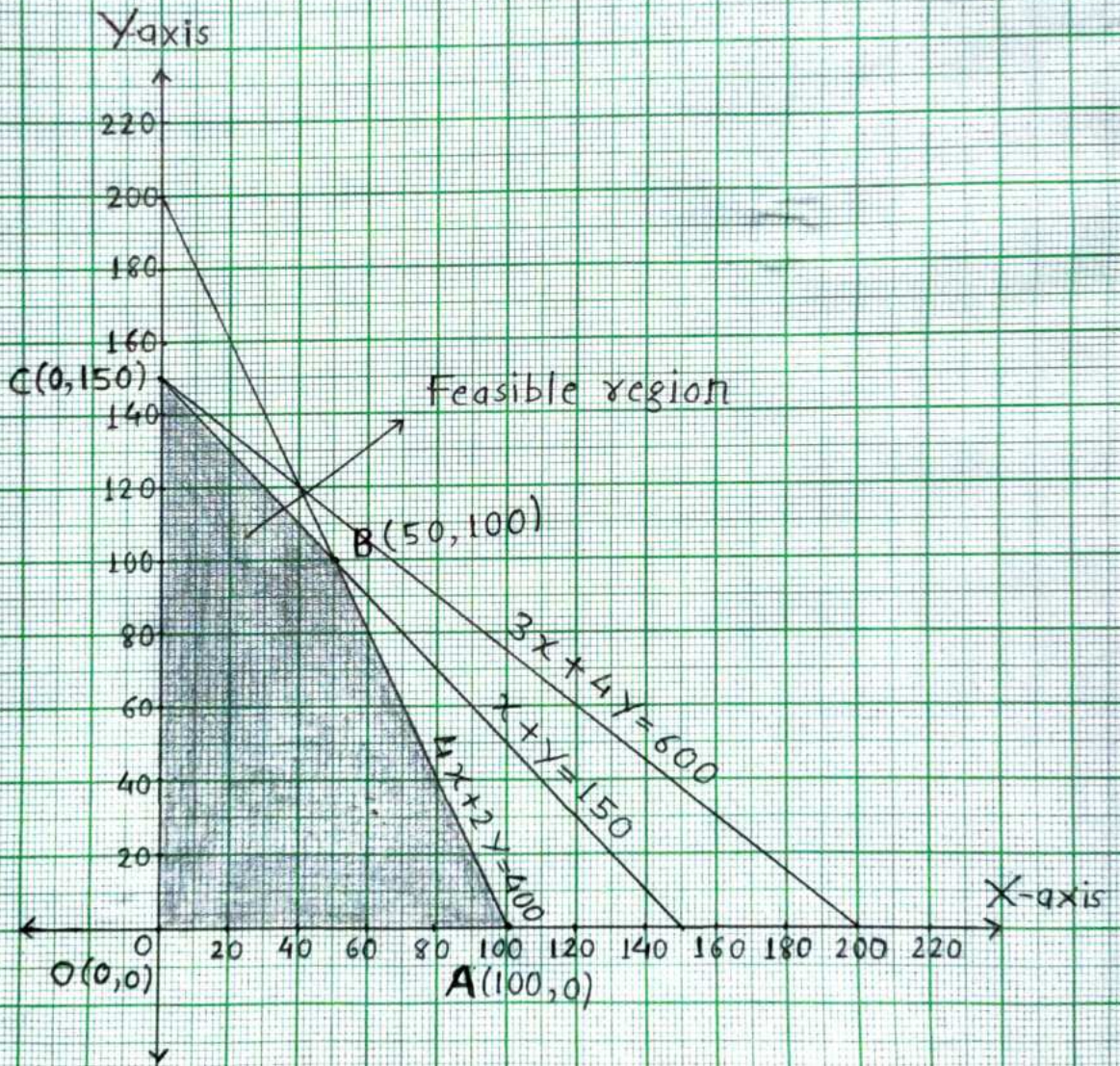
iii) For the equation $x + y = 150$:

x	y	(x, y)
0	150	(0, 150)
150	0	(150, 0)

Scale -

on X-axis: 1cm = 20 units

on Y-axis: 1cm = 20 units



The feasible region of the LPP is OABC, where $O(0, 0)$, $A(100, 0)$, $B(50, 100)$ and $C(0, 150)$.

Extreme point	Value of $Z = 30x + 20y$
$O(0, 0)$	$Z = 30 \times 0 + 20 \times 0 = 0$
$A(100, 0)$	$Z = 30 \times 100 + 20 \times 0 = 3000$
$B(50, 100)$	$Z = 30 \times 50 + 20 \times 100 = 3500$
$C(0, 150)$	$Z = 30 \times 0 + 20 \times 150 = 3000$

Here, the maximum value occurs at the point $B(50, 100)$.

Hence, the optimal solution is $x_1 = 50, x_2 = 100$.

And $\max Z = 30 \times 50 + 20 \times 100 = 3500$

BY USING SIMPLEX METHOD

The given LPP can be written in the standard form as –

$$\text{Maximize: } Z = 30x_1 + 20x_2$$

$$\text{Subject to: } 3x_1 + 4x_2 + s_1 + 0s_2 + 0s_3 = 600$$

$$4x_1 + 2x_2 + 0s_1 + s_2 + 0s_3 = 400$$

$$x_1 + x_2 + 0s_1 + 0s_2 + s_3 = 150$$

with $x_1, x_2 \geq 0$.

$$\text{Let } B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and setting } x_1 = 0, x_2 = 0.$$

Then an initial basic feasible solution is given by-

$$x_B = B^{-1}b$$

$$\Rightarrow x_B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 600 \\ 400 \\ 150 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 600 \\ 400 \\ 150 \end{bmatrix} = \begin{bmatrix} 600 \\ 400 \\ 150 \end{bmatrix}$$

$$\Rightarrow x_B = (s_1, s_2, s_3) = (600, 400, 150)$$

Initial simplex table

			30	20	0	0	0	
c_B	B	x_B	x_1	x_2	s_1	s_2	s_3	Ratio
0	s_1	600	3	2	1	0	0	$\frac{600}{3} = 200$

0	s_2	400	4	2	0	1	0	$\frac{400}{4} = 100$
0	s_3	150	1	1	0	0	1	$\frac{150}{1} = 150$
		z_j	0	0	0	0	0	
		$z_j - c_j$	-30↑	-20	0	0	0	

Since $z_1 - c_1 = -30$, the most negative, the variable x_1 will enter basis B in place of s_2 (leaving variable). Here, the pivot element is 4.

First iteration

			30	20	0	0	0	
c_B	B	x_B	x_1	x_2	s_1	s_2	s_3	Ratio
0	s_1	300	0	$\frac{1}{2}$	1	$-\frac{3}{4}$	0	$\frac{300}{1/2} = 600$
30	x_1	100	1	$\frac{1}{2}$	0	$\frac{1}{4}$	0	$\frac{100}{1/2} = 200$
0	s_3	50	1	$\frac{1}{2}$	0	0	1	$\frac{50}{1/2} = 100$
		z_j	30	15	0	$\frac{15}{2}$	0	
		$z_j - c_j$	0	-5	0	$\frac{15}{2}$	0	

Since $z_2 - c_2 = -5$, the most negative, the variable x_2 will enter basis B in place of s_3 (leaving variable). Here, the pivot element is $1/2$.

Second iteration

			30	20	0	0	0	
c_B	B	x_B	x_1	x_2	s_1	s_2	s_3	Ratio
0	s_1	250	0	0	1	$-\frac{1}{2}$	-1	
30	x_1	50	1	0	0	$\frac{1}{2}$	-1	
20	x_2	100	0	0	1	$-\frac{1}{2}$	2	
		z_j	30	20	0	5	10	
		$z_j - c_j$	0	0	0	5	10	

Since all $z_j - c_j \geq 0$, the optimal solution has been reached.

Hence, the optimal solution is $x_1 = 50, x_2 = 100$.

And $\max Z = 30 \times 50 + 20 \times 100 = 3500$

**Mahatma Gandhi Arts, Science and Late N. P.
Commerce College, Armori**

Department of Mathematics

Project Work

NAME: MISS. ROHINI MAROTRAO SABLE

CLASS: M.SC. SEM-II (SESSION 2023-24)

TOPIC: LPP AND ITS APPLICATIONS

GUIDED BY: Prof. A. A. KHARWADE SIR




A.A.K.
25/04/24
submitted



MAHATMA GANDHI ARTS, SCIENCE AND LATE N. P.
COMMERCE COLLEGE, ARMORI, DIST:GADCHIROLI

CERTIFICATE

This is to Certify that Miss. Rohini Mayotrao Sable
of Class **M.Sc. Sem-II (SUMMER-24)** has Successfully Completed
his/her Project Work on the Topic LPP and Its
Applications.....Under the Guidance of
Prof. A. A. Kharwade.....for the course
'FIELD PROJECT' (Session 2023-24).


Dr. L. H. Khalsa
Head of Department
HEAD
Department of Mathematics
Mahatma Gandhi Arts,science
N.P.Commerce College,Armorj

Index

Sr No.	Content	Page No.
1.	Introduction	3-4
2.	Linear Programming Problem	5
3.	Characteristics of Lpp	6
4.	Some Definitions And Theorems Of Lpp	8
5.	Big-M Method	9-10
6.	Application Problem	11-15
7.	Some other Applications	16-17

INTRODUCTION

In Mathematics, **linear programming** is a method of optimising operations with some constraints. The main objective of linear programming is to maximize or minimize the numerical value. It consists of linear functions which are subjected to the constraints in the form of linear equations or in the form of inequalities. Linear programming is considered an important technique that is used to find the optimum resource utilisation. The term “linear programming” consists of two words as linear and programming. The word “linear” defines the relationship between multiple variables with degree one. The word “programming” defines the process of selecting the best solution from various alternatives.

Linear Programming is widely used in Mathematics and some other fields such as economics, business, telecommunication, and manufacturing fields.

Linear programming (LP) or Linear Optimisation may be defined as the problem of maximizing or minimizing a linear function that is subjected to linear constraints. The constraints may be equalities or inequalities. The optimisation problems involve the calculation of profit and loss. Linear programming problems are an important class of optimisation problems, that helps to find the feasible region and

optimise the solution in order to have the highest or lowest value of the function.

In other words, linear programming is considered as an optimization method to maximize or minimize the objective function of the given mathematical model with the set of some requirements which are represented in the linear relationship. The main aim of the linear programming problem is to find the optimal solution.

Linear programming is the method of considering different inequalities relevant to a situation and calculating the best value that is required to be obtained in those conditions. Some of the assumptions taken while working with linear programming are:

- The number of constraints should be expressed in the quantitative terms
- The relationship between the constraints and the objective function should be linear
- The linear function (i.e., objective function) is to be optimised

LINEAR PROGRAMMING PROBLEM

Linear Programming Problem (LPP) typically consists of three main components:

1. **Objective Function:** This defines the quantity to be maximized or minimized. It could be profit, cost, time, etc. represented as a linear equation.
2. **Constraints:** These are the limitations or conditions that must be satisfied. Constraints are also represented as linear equations or inequalities. They reflect the real-world limitations, such as resource availability, capacity restrictions, demand requirements, or other operational constraints.
3. **Decision Variables:** These are the variables that we need to determine in order to solve the problem. They represent the choices or decisions we can make to achieve the objective.

CHARACTERISTICS OF LPP

1. **Linearity:** All the equations involved in an LPP, including the objective function and constraints, must be linear. This means that each variable appears to the first power only and does not involve any products or divisions of variables.
2. **Additivity:** The objective function and constraints are additive, meaning that the total contribution of each variable to the objective function or constraint is the sum of its individual contributions.
3. **Certainty:** LPP assumes that all parameters in the objective function and constraints are known with certainty and do not vary.
4. **Non-negativity:** In most cases, decision variables in an LPP are restricted to non-negative values. This means that variables cannot take on negative values, as negative quantities often don't make sense in real-world applications.
5. **Proportionality:** The relationships between variables in an LPP are proportional. This implies that if one variable increases or decreases, other variables will also increase or decrease in direct proportion.

6. **Divisibility:** Decision variables are assumed to be divisible into arbitrarily small quantities. This characteristic allows for solutions that include fractional or decimal values of decision variables.
7. **Optimality:** The goal of solving an LPP is to find the optimal solution that maximizes or minimizes the objective function while satisfying all constraints. This solution represents the best possible outcome given the available resources and constraints.

SOME DEFINITIONS AND THEOREMS

1. **Feasible Region:** The feasible region is the set of all feasible solutions that satisfy all constraints in the LPP. It represents the space in which the optimal solution must lie. The feasible region is determined by the intersection of the constraints.
2. **Optimal Solution:** The optimal solution is the solution to the LPP that either maximizes or minimizes the objective function while satisfying all constraints. It represents the best possible outcome given the available resources and constraints.
3. **Feasible Solution:** A feasible solution is a solution to the LPP that satisfies all constraints. Feasible solutions may not necessarily be optimal but are essential for ensuring that the problem is solvable.

The fundamental theorem of LPP

If a linear programming problem admits an optimal solution then the optimal solution occurs at one of the extreme points of the feasible region

BIG-M METHOD

The Big-M method is an alternative method for solving an LPP using artificial variables, when the constraints of the LPP are (\geq or $=$) type.

- (1)** First convert the given LPP in its standard form (maximization problem, constraints into equations, all b_i 's non-negative).
- (2)** Add the artificial variables $A_i(\geq)$ to the LHS of the constraints of (\geq or $=$) type and obtain an initial basic feasible solution and assign a large penalty value '-M' to this artificial variables in the objective function.
- (3)** Solve the modified LPP using the general simplex method until the following three possibilities arises-
 - i) If no artificial variable appears in the basis and the optimality condition is satisfied ($Z_j - C_j \geq 0$) then the current solution is the optimal basic feasible solution.
 - ii) If atleast one artificial variable appears in the basis with zero value in the X_B column and the optimality condition is satisfied ($Z_j - C_j \geq 0$) then the current solution is the optimal basic feasible solution, which is degenerate solution.
 - iii) If atleast one artificial variable appears in the basis with positive value in the X_B column and the optimality condition is

satisfied ($Z_j - C_j \geq 0$) then the original problem has no feasible solution. The solution satisfies the constraints but does not optimize the objective function, since it contains a very large penalty '-M' and it is called Pseudo optimal solution.

APPLICATION PROBLEM

A car manufacturing plant produces two types of cars, Sedan and SUV, using two different assembly lines, Line A and Line B. Each Sedan requires 20 hours of Line A's time and 15 hours of Line B's time, while each SUV requires 25 hours of Line A's time and 20 hours of Line B's time. The plant has 300 hours of Line A's time and 250 hours of Line B's time available per week.

To meet market demand, the plant must produce at least 10 Sedans per week.

Formulate a Linear Programming Problem to maximize the plant's weekly car production output while considering the given constraints.

Solution:

MATHEMATICAL MODEL

Let $x \rightarrow$ No. Of weekly sedan car production

$y \rightarrow$ No. Of weekly SUV car production

Let $Z \rightarrow$ Total plant's weekly car production of sedan and SUV

Objective: $\text{Max } Z = x + y$

Subject to constraints:

i) $20x + 25y \leq 300$ (line A's constraint)

$$\text{ii) } 15x + 20y \leq 250 \text{ (line B's constraint)}$$

$$\text{iii) } x \geq 10$$

$$\text{And } x, y \geq 0.$$

Here, our goal is to maximize the plant's weekly car production of sedan and SUV cars while considering the constraints of availability of line A and line B.

BY USING BIG-M METHOD

The given LPP can be written in the standard form as –

$$\text{Max } Z = x + y + 0s_1 + 0s_2 + 0s_3 - MA$$

$$\text{Subject to: } 20x + 25y + s_1 + 0s_2 + 0s_3 + 0A = 300$$

$$15x + 20y + 0s_1 + s_2 + 0s_3 + 0A = 250$$

$$x + 0y + 0s_1 + 0s_2 - s_3 + A = 10$$

$$\text{with } x_1, x_2 \geq 0.$$

$$\text{Let } B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and setting } x = 0, y = 0, s_3 = 0.$$

Then an initial basic feasible solution is given by-

$$x_B = B^{-1}b$$

$$\Rightarrow x_B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 300 \\ 250 \\ 10 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 300 \\ 250 \\ 10 \end{bmatrix} = \begin{bmatrix} 300 \\ 250 \\ 10 \end{bmatrix}$$

$$\Rightarrow x_B = (s_1, s_2, A) = (300, 250, 10)$$

Initial simplex table

			1	1	0	0	0	-M	
c_B	B	x_B	x	y	s_1	s_2	s_3	A	Ratio
0	s_1	300	20	25	1	0	0	0	$\frac{300}{20} = 15$
0	s_2	250	15	20	0	1	0	0	$\frac{250}{15} = 16.6$
-M	A	10	1	0	0	0	-1	1	$\frac{10}{1} = 10$
		z_j	-M	0	0	0	M	-M	
		$z_j - c_j$	-M-1 ↑	-1	0	0	M	0	

Since $z_1 - c_1 = -M - 1$, the most negative, the variable x will enter basis B in place of A (leaving variable). Here, the pivot element is 1.

Drop the artificial variable A's column.

First iteration

			1	1	0	0	0	
c_B	B	x_B	x	y	s_1	s_2	s_3	Ratio
0	s_1	100	0	25	1	0	20	$\frac{100}{25} = 4$

0	s_2	100	0	20	0	1	15	$\frac{100}{20} = 5$
1	x	10	1	0	0	0	-1	-
		z_j	1	0	0	0	-1	
		$z_j - c_j$	0	-1	0	0	-1	

Since $z_2 - c_2 = -1$, the most negative, the variable y will enter basis B in place of s_1 (leaving variable). Here, the pivot element is 25.

Second iteration

			1	1	0	0	0	
c_B	B	x_B	x	y	s_1	s_2	s_3	Ratio
1	y	4	0	1	$\frac{1}{25}$	0	$\frac{4}{5}$	$\frac{4}{4/5} = 5$
0	s_2	20	0	0	$\frac{4}{5}$	1	-1	-
1	x	10	1	0	0	0	-1	-
		z_j	1	1	$\frac{1}{25}$	5	$-\frac{1}{5}$	
		$z_j - c_j$	0	0	$\frac{1}{25}$	5	$-\frac{1}{5}$	

Since $z_5 - c_5 = -\frac{1}{5}$, the most negative, the variable s_3 will enter basis B in place of y (leaving variable). Here, the pivot element is $4/5$.

Third iteration

			1	1	0	0	0	
c_B	B	x_B	x	y	s_1	s_2	s_3	Ratio
0	s_3	5	0	$\frac{5}{4}$	$\frac{1}{20}$	0	1	-
0	s_2	25	0	$\frac{5}{4}$	$-\frac{3}{4}$	1	0	-
1	x	15	1	$\frac{5}{4}$	$\frac{1}{20}$	0	0	-
		z_j	1	$\frac{5}{4}$	$\frac{1}{20}$	0	0	
		$z_j - c_j$	0	$\frac{1}{4}$	$\frac{1}{20}$	0	0	

Since all $z_j - c_j \geq 0$, the optimal solution has been reached.

Hence, the optimal solution is $x = 15, y = 0$.

And $\max Z = 15 + 0 = 15$

Hence, the plant must produce only sedan cars to maximize his weekly car production.

SOME OTHER APPLICATIONS

Linear programming problems (LPPs) have numerous applications across various fields. Some common applications include:

1. **Production Planning:** LPPs are widely used in manufacturing industries to optimize production schedules, resource allocation, and inventory management.
2. **Logistics and Transportation:** LPPs help in determining the most efficient routes for transportation, minimizing costs while meeting demand and capacity constraints.
3. **Finance and Investment:** LPPs aid in portfolio optimization, where investors aim to maximize returns while minimizing risks within given constraints such as budget limits and risk tolerance.
4. **Supply Chain Management:** LPPs optimize supply chain operations by determining the best allocation of resources, production levels, and distribution strategies to meet demand while minimizing costs.
5. **Resource Allocation:** LPPs are used in various resource allocation problems such as workforce scheduling, facility location planning, and energy distribution optimization.

6. **Marketing and Advertising:** LPPs assist in optimizing marketing campaigns by determining the allocation of resources across different channels to maximize reach and effectiveness within budget constraints.
7. **Telecommunications:** LPPs help in optimizing network design, routing, and resource allocation in telecommunications networks to minimize costs and maximize efficiency.
8. **Environmental Management:** LPPs are utilized in environmental planning and management to optimize resource usage, waste management, and pollution control strategies.
9. **Healthcare Management:** LPPs aid in healthcare resource allocation, such as determining the optimal staffing levels, scheduling surgeries, and optimizing hospital resource utilization.
10. **Agricultural Planning:** LPPs assist in crop planning, land use optimization, and farm management by maximizing yields while minimizing costs and resource usage.



**"NEST TREE PREFERENCE BY COLONIAL WATER BIRDS
AND THEIR CHARACTERISTICS IN WAGHALA, TAH.
ARMORI, DIST. GADCHIROLI WITH SPECIAL REFERENCE
TO ASIAN OPEN BILL STORK"**

A PROJECT REPORT SUBMITTED TO
GONDWANA UNIVERSITY OF GADCHIROLI
IN PARTIAL FULFILMENT FOR
DEGREE OF MASTER OF SCIENCE IN ZOOLOGY



SUBMITTED BY
Miss. Achal Dinesh Mohitkar
M.Sc. II (Semester IV)

GUIDED BY
Prof. N. A. BORODE
(Assistant Professor)

2023-2024

PG DEPARTMENT OF ZOOLOGY

Mahatma Gandhi College of Arts, Science and Late N. P. Commerce College, Armori
Dist: Gadchiroli

DECLARATION

I declare that project "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" was done by me in Mahatma Gandhi Art, Science late N.P. commerce college, Armori during the academic session 2023-2024. This project work has not been submitted earlier to any University or institution for the award of any diploma or a degree.

Date: 15-09-2024

Place: Armori

A Mohitkar.

Miss. Achal Dinesh Mohitkar


M.Sc. II (Semester IV)


CERTIFICATE

This to certify **Miss. Achal Dinesh Mohitkar** has carried out her project work on the topic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023 - 2024 under my supervision in the Post Graduate Department of Zoology M.G Art Science and late N.P. Commerce College Armori. This research work presented in this project is own work of the candidate.


Date:

Place:


Supervisor
Dr. J. N. Papadkar
(HOD ^{HEAD} of Zoology)
Dept. of Zoology
M. G. College, Armori


Guided By
Prof. N. A. Borode
(Assistant Professor)


Internal Examiner


15/04/2024
External Examiner

CERTIFICATE

This is to certify that **Miss. Achal Dinesh Mohitkar** has carried out this project work on the epic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date: 15-09-2024

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGEMENT

I would like to thank sincerely to **Prof. N. A. Borode**, Professor P.G. Department of Zoology M.G. Arts, Science and Late. N.P. Commerce College **Armori**, they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks to Principal of college **Dr. Lalsingh Khalsa** and Head of Department of Zoology **Dr. J. N. Papadkar** for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in day-to-day work. I also like to thank my family to support me in every decision about study. I also take these opportunities to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step that provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.

INDEX

Sr. No.	Content	Page No.
1	Introduction	8
2	Review of Literature	11
3	Material and Methodology	14
4	Result	17
5	Discussion & Conclusion	21
6	References	23

**“TO STUDY POULTRY FARMING AND MANAGEMENT
SYSTEM IN POULTRY FARM, NEAR VAIRAGAD
TALUKA ARMORI, DISTRICT GADCHIROLI,
MAHARASHTRA, INDIA”**

**A Project Submitted To Gondwana University, Gadchiroli As
Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submitted by

Mr : CHHAGAN BHASKAR BODANE

M.Sc. II year

(Semester IV)

Under The Guidance Of

Dr. Jayesh Papadkar
(Assistant Professor)

Mr. Dhammadip Sahare
(Assistant Professor)



Post Graduate Teaching Department Zoology

**Mahatma Gandhi Arts, Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**

2023-2024

CERTIFICATE

This is to certified that project entitle "TO STUDY POULTRY FARMING AND MANAGEMENT SYSTEM IN POULTRY FARM, NEAR VAIRAGAD, TALUKA ARMORI, DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" submitted by Mr. Chhagan Bhaskar Bodane as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.

The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of science, Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place :- Armori

Date :-



Mr : Chhagan B. Bodane
M.SC. II Year
(SEM. IV)



Dr. J. N. Papadkar
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori



Prof. Dhammadip W. Sahare
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

Forwarded by




Dr. J. N. Papadkar
Head Of Department
Mahatma Gandhi Science College
Armori, Gadchiroli.
HEAD
Dept. of Zoology
M. G. College, Armori.



Dr. L. H. Khalsa
Principal
Mahatma Gandhi Science College
Armori, Gadchiroli.
PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli



Internal Examiner



15/4/2024

External Examiner

DECLARATION

I here declare that, the piece of work presented in the project entitled " To study poultry farming and management system in poultry farm ,near vairagad ,taluka armori , dist. Gadchiroli (M.S.) India " has been carried out under the guidance of Prof. Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli.

The work presented in this dissertation has not been submitted in part or in full, for any degree , diploma or a certificate to any University.

Place :- Armori

Date :- 15/04/2024



Mr: Chhagan B. Bodaane

M.SC. II Year

(SEM. IV)

ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of **Prof. Dhammadip Sahare** sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to insufficient to express my gratitude towards him, which will remains inhibited in my memory and carrier. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provide in the department by him have given impetus to work on challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestion on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmate Komal Y. Bharre , Rashmi D. Nandeshwar , the entire laboratory , library , office bearers of the department for their complete cooperation throughout the completion of my project.



Mr : Chhagan B. Bodane

M.Sc. II Year

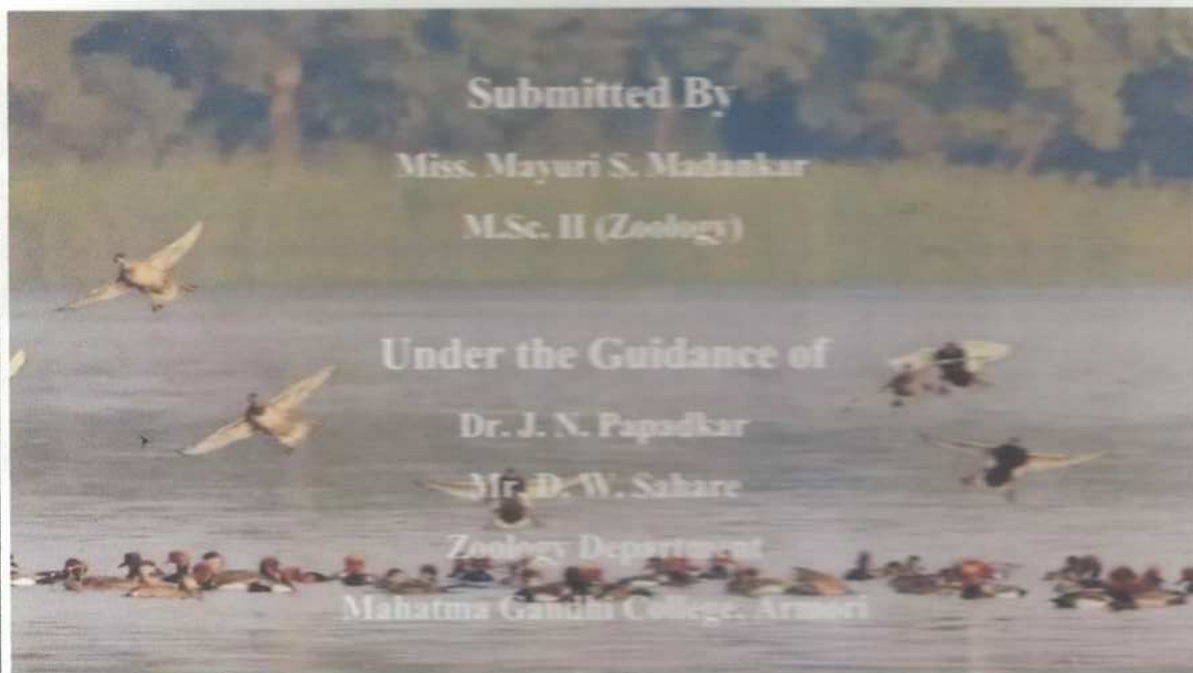
(Semester - IV)

2023-2024

Sr. No.	Contents
1	Introduction
2	Review Of Literature
3	Materials And Methods
	A)Study Area
	B)Sampling Method
4	Observation And Result
5	Discussion
6	Conclusion
7	References

**“DIVERSITY AND RICHNESS OF BIRD SPECIES IN
BAWANTHADI DAM AREA AND AROUND, TUMSAR,
DIST. BHANDARA”**

**A Dissertation Submitted to Gondwana University, Gadchiroli as partial
Fulfillment of the Requirement for Degree of Master of Science (Zoology)**



**Post Graduate Teaching Department & Research Academy Zoology
Mahatma Gandhi Arts, Science and Late. N. P. Commerce College Armori,
Dist. Gadchiroli (M.S.)**

2023-2024

CERTIFICATE

This is to certify that the project entitled **DIVERSITY AND RICHNESS OF BIRD SPECIES IN BAWANTHADI DAM AREA AND AROUND, TUMSAR, DIST. BHANDARA** has submitted by **Miss. Mayuri S. Madankar** as partial fulfillment of the requirement pertaining to the Nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana University, Gadchiroli. It is a bonafide research work carried out by her under our supervision and guidance.

This project fulfills the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of Science, Gondwana University. The work embodied in this project has not been submitted for any degree or diploma.

Place: - Armori

Date: - 15-04-2024



Dr. J. N. Papadkar

Supervisor



Mr. D. W. Sahare

Supervisor



HEAD
Dept. of Zoology
M. G. College, Armori.



PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli



Internal Examiner



15/4/2024

External Examiner

DECLARATION

I hereby declare that, the piece of work presented in the Project entitled, "**DIVERSITY AND RICHNESS OF BIRD SPECIES IN BAWANTHADI DAM AREA AND AROUND, TUMSAR, DIST. BHANDARA**" has been carried out under the guidance of **Dr. J. N. Papadkar & Mr. D. W. Sahare** Department of Zoology, M. G. College, Armori.

The work was carried out at the M. G. College, Armori and submitted for the partial fulfillment for the degree in Master of Science, Gondwana University, Gadchiroli

The work presented in this dissertation has not been submitted in part or in full, for any degree, diploma or a certificate to any University.

Place: - Armori

Date: - 15.04.2024



Miss. Mayuri S. Madankar

M. Sc. II (Zoology)

Mahatma Gandhi College, Armori

Dr. J. N. Papadkar
Department of Zoology
M. G. College, Armori

Dr. D. W. Sahare
Department of Zoology
M. G. College, Armori

NAAC Re-accredited – 'A' Grade

**Mahatma Gandhi College of Science, Arts, and Late. N.
P. Commerce, College, Armori, Dist. Gadchiroli**

CERTIFICATE

This is to certify that **Miss. Mayuri S. Madankar** is bonafide student of P.G. Department of Zoology, Mahatma Gandhi College, Armori. She has submitted the project work for the partial fulfillment of the Master Degree in Zoology of Gondwana University, Gadchiroli.

Date: - 15-04-2024



Mr. J. N. Papadkar

Head of Dept. of Zoology
Mahima Gandhi College,
Armori, Gadchiroli

Dr. L. H. Khalsa

Principal
Mahima Gandhi College,
Armori, Gadchiroli

ACKNOWLEDGEMENT

I owe my gratitude to the **Almighty shri ganesk** and thank him for every blessing he has bestowed upon me.

I would like to take this opportunity to express my deep sense of gratitude to my project supervisor Prof. Dr. J. N. Papadkar & D. W. Sahare, Zoology Department, Post Graduate Teaching and Learning Academy, M. G. College, Armori for his judicious planning, critical appraisal, inspiring and sagacious guidance, inexorable supervision and support with absolute positive attitude without which this study would have not been accomplished.

I am extremely grateful Mr. J. N. Papadkar, Head of Dept., M. G. College, Armori for technical guidance, pertinent suggestions in planning and critical amendments made during the entire period of my research work.

I express my deep sense of gratitude and indebtedness to Dr. L. H. Khalsa, Principal, M. G. College, Armori for providing the necessary facilities throughout the tenure of this work.

A good support system is important to surviving and staying sane in research. I am very much grateful to my colleagues Vaishnavi Meshram, Pallavi Kawle, fateheen and non-teaching staff Shri. Khushal Ramteke, Laboratory Attendant of Department of Zoology, M. G. College, Armori for their co-operation and help rendered to me.

I am very much grateful to my husband Avinash Uprikar, due to they were care which helped me survive even in the worst situation during my research.

I am unable to express my emotions through words for my s. Yogita Madankar and brother Mr. Dhananjay Madankar for his s. generous care and providing me with an excellent suggestions experimental design. He was always beside me during the happy and hard moments to push and motivate me.

Last but not least, I would like to pay high regards to my beloved mother Mrs. Sunita Madankar and dedicated father Mr. Sudhakar Madankar for their suffering, hard work, sincere encouragement and inspiration throughout my life and lifting me uphill this phase of life.

Date: -

Miss. Mayuri S. Madankar

I am unable to express my emotions through words for my sister Miss. Yogita Madankar and brother Mr. Dhananjay Madankar for his support, generous care and providing me with an excellent suggestions in experimental design. He was always beside me during the happy and hard moments to push and motivate me.

Last but not least, I would like to pay high regards to my beloved mother Mrs. Sunita Madankar and dedicated father Mr. Sudhakar Madankar for their suffering, hard work, sincere encouragement and inspiration throughout my life and lifting me uphill this phase of life.

Date: -

Miss. Mayuri S. Madankar

CONTENTS

CHAPTER NO.	TOPIC NAME	PAGE NO.
1.	INTRODUCTION	1 to 7
2.	MATERIALS AND METHODS	8 to 9
3.	OBSERVATION	10 to 20
4.	RESULTS AND DISCUSSIONS	21 to 39
5.	REFERENCES	40 to 42

CHAPTER: I

INTRODUCTION

Birds are a group of vertebrates, characterized by feathers, a beak with no teeth, the laying of eggs with hard shell, a high metabolic rate, a four-chambered heart, and a lightweight. Bird wings, which evolved from forelimbs, enabled birds the ability of bird flight. Some birds are intelligent especially parrots. Many species annually migrate great distances. Birds are social, communicating with visual signals, calls, and bird songs, and participating in such social behaviours. Birds produce offspring by laying eggs which are fertilized through sexual reproduction. They are usually laid in a nest and incubated by the parents. Most birds have an extended period of parental care after hatching. Some birds, such as hens, lay eggs even when not fertilized, though unfertilized eggs do not produce offspring. Many species of birds are economically important. Domesticated and undomesticated birds (poultry and game) are important sources of eggs, meat, and feathers. Birds are warm-blooded vertebrate (having a backbone) animals whose bodies are covered with feathers and whose forelimbs are modified into wings. Most can fly.

Birds are an integral part of the ecosystem and have importance for eco migratory birds can gain a better understanding of seasonal climate changes. By conserving birds and protecting their habitats we can continue to gain insights from our birds friends. Birds are one of the most populous life forms on the planet, and that biodiversity leads to a richness of life and beauty. It may be influenced by biogeography (Karr 1976). Some landscape exhibit high richness in biological diversity where others show an impoverished flora and fauna. Various scientist have been conducted to look at bird diversity in South Indian Forest (Joshua and

Johnsing 1986, Pramod et al 1997, Kunte et al 1999), relationship between birds species diversity and vegetation (Able 1976, Terbrgh 1985, Hawkins 1999, Joshi et al 2012), factors responsible for species 2004, Bhatt and Joshi 2011) (Dodia and Dhadhal 2010) The numerous observations by amateur and professional bird watchers may support the idea of the value of habitat of bird diversity conservation. Nevertheless there is lack information of scientific documentation and preventive measure on bird diversity conservation in this area.

Birds and their diversity constitute a main part of the natural environment and play a functional role as agents of flower pollination, seed dispersal, source of food chain and agents in breaking seed dormancy (Nason, 1992). Birds are good environmental indicators revealing the state of the ecosystems such as forest edges, wetlands and major river basins. They also act as dispersal agents in transferring nutrients and spores from one place to another during their migration and local movements (Niemi, 1985). The avian habitat is roughly divided into forest, and wetlands.

Bird community evaluation has become an important tool in biodiversity conservation and for identifying conservation actions in areas of high human pressure. Indian subcontinent is known for diverse and rich bird species whose taxonomy, distribution and their general habitat characteristics are well documented in India. Bird communities have been studied fairly well both in temperate and tropical forests. However, only a very little information is known about bird community structure and their dynamics in India. Understanding the diversity and structure of bird communities is essential to delineate the importance of regional or local landscapes for avian conservation. Determinations of bird population in different habitats are central to understanding the community structure and niche relationships, as well as for intelligent management of

Chapter - 2

**MATERIALS &
METHODS**

CHAPTER:-II

MATERIALS AND METHODS

Human beings affect the survival of birds by modifying their habitats. Aim of the present study providing a comprehensive list of the bird's species of Bhandara District Maharashtra State.

Study area: The habitat of Bawanthadi Dam, Tah. Tumsar, of District Bhandara is selected for study. Activities of birds recorded during the survey period included calling, overflying, perching, walking, mobbing, byssi in the construction of nest, collection of grass materials, feeding and loafing. The frequency of each activity was summed up to give the activity rating and the percentages values of the frequencies of each activity were calculated.

Methods: Some of the basic methods used in this study as described by Bibby et al. (1992) are:

- a. **Point counts:** to determine abundance by undertaking a bird count from a fixed location for a fixed period of time. The bird species seen or heard are recorded,
- b. **Line transect:** suitable for estimating density and abundance which involves moving along a fixed route (transect) and recording the bird species seen and heard on both sides of the transect. The study was conducted from December 2023 to February 2024. The bird counts were carried out in the morning from 7.00 am to 10.00 am and in the evening from 4.00 pm to 6.00 pm. A binocular (Olympus) was used to confirm the identification of the birds; nests were located by sight. For every bird species the following parameters were recorded:

Chapter - 3

OBSERVATION

CHAPTER: III OBSERVATION

BAYA WEAVER (WEAVER BIRD):-



CLASSIFICATION:

KINGDOM	: ANIMALIA
PHYLUM	: CHORDATA
CLASS	: AVES
ORDER	: PASSERIFORMES
FAMILY	: PLOCEIDAE
GENUS	: Ploceus
SPEICIES	: Philippinus

CHARACTERS:

- 1) The weaver's bird is a characterized by a stout, conical, seed crushing bill.
- 2) Baya weaver is a social and gregarious bird.
- 3) They forage in flocks for seeds, both on the plant and on the ground.
- 4) They depended on wild grasses such as guinea grass (*panicum maximum*) as well as rice for both as food and material for nesting.
- 5) They may also feed on butterflies and insect.

Identification:-

- 1) These are sparrow sized (15cm) they have a stout conical bill and a short square tail.
- 2) The non breeding male and female looks alike.

- 3) Breeding male has a bright yellow crown, dark brown mask, blackish brown bill.
- 4) They are seasonally dimorphic in plumage, the breeding male being largely yellow.

Habitat:

- 1) These birds are best known for the clearly woven, compact resort shaped nest suspended in colonies from palm fronds and babbul (acacia) a tree usually over water.
- 2) They are wide spread and common but prone to local, seasonal movement, mainly in response to rain and food availability.

COMMON MYNA

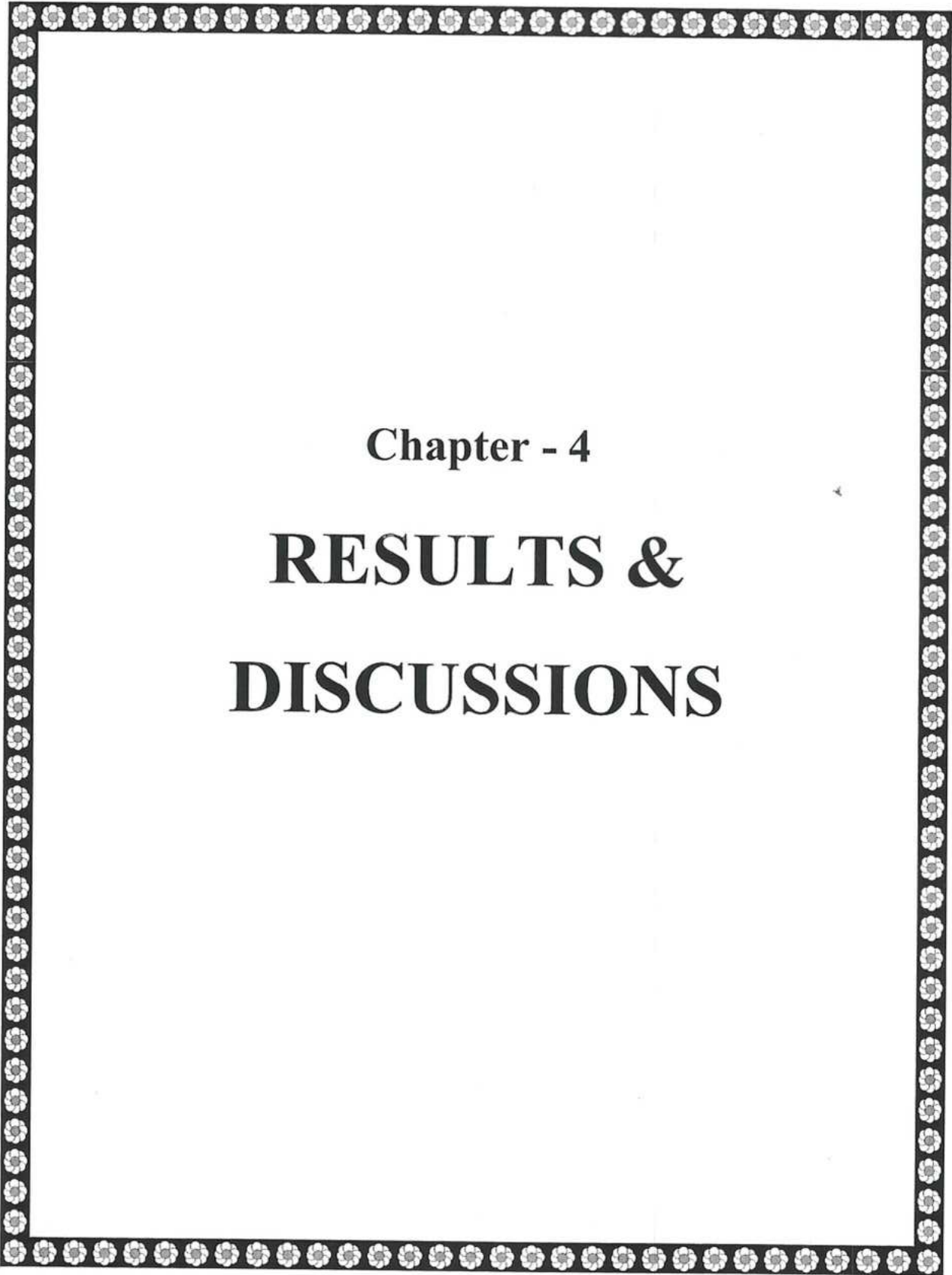


CLASSIFICATION

- KINGDOM : ANIMALIA
 PHYLUM : CHORDATA
 CLASS : AVES
 ORDER : PASSERIFORMES
 FAMILY : STURNIDAE
 GENUS : Acridotheres
 SPECIES : Tristis

CHARACTERS:

- 1) It is an omnivorous open woodland bird with a strong territorial instinct, it has adapted extremely well to urban environment.



Chapter - 4

**RESULTS &
DISCUSSIONS**

CHAPTER: IV

RESULTS AND DISCUSSIONS

A total of 151 bird's species distributed in 15 orders and 45 families were recorded during the survey period. Sixteen families were represented only by one species each. Passeriformes was the most rich of species (63 species) followed by Ciconiiformes (39 species). Rosy starling (*Sturnus roseus*) was recorded in the months of January, February and March; whereas Baya Weaver (*Ploceus philippinus*) was more abundant in the four months of December, January, February and March. Total number of 151 species was recorded during the survey. A total of 253 nests belonging to species of 15 families were recorded, most of which were of House Swift (*Apus nipalensis*, 200 nests) and Baya Weaver (*Ploceus philippinus*, 180).

Diverse populations of birds have been identified in the Bhandara district at different selected geographic site either as breeding population, winter, rainy and summer visitor or migration. Aquatic birds observed in randomly selected Bawanthadi Dam, Tumsar, District Bhandara. Total 73 bird's species belonging to twenty eight families were reported in and around Bhandara district.

Bird diversity is critical study. We share more than 10,000 species of birds. Study of bird diversity means understanding ecology. Birds are an integral part of the ecosystem and serve many important purposes. Biodiversity, we can better understand the relationships between all living organisms and how the interactions of those relationships can affect humans directly. Species richness decreased with increasing urbanization (Melles et al 2003). Urban birds communities are usually characterized by the dominance of a few species (Beissinger and Osborne 1982, Marzluff 2001) and most of the species making up the communities are introduced.

Chapter - 5

REFERENCES

CHAPTER-V

REFERENCES

- Bibby C. J., Burgess N. D. & Hill D. A., 1992, Bird Census Techniques, Academic Press, London, pp. 67-84.
- Nason I., 1992. Discovering birds, Pisces Publication, pp. 67-69.
- Niemi G. J., 1985, Patterns of morphological evolution in bird genera of New World and Old World Peatlands, Ecology, 66: 1215-1228.
- Kaar J. R. (1976) Seasonality resource availability and community diversity in tropical bird communities. American Natural, 105 423-435.
- Joshua J. and Johnsingh A. J. T. (1986) Observation on birds on Mundathurai Platen, Tamilnadu, Journal Bombay National History Society, 75: 1028-1035.
- Pramod P., Joshi N. V., Ghate U. and Gadgil M. (1997) On the hospitability of Western Ghats habitats for bird communities, Current Science, 73: 122-127.
- Kunte K., Jogleker A., Utkarsh G. and Pramod P. (1999) Patterns of butterfly, bird and tree diversity in the Western Ghats, Current Science, 77(4): 577-586.
- Able K. P. and Noon B. R. (1976) Avian community structure along elevation gradients in the northeastern United States. Oecologia 2: 275-294.
- Terborgh J. (1985) The role of ecotones in the distribution of Andean birds, Ecology, 66: 1237-1246.
- Hawkins A. F. A. (1999) Altitudinal and Latitudinal distribution of east Malagasy forest bird communities, Journal Biogeography, 26: 447-458.

**“TO STUDY POULTRY FARMING AND MANAGEMENT
SYSTEM IN POULTRY FARM, NEAR VAIRAGAD
TALUKA ARMORI, DISTRICT GADCHIROLI,
MAHARASHTRA, INDIA”**

**A Project Submitted To Gondwana University, Gadchiroli As
Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submitted by

Miss. KOMAL YADAV BHARRE

M.Sc. II YEAR

(Semester IV)

Under The Guidance Of

Dr. Jayesh Papadkar
(Assistant Professor)

Mr. Dhammadip Sahare
(Assistant Professor)



Post Graduate Teaching Department Zoology

**Mahatma Gandhi Arts, Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**

2023-2024


CERTIFICATE


This is to certified that project entitle "TO STUDY POULTRY FARMING AND MANAGEMENT SYSTEM IN POULTRY FARM, NEAR VAIRAGAD, TALUKA ARMORI, DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" submitted by Miss. Komal Yadav Bharre as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.

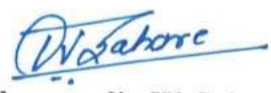
The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of science, Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place :- Armori


Date :- 15-4-2024


Miss. Komal Y. Bharre
M.SC. II Year
(SEM. IV)


Dr. J. N. Papadkar
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori



Prof. Dhammadip W. Sahare
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

Forwarded by


Dr. J. N. Papadkar
Head Of Department
Mahatma Gandhi Science College
Armori, Gadchiroli.
HEAD
Dept. of Zoology
M. G. College, Armori.


Dr. L. H. Khalsa
Principal
Mahatma Gandhi Science College
Armori, Gadchiroli.
PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli


Internal Examiner


15/4/2024
External Examiner

DECLARATION

I here declare that, the piece of work presented in the project entitled " To study poultry farming and management system in poultry farm ,near vairagad ,taluka armori , dist. Gadchiroli (M.S.) India " has been carried out under the guidance of Prof. Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli. The work presented in this dissertation has not been submitted in part or in full, for any degree , diploma or a certificate to any University.

Place :- Armori

Date :- 15-4-2024


Miss. Komal Y. Bharre

M.SC. II Year
(SEM. IV)


ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of **Prof. Dhammadip Sahare** sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to insufficient to express my gratitude towards him, which will remains inhibited in my memory and carrier. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provide in the department by him have given impetu\$ to work on challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestion on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmates Chhagan B. Bodane, Rashmi D. Nandeshwar , the entire laboratory , library , office bearers of the department for their complete cooperation throughout the completion of my project.


Miss. Komal Y. Bharre
M.Sc. II Year
(Semester - IV)

Sr. No.	Contents
1	Introduction
2	Review Of Literature
3	Materials And Methods
	A) Study Area
	B) Sampling Method
4	Observation And Result
5	Discussion
6	Conclusion
7	References

INTRODUCTION

According to agriculture diary, poultry refers to a wide range of birds of various species and it applies to them generally alive or dressed that is killed and prepared for sales. It involves chickens, turkeys, ducks, geese, guinea fowl, pigeons, peacock, peafowl, ostriches, quails and even other game birds. Most of them may be classified based on the basis of utility, economic value or purpose and this may include meat type, egg type, dual purpose, game, ornamental etc. Changing food habits, globalization, industrialization, rising income and urbanization have created a favorable atmosphere for development of poultry sector. Poultry is one of the fastest growing segment of livestock/agriculture sector and contributes a major share in terms of protein supplementation from eggs and meat. India is the 3rd largest producer of eggs and 5th rank meat production in the world.

Development of Poultry Industry in India has made huge steps during the last three decades evolving from backyard farming to a full-fledged commercial enterprise as a result of research and development initiated by the Government and subsequently taken up by the organized private sector. Hybrid layers of today lay on an average of 310-320 eggs per year compared to 240-250 eggs 30 years back. Similarly, present day broilers attain 1.8 to 2.0 kg mean body weight with a FCR of 1.6 to 1.8 in only 38 days (about 6 weeks).

For every success of poultry business, adequate knowledge on various aspects of poultry production is very much needed and one can get sufficient professional and technical information from this course, status of poultry farm.

THREE TYPE OF POULTRY

Laying Breeds: These breeds are known for their egg-laying capacity

Meat Breeds,

Dual-Purpose Breeds.

The poultry sector in India has undergone a paradigm shift in structure and operation from a mere backyard activity into a major commercial agriculture based industry over a period of four decades from around 1980 to 2017. Development of high yielding layer chickens and broiler chicken varieties together with standardized package of practices on nutrition, housing, management and disease control have contributed to spectacular growth rates in egg (4-6 % per annum) and broiler production (8-10 % per annum) in India. It is exemplary to see the government put effort into building infrastructure for the industry, especially providing access to various rural regions via entrepreneurial schemes. Despite this, the needs of integrated backyard collectives haven't been properly studied or assessed.

Scavenging breeds of chickens reared for both meat and egg production (dual-purpose). DPP have a few key attributes that make them particularly successful and profitable in rural areas: Suited to harsher conditions and can be primarily forage fed.

The Study Of Poultry Farming in Armori, District – Gadchiroli.

Poultry farming ,raising of birds domestically or commercially,primarily for meat and eggs but also for feathers.Chickens,turkeys,ducks and geese are of primary importance ,while guinea fowl and squabs (young pigeons) are chiefly of local interest.This article treats the principle and practices of poultry farming .for a discussion of the food value and processing of poultry.products,see egg and poultry processing.

Commercial production

Feeding:-

Commercial poultry feeding is a highly perfected science that ensures a maximum intake of energy for growth and fat production.High-quality and well-balanced protein sources produce a maximum amount of muscle,organ,skin and feather growth.The essential minerals produce bones and eggs ,with about 3 to 4 percent of the live bird being composed of minerals and 10 percent of the egg.Antibiotics are widely used to stimulate appetite ,control harmful bacteria and prevent disease.For chickens,modern rations produce about 0.5 kg (1 pound) of broiler on about 0.9 kg (2 pound) of feed and a dozen eggs from 2 kg (4.5 pounds) of feed.Energy supplements constitute 60-70% of poultry feed , provides bulk and satiety. They may further be divided into high energy like maize, wheat, sorghum, broken rice, fats /oils and low energy stuffs like pearl millet/other millets, rice polish/bran, molasses/tapioca flour.

MANAGEMENT :-

Carefully controlled environment that avoids crowding ,chilling,overheating or frightening is almost of the poultry forming a universal in poultry farming .The feeding ,watering ,egg gathering ,and cleaning operations are highly mechanized.poultry breeding is the outstanding example of the application of basic genetic principles of inbreeding and crossbreeding as well as of intensive mass selection to effect faster and cheaper gains in meat and maximum egg production for the egg-laying strains.maximun use of heterosis ,or hybrid vigour,through incrosses and crossbreeding has been made.

Types of poultry

Chickens:-

Mass production of chicken meat and eggs began in the early 20th century, but by the middle of that century meat production had outstripped egg production as a specialized industry. The market for chicken meat has grown dramatically since then, with worldwide exports reaching nearly 12.5 million metric tons (about 13.8 million tons) by the early 21st century.

Broiler Chicken:-

Eggs come from hens raised specifically to lay eggs, but chickens that are raised for meat are called broiler. These chickens are typically white, and are bred specifically for optimal health and size to produce a quality product for the consumer. Broiler chickens are raised in large, open structures called houses.

Layer:-

Layer chickens are a particular species of hens that need to be raised from one day old, and they start laying eggs commercially from 18-19 weeks of age. They remain to lay eggs continuously till 72-78 weeks of age. They can produce about one kg of eggs by consuming about 2.25 kg of food during their egg-laying period. To produce hybrid eggs, consider the various characteristics of cock and hen before breeding. Different types of highly egg-productive layer breeds are available worldwide. Layer chicken for poultry farming when raising laying hens, it is not as tiring as broilers, and it is easier to manage in all aspects, so this is also an advantage. Commercial hens typically start laying eggs at 16-21 weeks of age, although egg production declines quickly after about 25 weeks of age.

Parent:-

We breed the IB 308-AP Broiler as parents ,derived from Aviagen's ROSS 308-AP grandparent,in our own as well as in contract farms,Providing the right temperature,pure water,fress air and nutritious feed,we raise the parents with maximum care in our 9 breeding farms.The Parent Stock (PS) are mated to produce fertile eggs that hatch to become the ultimate generation – the commercial laying hens.The Parent Stock are the breeders used to produce the. layers or broilers used it in the production house. usually the parent stock consists of male line and. female line.the process of breeding chickens to produce high-quality and genetically superior chicks that will be used to raise broilers or egg-laying chickens.

REVIEW OF LITERATURE

Poultry farming in India, in spite of several constraints, has progressed considerably during the last decade.

The present study has been undertaken to examine various aspects related to the growth and development of poultry production in the country. Poultry production in India was confined to backyards till recently. Local breed of birds were reared for the supply of eggs and meat. The increasing demand for poultry products necessitates augmenting the supply by importing improved breeds of poultry. In 1961, the proportion of hybrid populations in the total population of poultry was about 2 percent. Within a couple of decades, these birds have dominated the market sidelining the indigenous birds. The technological advances have revolutionized the role and the structure of poultry industry in India. It became one of the most specialized enterprises in many parts of the country. A general confidence has been created among the people that green revolution has ushered an era of self-reliance in the food grain production. The rapidly growing population has created some doubts in the said hypothesis. In fact, crop production alone may not solve the food problem of the country. The advances in cereal technology, of course, can fill the empty stomach, but it may not help in the balanced growth of the human body.

The chief ingredients of balanced diet also comprise proteins, fats, minerals and vitamins, which are essential for growth. The supply of these items can easily be increased through increased production. Headley (1964) estimated that production functions for egg-laying flocks of hybrid and leghorn hens raised on Iowa state farms. The regression analysis indicated that flock size, housing area, corn equivalent labor and protein equivalents significantly contributed for gross returns. Hunter (1981) studied the economic aspects of egg production in Australian poultry farms. That study revealed that feedcosts occupy a major share of total cost of production of eggs followed by cost of chicks and labor. Goutard & Magalhaes, (2006) have identified the major marketing channels of poultry and poultry products. Here, the marketing channel shows that a large number of middlemen are involved in the marketing chain between producers and consumers. It was found that an average trader handles between 40 to 100 chickens per week while the middleman manages 2000 eggs per month. Moreover,

Poultry farming in India, in spite of several constraints, has progressed considerably during the last decade.

The present study has been undertaken to examine various aspects related to the growth and development of poultry production in the country. Poultry production in India was confined to backyards till recently. Local breed of birds were reared for the supply of eggs and meat. The increasing demand for poultry products necessitates augmenting the supply by importing improved breeds of poultry. In 1961, the proportion of hybrid populations in the total population of poultry was about 2 percent. Within a couple of decades, these birds have dominated the market sidelining the indigenous birds. The technological advances have revolutionized the role and the structure of poultry industry in India. It became one of the most specialized enterprises in many parts of the country. A general confidence has been created among the people that green revolution has ushered an era of self-reliance in the food grain production. The rapidly growing population has created some doubts in the said hypothesis. In fact, crop production alone may not solve the food problem of the country. The advances in cereal technology, of course, can fill the empty stomach, but it may not help in the balanced growth of the human body.

The chief ingredients of balanced diet also comprise proteins, fats, minerals and vitamins, which are essential for growth. The supply of these items can easily be increased through increased production. Headley (1964) estimated that production functions for egg-laying flocks of hybrid and leghorn hens raised on Iowa state farms. The regression analysis indicated that flock size, housing area, corn equivalent labor and protein equivalents significantly contributed for gross returns. Hunter (1981) studied the economic aspects of egg production in Australian poultry farms. That study revealed that feedcosts occupy a major share of total cost of production of eggs followed by cost of chicks and labor. Goutard & Magalhaes, (2006) have identified the major marketing channels of poultry and poultry products. Here, the marketing channel shows that a large number of middlemen are involved in the marketing chain between producers and consumers. It was found that an average trader handles between 40 to 100 chickens per week while the middleman manages 2000 eggs per month. Moreover, it is estimated that the average number of birds that are sold at local markets ranges

from 30 to 400 per day. According to Bhardwaj et al. (1995), in a study on cost behavior and marketing margins of broilers, observed that cost of raising broilers varied according to the size of poultry farms. In marketing broilers, the retailers earned maximum profits, whereas the producers' profit was only half of that of retailer. Bhardwaj et al. (1996), in a study of broilers in Haryana, concluded that the supply of broilers was affected by bird mortality and culling rate, which depended on bird age and size of poultry farms. The depletion rate decreased as the size of poultry farm increased. The study further showed that the marketing practices were influenced by the size of farms and seasons. Pandey et al. (1996a) studied the status of poultry production in India and also analyzed the behavior of production cost of poultry products in selected areas. The study showed that poultry had become a vital component of the farm economy as it generated additional income and employment in the rural area. The cost estimated revealed that feed alone accounted for about two-thirds of the total cost. The study concluded that availability of feed at reasonable prices would provide an incentive to the farmers to produce more poultry. Pandey et al. (1996b) observed that the development of poultry production was adversely affected by wide fluctuations in the demand. The study showed that rise in the price of eggs was comparatively lower than the rise in prices of milk, food articles and all commodities during the period of 1982-94. The production and disposal of eggs at poultry farms revealed that more than 98 percent of the eggs were sold for profit. The main marketing agents were identified as wholesale dealer and contractors. Iqbaluddin (1996) mentions that in most of the poultry pockets in India, marketing was still controlled by private traders. Fluctuation in the prices of poultry products was one of the main constraints for attracting investment in the sector.

Market Intervention Scheme (MIS) for Andhra Pradesh, Tamil Nadu, Punjab, Haryana, Madhya Pradesh procurement of eggs in Andhra Pradesh, Tamil Nadu, Punjab, Haryana, Madhya Pradesh and Rajasthan by NAFED had shown encouraging results, though the magnitude of operation is very small. Seetharaman (1996) studied the pattern of poultry development in India. He observed that out of 9 states, with well-developed poultry industry, only in two of them, i.e., in Gujarat and Maharashtra, the poultry cooperatives were doing well. He recommended that poultry cooperatives need to be extended in all poultry Development of Poultry Industry in India has made huge step during the last three decades evolving from backyard farming to a full-fledged

commercial enterprise as a result of research and development initiated by the Government and subsequently taken up by the organized private sector. Hybrid layers of today lay on an average of 310-320 eggs per year compared to 240-250 eggs 30 year back. Similarly, present day broilers attain 1.8 to 2.0 kg mean body weight with a FCR of 1.6 to 1.8 in only 38 days (about 6 weeks). For every success of poultry business, adequate knowledge on various aspects of poultry production is very much needed and one can get sufficient professional and technical information from this course, status and perspective of Indian poultry Industry. Various types of poultry farms and farming systems practiced in India. According to agriculture diary, poultry refers to a wide range of birds of various species and it applies to them generally alive or dressed that is killed and prepared for sales. It involves chickens, turkeys, ducks, geese, guinea fowl, pigeons, peacock, peafowl, ostriches, quails and even other game birds. Most of them may be classified based on the basis of utility, economic value or purpose and this may include meat type, egg type, dual purpose, game, ornamental etc. changing food habits, globalization, industrialization, rising income and urbanization have created a favorable atmosphere for development of poultry sector. Poultry is one of the fastest growing segment of livestock/agriculture sector and contributes a major share in term of protein supplementation from eggs and meat. India is the 3rd largest producer of eggs and 5th rank meat production in the world.

MATERIAL AND METHOD

Armori is a town and municipal council in the Gadchiroli district in the Indian state of Maharashtra. It is connected with the national Highway NH-353C.

It is located on the left of the Wainganga river, a tributary of the Pranahita River which meets the Godavari River. Armori is located at 20.46°N 79.98°E. It has an average elevation of 199 metres (676 feet).

Armori is well connected to major industrial and commercial places by road. It is about 120 km from the city of Nagpur and about 36 km from district headquarters Gadchiroli. The Maharashtra State Road Transport Corporation (MSRTC) runs buses connecting Gadchiroli to Nagpur via Armori, Brahmpuri, Nagbhid, Umred with a frequency of about 45 min.

Study area-

Armori-Vairagad Manapur, T-point

Tah-Armori, District-Gadchiroli, 441208



Fig no. 1. Satelite Image Of Poultry Farm ,Vairagad,Tah-Armori, District Gadchiroli

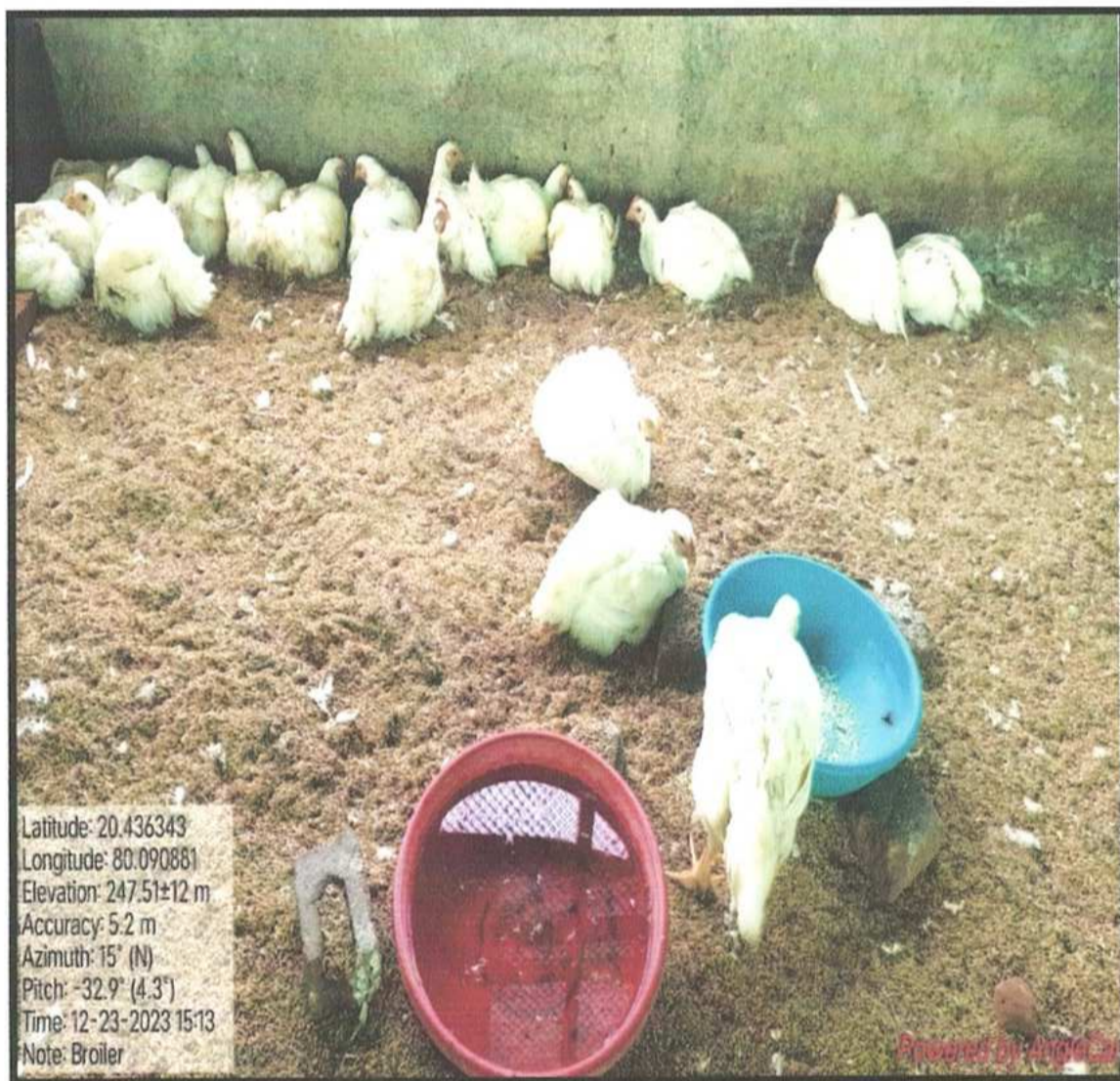


Fig No.2. Broiler Breed

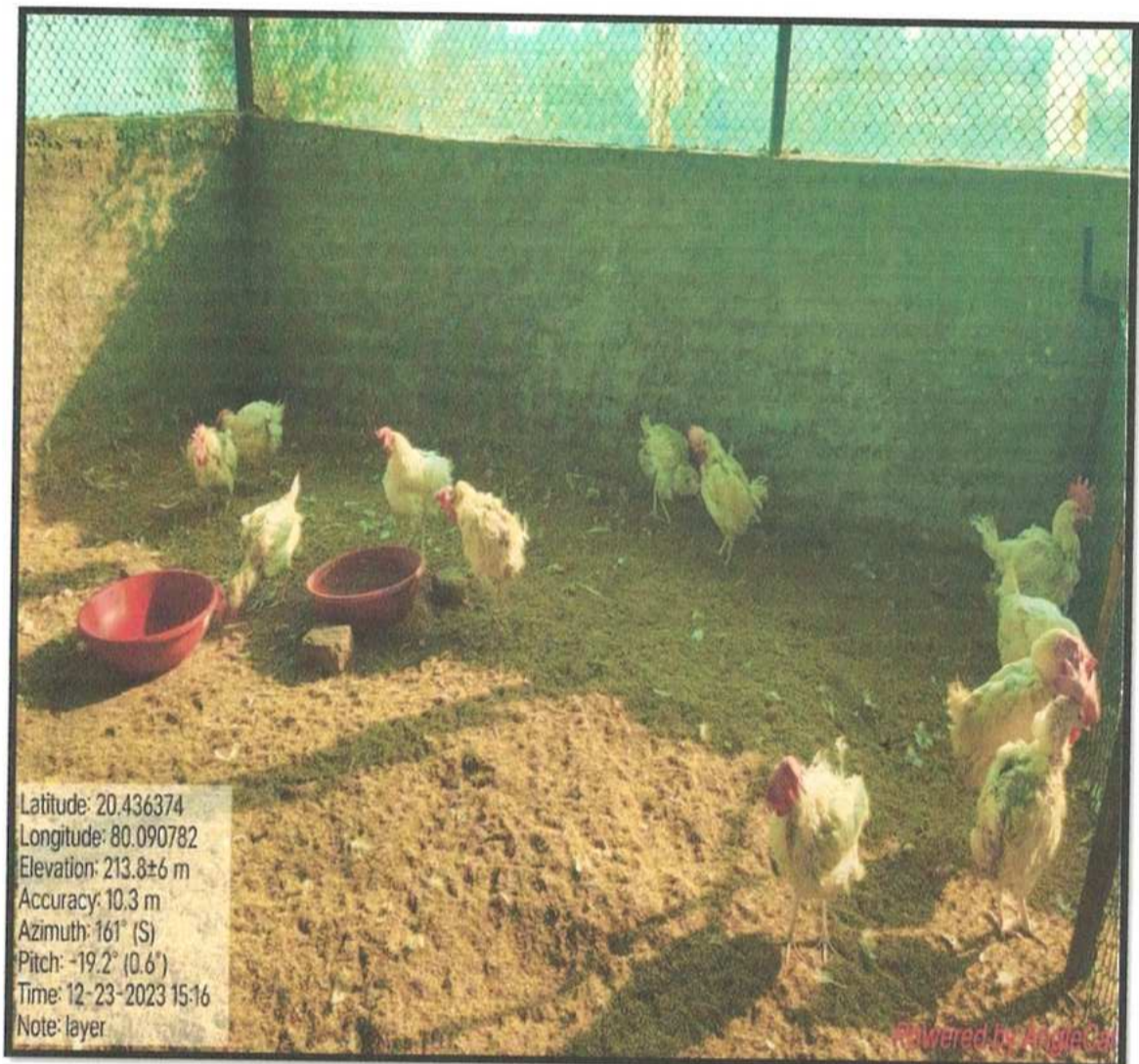


Fig no. 3 Layer Breed



Fig no. 4. Desi Layer Breed

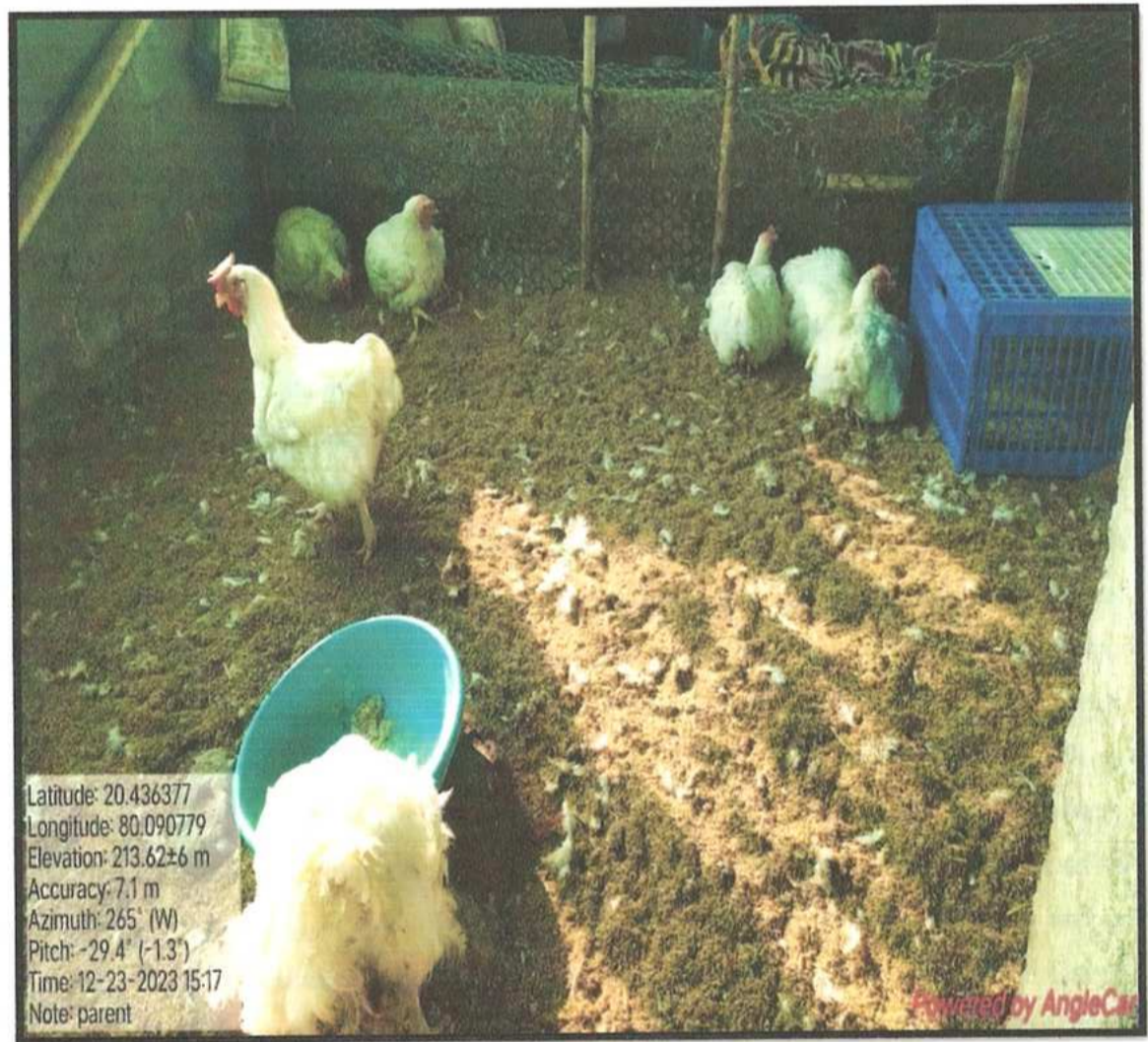


Fig No. 5. Parent Breeds

RESULT

In the beginning, participants were asked, in an open question, which criteria they took into account when choosing eggs or chicken meat. They attached high importance to product criteria such as weight, height, expiration date, and hygiene (cleanliness, color, appearance). Secondly, citizens expressed that the housing conditions of poultry (especially of laying hens) are very important when buying eggs or chicken meat. In this context, participants indicated confidence in buying products directly from trusted farmers. They assessed the production of those products as more transparent and the husbandry conditions for animals as better. The price aspect was mostly not mentioned first, though it played an important role for some participants. Overall, poultry meat was stated to be one of the preferred meat types by most of the respondents in terms of price, healthfulness, convenience, and availability. However, almost all participants revealed a lack of trust in common certification systems such as QS (German quality scheme for food), the EU organic label, and especially in products from discount stores. Against this background, some participants revealed intentions to reduce poultry farming is one of the most efficient animal husbandry methods and it provides nutritional security to a significant number of the world population. Using modern intensive farming techniques, global production has reached 133.4 mil. t in 2020, with a steady growth each year. Such intensive growth methods however lead to a significant environmental footprint. Waste materials such as poultry litter and manure can pose a serious threat to environmental and human health, and need to be managed properly. Poultry production and waste by-products are linked to NH₃, N₂O and CH₄ emissions, and have an impact on global greenhouse.

DISCUSSION

Poultry farming is the form of animal husbandry which raises domesticated birds such as chickens, ducks, turkeys and geese to produce meat or eggs for food. Poultry – mostly chickens – are farmed in great numbers. More than 60 billion chickens are killed for consumption annually.[2][3] Chickens raised for eggs are known as layers, while chickens raised for meat are called broilers.[4]In the United States, the national organization overseeing poultry production is the Food and Drug Administration (FDA). In the UK, the national organisation is the Department for Environment, Food and Rural Affairs (DEFRA).

Poultry farm in showing black terrain in foreground after controlled burn to stimulate new growth of nutritious grass Poultry farming is a vital component of modern agriculture, playing a crucial role in the production of eggs and meat, and contributing significantly to the overall food industry. In specifically, Poultry farming holds great importance as Nigeria has the largest annual egg production and second largest chicken population in Africa, providing sustenance to a large portion of the population. However, the benefits of poultry farming extend beyond its role in the food supply chain.

As population continues to grow, there will be an increasing demand for poultry products. This demographic change is expected to put additional strain on the agricultural sector, which will need to adapt and expand its capabilities to meet the rising need for food. The impending challenge is further compounded by the looming threat of climate change, which poses a significant risk to food security.

In light of these circumstances, it becomes even more crucial to recognize the broader significance of poultry farming. Beyond its immediate contribution to diets through the provision of meat and eggs, it plays a pivotal role in ensuring food security for the growing population. Efforts to support and sustain the poultry industry become paramount, not only for meeting the nutritional needs of the population but also for safeguarding against potential food shortages in the face of climate change. Poultry and eggs are nutrient rich and incredibly healthy to consume. Poultry is a great source of niacin, which improves circulation, selenium to protect against cell damage, phosphorus, and B12 vitamins. Eggs contain choline to help with digestion and brain

function, as well as numerous essential vitamins. Along with fish, poultry is also considered the healthiest meats in the market due to its nutritional value, abundance of minerals, and low calories. It is also one of the less expensive types of meat, meaning that more people of different income levels can afford it.

Due to their affordability and nutritional value, eggs are seen as an important vehicle to ensuring all people have access to healthy food. In the case of children specifically, The Global Alliance for Improved Nutrition (GAIN) recognized the significance of promoting higher egg consumption and thus initiated a campaign to encourage its increase.

Poultry farming is a form of animal husbandry which deals with the practice of rearing and breeding of poultry birds. Good animal husbandry practices ensure that proper food, shelter, hygiene, disease-care, protection, etc is given to the concerned animals. The qualitative approach applied here, ensures an uncovering of more specific and underlying views and perceptions that enable an understanding of how highly diverse groups of citizens assess poultry production systems. These results are important to address acceptance problems and different perceptions between several citizen groups and farmers, as well as the whole supply chain to adapt production systems and initiatives in line with public concerns and expectations of animal welfare. However, qualitative approaches such as focus group discussions cannot be used to gain representative results. Nevertheless, similarly criticized topics in modern livestock production systems were also found in quantitative studies.

BENEFIT FOR POULTRY FORMING

Poultry farming provides a high yield. Much capital is not required to become a poultry farmer. Lots of spaces are not required to begin poultry farming. You can start with your available area. Poultry farming might be immediately lucrative. Only fewer maintenance is needed for poultry farmers. You can easily acquire a license for this business as raising agricultural products that have immediate demand. Employment opportunities on multiple levels are created. Most financial institutions & businessmen will approve lending packages for poultry farmers. It has a quick return on your investment. Marketing is very easy. protect animals from various harmful diseases. Animal husbandry creates employment along with the proper business settlement. By animal husbandry process people are able to do breeding processes like cross-breeding for higher yield. This increases the production of various food products such as milk, eggs, meat, etc. poultry farming, raising of birds domestically or commercially, primarily for meat and eggs but also for feathers. Chickens, turkeys, ducks, and geese are of primary importance, while guinea fowl and squabs (young pigeons) are chiefly of local interest. Hens can also provide eggs that reduce food insecurity. It can be profitable. You can raise chickens for meat and be able to replenish your food supply once per quarter.

Hens can also provide eggs that reduce food insecurity. It can be profitable. Commercial hens typically start laying eggs at 16-21 weeks of age, although egg production declines quickly after about 25 weeks of age. This means that, in many countries, flocks around 72 weeks of age are not economically viable and are slaughtered after about 12 months of laying eggs, although chickens naturally live 6 years or more. In some countries, hens are forced to moult to re-lay eggs. Egg-laying systems often automatically control environmental conditions. For example, the duration of the mild phase is initially increased to encourage the onset of egg-laying at 16-20 weeks of age, and then mimics the length of summer, thereby stimulating hens to continue laying eggs throughout the year. Typically, egg-laying only occurs during the warmer months. Chicken farming is very common now of chicken farming.

ADVANTAGE OF POULTRY FORMING

Poultry farming in the United States involves over 233,000 locations. Over 8.54 billion broilers are produced each year through this industry, along with approximately 100 billion eggs and over 238 million turkeys. The combined value of all of these agricultural products is about \$50 billion per year. This figure is up over 9% from what the industry was able to achieve in 2013. When you include figures from around the world, the revenues and output triple thanks to large operations in the Asia-Pacific region.

Although poultry farming is a process that produces an image of hundreds of small birds crammed into a small cage, unable to move, this is not the industry standard. Intensive agricultural practices are different than unethical ones. Hens begin laying eggs at 16 to 20 weeks, but their product levels begin to decline in 1-2 months. That is why these hens are considered economically unviable and sent for meat products.

Chicken is one of the most consumed meat products in the world today. Eggs and turkey items are also increasing in popularity. When taking a look at the advantages and disadvantages of poultry farming, there is a definite need to balance the requirement for profits and an ongoing food supply with the humane treatment of these birds during their lifetime. The main purpose of Poultry Farming is the production of eggs, meat, etc. Numerous chickens were grown in poultry farms for the production of eggs and meat. Poultry farm management requires proper housing and feeding of fowls. The housing should be hygienic and with proper ventilation. The feed should be rich in nutrients suitable for broilers and egg layers separately. The primary objective of providing housing to poultry is to protect them from sun, rain and predators. Housing is also essential to provide comfort. Poultry houses should be well ventilated, reasonably cool in summer and warm during winter, and free from drafts. Around, billions of chickens are raised throughout the world as a good source of food from their eggs and meat. The main benefit of poultry farming is that it doesn't require high capital for starting. You just need basic capital to start raising poultry

CONCLUSION

There is usually a large impressive return on investments in poultry farming by concealing this analysis based on large scale poultry farming. According to wealthresult.com, average healthy layers lay egg almost every day or at least four times in a week, some breeds of layers can lay as much as 325 eggs in a year and take 21 days to hatch which means that a layer can reproduce another fowl twice in three days. So if one has 1000 healthy layers of good breed, they are capable of reproducing 24000 chicks in 40 days. Also within the 21 days, the egg is hatched and within 28 weeks, they are ready for the market which means a farmer can start making his or her money in 34 weeks after setting up his poultry farms.

This paper aimed to gain a deeper insight into different public perceptions of modern poultry production systems, including the views of meat eaters, vegetarians, and vegans. The qualitative study using focus groups with German citizens reveals a wide range of levels of knowledge about poultry production among citizens. In general, participants knew more about laying hens than about broiler production systems. Improvements that have already been made to increase the level of animal welfare (i.e., the ban on battery cages) are not yet fully recognized by citizens, indicating a communication gap between the poultry sector and citizens. The links between the use of medication and treatment of animals, feed, insufficient space, and the ability to express natural behavior were the most criticized topics during group discussions. Participants very often used common sense and lay theories to explain their perceptions of modern poultry production systems in their own words and, thus, concluded what was important for the animals' welfare and health. This is important to understand people who are not in touch with modern husbandry production systems. Vegetarians and vegans were critical, as I might assume, however, meat eaters were also skeptical and had negative perceptions of modern poultry production systems, albeit using more moderate terms than vegetarians and vegans. While the overall perception of intensive poultry production was negative, chicken meat still has a positive image for most citizens. However, participants often mentioned that they would reduce or had already reduced their meat consumption because of animal welfare problems. The aspects in poultry production systems that were most criticized in the group discussions, such as

an intensive factory farming, including high stocking densities, no natural living conditions for poultry, and no caring human-animal relationship (Figure 1) need to be taken seriously by all members of the poultry sector. According to citizens, the current situation in modern poultry production systems leads to a high use and need of antibiotics, which endangers the health of people and animals. There are several possibilities to deal with these negative perceptions and the lay theories citizens have, such as to improve the current production systems or develop innovative housing systems to meet citizens' requirements or to implement trustworthy and transparent antibiotic-free-labels. A further possibility is to change the existing factbased unemotional communication and enlarge efforts to educate citizens that the individual animal is cared for in a modern production system. Furthermore, a dialogue between farmer and citizens about shared values concerning poultry welfare may lead.

REFERENCES

Textbook of Poultry Science, Sreenivasaiah, P.V. 2015 Handbook of Poultry Production and Management, Jadhav, N.V. and Siddiqui, M.F. 2010. Modern Poultry Farming Indian Reprint 2003 Edition by Hurd LM Principles and Practices of Poultry Husbandry, Newman Tom Poultry Farming: A Guide on How to Start Poultry Farming by Lucky James Boogaard, B. K., L. J. S. Boekhorst, S. J. Oosting, and J. T. Sørensen. 2011. Socio-cultural sustainability of pig production: Citizen perceptions in the Netherlands and Denmark. *Livest. Sci.* 140:189–200.

- Clark, B., G. B. Stewart, L. A. Panzone, I. Kyriazakis, and L. J. Frewer. 2016. A systematic review of public attitudes, perceptions and behaviours towards production diseases. *J. Agric. Environ. Ethics.* 29:455–478.
- De Jonge, J., and H. C. M. van Trijp. 2013. Meeting heterogeneity in consumer demand for animal welfare: A reflection on existing knowledge and implications for the meat sector. *J. Agric. Environ. Ethics.* 26:629–661.
- De Jonge, J., and H. C. M. van Trijp. 2013. The impact of broiler production system practices on consumer perceptions of animal welfare. *Poult. Sci.* 92:3080–3095.
- Delezie, E., W. Verbeke, J. de Tavernier, and E. Decuyper. 2006. Consumers' preferences toward techniques for improving manual catching of poultry. *Poult. Sci.* 85:2019–2027.
- European Commission. 2005. Attitudes of consumers towards the welfare of farmed animals. Report. Special Eurobarometer 229 Wave. 63.2:1–60.
- European Commission. 2016. Attitudes of Europeans towards animal welfare. Report. Special Eurobarometer 442 Wave EB. 84.4: doi:10.2875/884639.
- Fernqvist, F., A. Olsson, and S. Spendrup. 2015. What's in it for me? Food packaging and consumer responses, a focus group study. *Brit. Food J.* 117:1122–1135.
- Fisher, M. W. 2014. Is there a need for a more expansive use of ethics and values in reflecting on the use of animals in scientific research? *Animals.* 4:643–656.

- Furnham, A. 1988. *Lay Theories: Everyday Understanding of Problems in the Social Sciences*. Pergamon Press, Elmsford, NY, US. Glaser, B. G. 1965. The constant comparative method of qualitative research analysis. *Soc. Probl.* 12:436–445.
- Glaser, B. G., and A. L. Strauss. 2017. *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge, New York.
- Harper, G. C., and A. Makatouni. 2002. Consumer perception of organic food production and farm animal welfare. *Brit. Food J.* 104:287–299.
- Jokinen, P., S. Kupsala, and M. Vinnari. 2012. Consumer trust in animal farming practices - exploring the high trust of Finnish consumers. *Int. J. Consum. Stud.* 36:106–113.
- Jorgensen, B. 2015. To meat or not to meat? An analysis of on-line vegetarian persuasive rhetoric. *Poroj.* 11:1–19.
- Kiley-Worthington, M. 1989. Ecological, ethological, and ethical sound environments for animals: Toward symbiosis. *J. Agric. Environ. Ethics.* 2:323–347. Krueger, R., and M. Casey. 2000. *Focus Groups: A Practical Guide for Applied Research*. 3rd ed. Sage, Thousand Oaks, CA.
- Lickel, B., D. L. Hamilton, and S. J. Sherman. 2001. Elements of a lay theory of groups: Types of groups, relational styles, and the perception of group entitativity. *Pers. Soc. Psychol. Rev.* 5:129–140.
- Luy, J. 2017. 45 years “vernünftiger Grund” (reasonable justification) for killing animals. What did the German legislator mean in 1972? Conference of the German Veterinary Medical Society 30 March to 1 April 2017. Conference manuscript. Munich.
- Malhotra, N. 1999. *Marketing Research: An Applied Orientation*. Prentice Hall: Upper Saddle River, New Jersey.
- Prentice, D. A., and D. T. Miller. 1996. Pluralistic ignorance and the perpetuation of social norms by unwitting actors. *Adv. Exp. Soc. Psychol.* 28:161–209. Rothschild, M. L. 1999. Carrots, sticks, and promises: A conceptual framework for the management of public health and social issue behaviors. *J. Mark.* 63:24–37. Scheufele, D. A. 2014. Science communication as political communication. *Proc. Natl. Acad. Sci. USA.* 11:13585–13592.

- Scientific Advisory Board on Agricultural Policy. 2015. Pathways to a socially accepted livestock husbandry in Germany. Executive Summary and Synthesis Report. Berlin.
- Spiller, A., M. von Meyer-Höfer, and W. I. Sonntag. 2016. Gibt es eine Zukunft für die moderne konventionelle Tierhaltung

**“TO STUDY FISH DIVERSITY OF RIVER WAINGANGA,
NEAR ARMORI, DISTRICT- GADCHIROLI,
MAHARASHTRA,INDIA”**

**A Project Submitted To Gondwana University,Gadchiroli
As Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submitted by

Miss.Mamta D.Kalbande

M.Sc. II year

Semester-IV

Under The Guidance Of

**Dr. Jayesh Papadkar
(Assistant Professor)**

**Mr.Dhammadip Sahare
(Assistant Professor)**



**Post Graduate Teaching Department Zoology
Mahatma Gandhi Arts,Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**

2023-2024

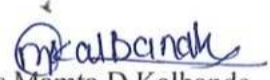
CERTIFICATE

This is to certified that project entitle "TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR-ARMORI, DISTRICT-GADCHIROLI, MAHARASHTRA, INDIA" submitted by Miss.Mamta D.Kalbande as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.

The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc.Degree(Zoology)in the faculty of science,Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place:-Armori

Date :- 15-04-24



Miss.Mamta D.Kalbande
M.SC.II Year

(SEM.IV)



Dr. J. N. Papadkar

Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori



Prof. Dhammadip W. Sahare

Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

Forwarded by



Dr. J. N. Papadkar
Head Of Department
Mahatma Gandhi Science College
Armori, Gadchiroli.

HEAD
Dept. of Zoology
M. G. College. Armori

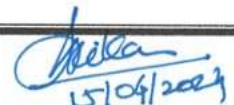


Dr. L. H. Khalsa
Principal
Mahatma Gandhi Science College
Armori, Gadchiroli.

PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli



Internal Examiner



15/04/2024

External Examiner

DECLARATION

I here declare that, the piece of work presented in the project entitled "**TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR ARMORI, DISTRICT GADCHIROLI, MAHARASHTRA, INDIA**" has been carried out under the guidance of Prof. Dhammadip Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli.

The work presented in this dissertation has not been submitted in part or in full, for any degree, diploma or a certificate to any University.

Place :- Armori

Date :- 15-04-24


Miss. Mamta D. Kalbande

M.SC. II Year

(SEM.IV)

ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of **Prof. Dhammadip Sahare** sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to be insufficient to express my gratitude towards him, which will remain inhibited in my memory and career. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provided in the department by him have given impetus to work on challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestion on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmates Khushabu Sahare, Shubhangi Thakare, Tejashwini, the entire laboratory, library, office bearers of the department for their complete cooperation throughout the completion of my project.


Miss. Mamta D. Kalbande

M.Sc. II Year

(Semester - IV)

Sr. No.	Contents
1	Introduction
2	ReviewOfLiterature
3	MaterialsAndMethods
	A)StudyArea
	B)SamplingMethod
4	ObservationAndResult
5	Discussion
6	Conclusion
7	References



**"NEST TREE PREFERENCE BY COLONIAL WATER BIRDS
AND THEIR CHARACTERISTICS IN WAGHALA, TAH.
ARMORI, DIST. GADCHIROLI WITH SPECIAL REFERENCE
TO ASIAN OPEN BILL STORK"**

**A PROJECT REPORT SUBMITTED TO
GONDWANA UNIVERSITY OF GADCHIROLI
IN PARTIAL FULFILMENT FOR
DEGREE OF MASTER OF SCIENCE IN ZOOLOGY**



**SUBMITTED BY
Miss. Alisha Buddhivant Shende
M.Sc. II (Semester IV)**

**GUIDED BY
Prof. N. A. BORODE
(Assistant Professor)**

2023-2024

PG DEPARTMENT OF ZOOLOGY

Mahatma Gandhi College of Arts, Science and Late N. P. Commerce College, Armori

Dist: Gadchiroli

DECLARATION

I declare that project "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" was done by me in Mahatma Gandhi Art, Science late N.P. commerce college, Armori during the academic session 2023-2024. This project work has not been submitted earlier to any University or institution for the award of any diploma or a degree.

Date: 15/04/2024

Place: Armori



Miss. Alisha Buddhivant Shende

M.Sc. II (Semester IV)

CERTIFICATE

This to certify **Miss. Alisha Buddhivant Shende** has carried out her project work on the topic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023 - 2024 under my supervision in the Post Graduate Department of Zoology M.G Art Science and late N.P. Commerce College Armori. This research work presented in this project is own work of the candidate.

Date:

Place:



Supervisor
Dr. J. N. Papadkar
(HOD of Zoology)
HEAD
Dept. of Zoology
M. G. College, Armori.



Guided By
Prof. N. A. Borode
(Assistant Professor)



Internal Examiner


15/04/2024

External Examiner

CERTIFICATE

This is to certify that **Miss. Alisha Buddhivant Shende** has carried out this project work on the epic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date:

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGEMENT

I would like to thank sincerely to **Prof. N. A. Borode**, Professor P.G. Department of Zoology **M.G. Arts, Science and Late. N.P. Commerce College Armori**, they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks to Principal of college **Dr. Lalsingh Khalsa** and Head of Department of Zoology **Dr. J. N. Papadkar** for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in day-to-day work. I also like to thank my family to support me in every decision about study. I also take these opportunities to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step that provided the physical and moral support without which this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.

INDEX

Sr. No.	Content	Page No.
1	Introduction	: 8
2	Review of Literature	: 11
3	Material and Methodology	: 14
4	Result	: 17
5	Discussion & Conclusion	: 21
6	References	: 23



**"NEST TREE PREFERENCE BY COLONIAL WATER BIRDS
AND THEIR CHARACTERISTICS IN WAGHALA, TAH.
ARMORI, DIST. GADCHIROLI WITH SPECIAL REFERENCE
TO ASIAN OPEN BILL STORK"**

**A PROJECT REPORT SUBMITTED TO
GONDWANA UNIVERSITY OF GADCHIROLI
IN PARTIAL FULFILMENT FOR
DEGREE OF MASTER OF SCIENCE IN ZOOLOGY**



**SUBMITTED BY
Miss. Shivani Rajendra Selote
M.Sc. II (Semester IV)**

**GUIDED BY
Prof. N. A. BORODE
(Assistant Professor)**

2023-2024

PG DEPARTMENT OF ZOOLOGY

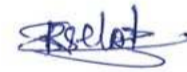
**Mahatma Gandhi College of Arts, Science and Late N. P. Commerce College, Armori
Dist: Gadchiroli**

DECLARATION

I declare that project "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" was done by me in Mahatma Gandhi Art, Science late N.P. commerce college, Armori during the academic session 2023-2024. This project work has not been submitted earlier to any University or institution for the award of any diploma or a degree.

Date: 15/04/2024

Place: Armori



Miss. Shivani Rajendra Selote

M.Sc. II (Semester IV)

CERTIFICATE

This to certify Miss. Shivani Rajendra Selote has carried out her project work on the topic entitled "Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork" during the academic session 2023 - 2024 under my supervision in the Post Graduate Department of Zoology M.G Art Science and late N.P. Commerce College Armori. This research work presented in this project is own work of the candidate.

Date: 15/04/2024

Place: Armori



Supervisor
Dr. J. N. Papadkar
(HOD of Zoology)
HEAD
Dept. of Zoology
M. G. College, Armori.



Guided By
Prof. N. A. Borode
(Assistant Professor)



Internal Examiner



External Examiner

CERTIFICATE

This is to certify that **Miss. Shivani Rajendra Selote** has carried out this project work on the epic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date:

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGEMENT

I would like to thank sincerely to **Prof. N. A. Borode**, Professor P.G. Department of Zoology M.G. Arts, Science and Late. N.P. Commerce College **Arneri**, they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks to Principal of college **Dr. Lalsingh Khalsa** and Head of Department of Zoology **Dr. J. N. Papadkar** for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in day-to-day work. I also like to thank my family to support me in every decision about study. I also take these opportunities to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step that provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.

INDEX

Sr. No.	Content	Page No.
1	Introduction	: 8
2	Review of Literature	: 11
3	Material and Methodology	: 14
4	Result	: 17
5	Discussion & Conclusion	: 21
6	References	: 23



**"NEST TREE PREFERENCE BY COLONIAL WATER BIRDS
AND THEIR CHARACTERISTICS IN WAGHALA, TAH.
ARMORI, DIST. GADCHIROLI WITH SPECIAL REFERENCE
TO ASIAN OPEN BILL STORK"**

**A PROJECT REPORT SUBMITTED TO
GONDWANA UNIVERSITY OF GADCHIROLI
IN PARTIAL FULFILMENT FOR
DEGREE OF MASTER OF SCIENCE IN ZOOLOGY**



**SUBMITTED BY
Miss. Rajashri Vilas Samarth
M.Sc. II (Semester IV)**

**GUIDED BY
Prof. N. A. BORODE
(Assistant Professor)**

2023-2024

PG DEPARTMENT OF ZOOLOGY

Mahatma Gandhi College of Arts, Science and Late N. P. Commerce College, Armori

Dist: Gadchiroli

DECLARATION

I declare that project "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" was done by me in Mahatma Gandhi Art, Science late N.P. commerce college, Armori during the academic session 2023-2024. This project work has not been submitted earlier to any University or institution for the award of any diploma or a degree.

Date: 15/4/2024

Place: Armori



Miss. Rajashri Vilas Samarth

M.Sc. II (Semester IV)

CERTIFICATE

This to certify **Miss. Rajashri Vilas Samarth** has carried out her project work on the topic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023 - 2024 under my supervision in the Post Graduate Department of Zoology M.G Art Science and late N.P. Commerce College Armori. This research work presented in this project is own work of the candidate.

Date: 15/04/2024

Place: Atmali



Supervisor
Dr. J. N. Papadkar
(HOD of Zoology)
HEAD
Dept. of Zoology
M. G. College, Armori



Guided By
Prof. N. A. Borode
(Assistant Professor)



External Examiner



External Examiner

CERTIFICATE

This is to certify that **Miss. Rajashri Vilas Samarth** has carried out this project work on the epic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date:

Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.

ACKNOWLEDGEMENT

I would like to thank sincerely to **Prof. N. A. Borode**, Professor P.G. Department of Zoology M.G. Arts, Science and Late. N.P. Commerce College **Armori**, they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks to Principal of college **Dr. Lalsingh Khalsa** and Head of Department of Zoology **Dr. J. N. Papadkar** for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in day-to-day work. I also like to thank my family to support me in every decision about study. I also take these opportunities to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step that provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.

INDEX

Sr. No.	Content	Page No.
1	Introduction	: 8
2	Review of Literature	: 11
3	Material and Methodology	: 14
4	Result	: 17
5	Discussion & Conclusion	: 21
6	References	: 23

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori,
Dist. Gadchiroli

Department of Zoology

Session 2023-24

Activity - Project submission Class M.Sc II sem IV Date - 15.04.2024
Zoology

Sr. No.	Name of Student	Signature
1.	Komal Yadav Bharane Topic - To study poultry farming And Managment system in poultry farm.	<u>Bharane</u>
2.	- Chhagan Bhaskar Bodane Topic - To study poultry farming and Managem- ent system in poultry farm.	<u>Bodane</u>
3.	- Pratiima Yogiraj Dhakate - Topic - study of diversity of Ants.	<u>Dhakate</u>
4.	- Mamta Dilip Kalbandhe - Topic - To Study Fish Diversity of river.	<u>Kalbandhe</u>
5.	- Pallavi Prabhakar Kawale Topic - study of diversity of Ants	<u>P.P. Kawale</u>
6.	- Tejashwini Devendra Kuzekar Topic - To study Fish of diversity of river Wainganga.	<u>Kuzekar</u>

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori,
Dist. Gadchiroli
Department of Zoology

Session 2023-24

Activity - Project submission Class M.Sc. II Sem. IV Date - 15.04.2024
ZOOLOGY

Sr. No.	Name of Student	Signature
7	- Sandhya Amol Meshram Topic - Study on Insect Diversity of paddy field in Armori Tahsil.	<u>S Meshram</u>
8	- Vaishnavi Ashok Meshram Topic - study of Diversity of Ants (Hymenoptera: Formicidae) in and Around Armori city of district. Gadchiroli.	<u>V. Ameshram</u>
9	- Achal Dinesh Mohitkar Topic - Nest tree preference by colonial water birds and their characteristics in waghara, Tah, Armori, Dist. Gadchiroli with special reference to Asian open bill stork "	<u>A Mohitkar</u>
10	- Rashmi Dilip Nandeshwar Topic - To study Poultry Farming and management system in Poultry farm, Near Vaizagad taluka Armori Dist. Gadchiroli, Maharashtra, India.	<u>R Nandeshwar</u>

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori,
Dist. Gadchiroli

Department of Zoology

Session 2023-24

Activity - Project Submission Class - M.Sc. II-IV sem Date - 15.04.2024

Sr. No.	Name of Student	Signature
11.	Rajshri vilas samarth	<u>Rajshri</u>
	TOPIC- Nest Tree preference by colonial water bird and their characteristics in waghala Armori. with special Reference To Asian open bill stork.	
12	Shivani Rajendra selote	<u>Selote</u>
	Topic- Nest tree preference by colonial water bird and their characteristics in waghala Armori with special Reference To Asian open bill stork.	
13	Khushabu Ashok Shahare	<u>Shahare</u>
	Topic- "To study fish diversity of river wainganga.	
14	Alisha Buddhivant shende	<u>Shende</u>
	Topic- Nest Tree preference by colonial water bird and their characteristics in waghala Armori with special Reference To Asian open	
15.	Name- shubhangi Rajeshwar Thakare	<u>Thakare</u>
	Topic Name:- To study Fish diversity of river wainganga	

Date . 15.04.2024



Prof. J. N. Papadkar
Dr. J. N. Papadkar

Mahatma Gandhi Arts, Sci & Late M.P. Commerce College Amroli

Department of Zoology

Session - 2023-24

Activity - Project submission Class - MSc II sem IV
Zoology Date - 15.04.2024

Sl No	Name of Students	Signature
✓ 16	Mrs Fatima A. Qureshi. Topic:- To study biodiversity and sustainable management of Lake Bhandara district Maharashtra, India.	
✓ 17	Mayuri Sudhakar Madankar Topic:- To study Diversity and Richness of Bird species in Bavanthadi Dam Area and Around, Tumsar, Dist. Bhandara	



HEAD
Dept. of Zoology
M. G. College, Amroli

Mahatma Gandhi Arts, Science & Late N. P. Commerce College, Armori

Skill Enhancement Course

Class- B.Sc. III Semester VI

Session 2023-24

Subject- Zoology

Sr. No.	Name of Student	Signature	Marks P1 (35)	Marks P2 (15)	Total
1.	Bulle Payal Anil	Bulle.	31	13	44
2.	Bhoyar Sonu Parasram	Bhoyar	31	14	45
3.	Bagmare Apurva Ashok	Bagmare	32	13	45
4.	Shiekh Maheknoj Jahid	Shiekh	33	15	48
5.	Khan Shifa Mobin	Khan	35	15	50
6.	Khan Pathan Kaniz Fatema Ibrahim	Khan	35	15	50
7.	Sheikh Sumera Parvin Mouhamad Shafee	Sheikh	35	15	50
8.	Mate Ashutosh Gajanan	Mate	30	12	42
9.	Chitmalwar Renuka Narendra	Chitmalwar	AB		
10.	Khewale Shivani Umesh	Khewale	32	13	44
11.	Madavi Manjusha Rayindra	Madavi	AB		
12.	Bagmare Vaishali Hiralal	V. H. Bagmare.	33	13	46
13.	Bhoyar Kalyani Dilip	Bhoyar	32	15	47
14.	Dhande Prachi Dakram	Dhande	30	11	41

S.B.
Prof. S. B. Kumbhar

Received
12/4/2024

HEAD
Dept. of Zoology
M. G. College, Armori



"Study on Insect Diversity of Paddy Field in Armori Tahsil, Dist. Gadchiroli"

A Project Report

Submitted To The

Gondwana University Gadchiroli

For The Degree Of

Master Of Science (Zoology)

Submitted By

Miss. Sandhya Amol Meshram

Under The Supervision of

Prof. J.N. Papadkar

(Supervisor)

Prof.D.W.Sahare

(Supervisor)

Dr. J.N. Papadkar

(HOD Of Zoology)

P.G. DEPARTMENT OF ZOOLOGY

MAHATMA GANDHI COLLEGE, ARMORI,

DIST. GADCHIROLI

SESSION : 2023 – 2024

Certificate

This is to certify that **Miss. Sandhya Amol Meshram** has carried out her project work on the topic entitled "**Study on Insect Diversity of Paddy Field in Armori Tahsil, Dist. Gadchiroli**" during the academic session **2023-2024** under my supervision in the Post Graduate Department of Zoology, **Mahatma Gandhi Arts, Science and Late N. P. Commerce College, Armori Dist. Gadchiroli.**

This research work presented in this project is own work of candidate.

Place :Armori

Date: 15/04/2024

Stit Meshram
Sandhya A. Meshram
(M.sc.II year sem IV)



Prof. J.N. Papadkar
(Supervisor)



Prof.D.W.Sahare
(Supervisor)



Dr. J.N. Papadkar
HEAD
(Dept. of Zoology)
M. G. College, Armori



PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli



Internal Examiner


15/04/2024

External Examiner

Certificate

This is to certify that Miss. **Sandhya Amol Meshram** has carried out her project work on the topic entitled "Study on Insect Diversity of Paddy Field in Armori Tahsil, Dist. Gadchiroli (M.S)" during the academic session **2023-24** under my supervision in the Post Graduate Department of Zoology, **Mahatma Gandhi Arts, Science and Late N. P. Commerce College, Armori Dist. Gadchiroli.**

This research work presented in this project is own work of candidate.

Dr. L. H. Khalsa

Principal

Place : Armori

Date : 15/04/2024

Mahatma Gandhi College, Armori,

Dist. Gadchiroli

Declaration

I declare that this project work of "Study on Insect Diversity of Paddy Field in Armori Tahsil, dist. Gadchiroli" was done by me in Mahatma Gandhi Arts, Science and Late N. P. Commerce College, Armori Dist. Gadchiroli during the academic session 2023-24. This project work has not been submitted earlier to any University or Institution for the award of any diploma or a degree.

Place : Armori

Date : 15/04/2024



Sandhya Amol Meshram

Sem IV M.Sc Zoology

M. G. College, Armori

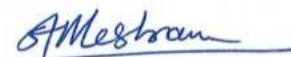
ACKNOWLEDGMENT

I would like to thank sincerely to my supervisor Prof. D. W. Sahare, P.G. Department of Zoology M. G. Arts, Science and Late N. P. Commerce College, Armori, dist. Gadchiroli. They not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks Principal of College Dr. Lalsingh Khalsa and Head of the Department of Zoology Dr. J. N. Papadkar for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in day to day work. I also like to thank my family to support me in every decision about study. I also take this opportunity to convey my gratitude to my friends of M. Sc. Group for giving me support in each and every step who provided the physical and moral support. Without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.



Sandhya Amol Meshram

M.Sc Sem IV Zoology

M. G. College, Armori

INDEX

Sr. No.	Topic	Page No.
1.	Introduction	1-2
2.	Review of literature	3-4
3.	Material and Methods	5
4.	Observation Table	6
5.	Result	7-10
6.	Discussion	* 11
7.	Conclusion	12
8.	Reference	13-14



**"NEST TREE PREFERENCE BY COLONIAL WATER BIRDS
AND THEIR CHARACTERISTICS IN WAGHALA, TAH.
ARMORI, DIST. GADCHIROLI WITH SPECIAL REFERENCE
TO ASIAN OPEN BILL STORK"**

**A PROJECT REPORT SUBMITTED TO
GONDWANA UNIVERSITY OF GADCHIROLI
IN PARTIAL FULFILMENT FOR
DEGREE OF MASTER OF SCIENCE IN ZOOLOGY**



**SUBMITTED BY
Miss. Shivani Rajendra Selote
M.Sc. II (Semester IV)**

**GUIDED BY
Prof. N. A. BORODE
(Assistant Professor)**

2023-2024

PG DEPARTMENT OF ZOOLOGY

Mahatma Gandhi College of Arts, Science and Late N. P. Commerce College, Armori

Dist: Gadchiroli

DECLARATION

I declare that project "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" was done by me in Mahatma Gandhi Art, Science late N.P. commerce college, Armori during the academic session 2023-2024. This project work has not been submitted earlier to any University or institution for the award of any diploma or a degree.

Date: 15/04/2024

Place: Amoli



Miss. Shivani Rajendra Selote

M.Sc. II (Semester IV)

CERTIFICATE

This to certify Miss. Shivani Rajendra Selote has carried out her project work on the topic entitled "Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork" during the academic session 2023 - 2024 under my supervision in the Post Graduate Department of Zoology M.G Art Science and late N.P. Commerce College Armori. This research work presented in this project is own work of the candidate.

Date: 15/04/2024

Place: Armori



Supervisor
Dr. J. N. Papadkar
(HOD of Zoology)
HEAD
Dept. of Zoology
M. G. College, Armori.



Guided By
Prof. N. A. Borode
(Assistant Professor)



Internal Examiner



External Examiner

CERTIFICATE

This is to certify that **Miss. Shivani Rajendra Selote** has carried out this project work on the topic entitled "**Nest tree preference by colonial water birds and their characteristics in Waghala, Tah. Armori, Dist. Gadchiroli with special reference to Asian Open bill Stork**" during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date:

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGEMENT

I would like to thank sincerely to **Prof. N. A. Borode**, Professor P.G. Department of Zoology M.G. Arts, Science and Late. N.P. Commerce College **Arneri**, they not only guided me in my project but also unlimited help provided to me in this constructive project work.

I express my special thanks to Principal of college **Dr. Lalsingh Khalsa** and Head of Department of Zoology **Dr. J. N. Papadkar** for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in day-to-day work. I also like to thank my family to support me in every decision about study: I also take these opportunities to convey my gratitude to my friends of M.Sc. group for giving me support in each and every step that provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude towards my all well-wishers.

INDEX

Sr. No.	Content	Page No.
1	Introduction	: 8
2	Review of Literature	: 11
3	Material and Methodology	: 14
4	Result	: 17
5	Discussion & Conclusion	: 21
6	References	: 23

**“TO STUDY FISH DIVERSITY OF RIVER WAINGANGA,
NEAR ARMORI, DISTRICT- GADCHIROLI,
MAHARASHTRA,INDIA”**

**A Project Submitted To Gondwana University,Gadchiroli
As Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submittedby

Miss.Shubhangi R.Thakare

M.Sc. II year

(SemesterIV)

Under The Guidance Of

**Dr. Jayesh Papadkar
(Assistant Professor)**

**Mr.Dhammadip Sahare
(Assistant Professor)**



**Post Graduate Teaching Department Zoology
Mahatma Gandhi Arts,Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**

2023-2024


CERTIFICATE

This is to certified that project entitle "TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR-ARMORI, DISTRICT-GADCHIROLI, MAHARASHTRA, INDIA" submitted by Miss. Shubhangi R. Thakare as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.

The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of science, Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place:- Armori

Date :- 15/04/2024



Miss. Shubhangi R. Thakare

M.Sc. II Year

(SEM. IV)



Dr. J. N. Papadkar

Project Supervisor

Department of Zoology

Mahatma Gandhi Science College Armori



Prof. Dhammadip W. Sahare

Project Supervisor

Department of Zoology

Mahatma Gandhi Science College Armori

Forwarded by



Dr. J. N. Papadkar

Head Of Department

Mahatma Gandhi Science College

Armori, Gadchiroli.

HEAD

Dept. of Zoology

M. G. College Armori.



Dr. L. H. Khalsa

Principal

Mahatma Gandhi Science College

Armori, Gadchiroli.

PRINCIPAL

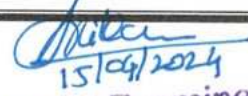
M. G. Arts, Science &

Late N. P. Commerce College

ARMORI, Dist. Gadchiroli



Internal Examiner



External Examiner

DECLARATION

I here declare that, the piece of work presented in the project entitled "**TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR ARMORI, DISTRICT-GADCHIROLI, MAHARASHTRA, INDIA**" has been carried out under the guidance of Prof. Dhammadip Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli.

The work presented in this dissertation has not been submitted in part or in full, for any degree, diploma or a certificate to any University.

Place :- Armori

Date :- 15/04/2024


Miss. Shubhangi R. Thakare

M.SC. II Year

(SEM.IV)

ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of **Prof. Dhammadip Sahare** sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to be insufficient to express my gratitude towards him, which will remain inhibited in my memory and carrier. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provided in the department by him have given impetus to work on a challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestion on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmates Mamta D. Kalbande, Khushabu Sahare, Tejashwini, the entire laboratory, library, office bearers of the department for their complete cooperation throughout the completion of my project.


Miss. Shubhangi R. Thakare

M.Sc. II Year

(Semester - IV)

Sr. No.	Contents
1	Introduction
2	ReviewOfLiterature
3	MaterialsAndMethods
	A)StudyArea
	B)SamplingMethod
4	ObservationAndResult
5	Discussion
6	Conclusion
7	References

**“Study of Diversity of Ants (Hymenoptera: Formicidae) in and
Around Armori City of District. Gadchiroli, Maharashtra,
India”**

PROJECT REPORT SUBMITTED

To

GONDWANA UNIVERSITY GADCHIROLI

FOR THE DEGREE OF

MASTER OF SCIENCE (ZOOLOGY)

SUBMITTED BY

MISS PRATIMA Y. DHAKATE

(M.Sc. Zoology Sem -IV)

UNDER THE SUPERVISOR OF

PROF. S.B. KUMRE

Assistant Professor

P. G. Department of Zoology

Mahatma Gandhi Arts, Science & Late. N. P. Commerce

College Armori, Dist. Gadchiroli

2023-2024

DECLARATION

I declare that this project work of "STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" was done by me in M.G. Arts science and Late N. P. Commerce collage, Armori during the academic session 2023-2024 this project work has not been submitted earlier to any university or institution for the award of any diploma or a degree.

Place: Armori

Date: 15/04/2024



Miss: Pratima Y. Dhakate
(M.SC. ZOOLOGY SEM IV)

CERTIFICATE

This is to certify that Miss Pratima Y. Dhakate has carried out this project work on the topic entitled "STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" during the academic session 2023-24 under my supervision in the post Graduate Department of Zoology, M. G. Arts Science and Late N. P. Commers College, Armori this research work presented in this project is the own work of the candidate.

Pratima

Miss. pratima Y. Dhakate
(M.Sc II Year sem-IV)

Place: Armori

Date: 15/04/2024

S.B.

Prof. S. B. Kumre
(supervisor)

J.N.

Dr. J.N. Papadkar
(Head)
HEAD
Dept. of Zoology
M. G. College, Armori

J.N.

Internal Examiner

J.N.
15/04/2024

External Examiner

Mahatma Gandhi Arts, Science & Late. N. P. Commerce College Armori,

Dist. - Gadchiroli

2023 - 2024

CERTIFICATE

This is to certify that Miss Pratima Y. Dhakate has carried out this project work on the epic entitled **“STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA”** during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Pratima Y. Dhakate

Miss. Pratima Y. Dhakate
(M.Sc II year Sem IV)

Place: Armori

Date: 15/04/2024

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGMENTS

I would like to thank sincerely to my supervisor Prof. S. B. Kumre professor P. G. Department of Zoology M.G. Arts Science and Late. N. P. Commers College Armori not only guided me in my project but also Unlimited help provided to me in this constructive project work.

I express my special thanks to the principal of the college Dr. Lalsingh Khalsa and the head of Department of zoology Dr. J. N. Papadkar for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in my day-to-day work. I also like to thank my family to support me in every decision to study. I also take this opportunity to convey my graduate to my friends of the M.Sc. group for giving me support in every step provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude toward my all well- wishers.

CONTENT

Chapter No.	Chapter Name	Page No.
I	Introduction	1-3
II	Review of Literature	4-6
III	Material and Methods	7
IV	Photo Plate A	8
V	Photo Plate B	9-10
VI	Observation	11-14
VII	Graph	15
VIII	Result and Discussion	16
IX	Conclusion	17
X	References	18-23

INTRODUCTION



STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA

INTRODUCTION:

Ants are highly organized and social insects belonging to the family Formicidae, within the order Hymenoptera, which also includes bees and wasps. They are found on every continent except Antarctica, inhabiting a wide range of ecosystems, from forests and grasslands to urban areas. With over 12,000 known species, ants are one of the most successful groups of organisms on Earth.

These tiny creatures exhibit remarkable social behavior, living in colonies that can vary in size from just a few individuals to millions. Within a colony, ants are divided into different castes, each with specific roles and responsibilities. These castes typically include queens, workers, and sometimes soldiers.

The queen is the reproductive center of the colony, responsible for laying eggs. Workers, which are sterile females, perform various tasks such as foraging for food, caring for the young, and maintaining the nest. Soldiers, found in some species, defend the colony against threats.

Ants communicate through a combination of chemical signals, known as pheromones, and physical movements. This communication allows them to coordinate their activities effectively, such as finding food sources or defending the colony.

Ants are omnivorous, feeding on a wide range of organic matter, including other insects, nectar, seeds, and even fungi. Some species are known for their agricultural behavior, cultivating fungi as a food source.

Their ecological importance cannot be overstated. Ants play crucial roles in ecosystem functioning, such as seed dispersal, nutrient recycling, and pest control.

Despite their small size, ants have a significant impact on human societies. While some species are beneficial, others can be agricultural pests or household nuisances, invading homes and causing damage.

**REVIEW OF
LITERATURE**

REVIEW OF LITERATURE:

Ants are diverse organisms that have an impact on their surrounding environment (Hölldobler and Wilson 1990, Andersen and Sparling 1997, Majer and Nichols 1998, Peck *et al.* 1998, Lobry de Bruyn 1999, Agosti *et al.* 2000). They are one of the dominant organisms on land (Agosti *et al.* 2000). If all the world's ants were combined, it is estimated that they would weigh about as much as all human beings (Hölldobler and Wilson 1994). They also participate in every part of the trophic system (Carroll and Janzen 1973, Trager 1998). They play a major role in dispersing seeds for many plant species (Berg 1975, Beattie, 1985, Willson *et al.* 1990), are the chief predators of insects and other arthropods (Mirenda *et al.* 1980, Youngs 1983, Porter and Savignano 1990), and other invertebrates (Whitcomb *et al.* 1973, Jackson *et al.* 1998), and vertebrates' prey on them for food (Milne and Milne 1950, Taigen and Pough 1983, Reiss 2001). Ants circulate and aerate more soil in the tropics than do earthworms, thus moving nutrients throughout the landscape (Lobry de Bruyn and Conacher 1990, Hölldobler and Wilson 1994). In a study of *Formica cinereamontana* Emery, (Baxter and Hole 1967) found that mineral soil in the upper half to two-thirds of a representative mound consists of about 85% B horizon material.

In their respective studies, Wheeler (1917), Weber (1943), and Gregg (1963) each conducted research on mountain ants in different regions: North America, Sudan, and Colorado, respectively. They specifically focused on observing ants inhabiting elevations exceeding 2000 meters. Fisher (1996a & b, 1997, 1998, 1999, 2002) conducted extensive research on ant diversity patterns along an elevational gradient in Madagascar and RNI d'Andringitra. His findings suggested that species richness reaches its peak at mid-elevation. This peak could be attributed to the amalgamation of two distinct ant assemblages from lower and montane forests.

In their study, Brühl *et al.* (1998) examined the stratification of ants within a primary rainforest in Sabah, Borneo. Their observations revealed a dominance of Myrmicinae (39.9%), followed by Formicinae (31.5%), Ponerinae (11.5%), and Dolichoderinae (10.2%). In a subsequent study, Brühl *et al.* (1999) investigated the altitudinal distribution of leaf litter ants along a transect in the primary rainforest of Mount Kinabalu. The ant fauna observed along the gradients comprised 283 species from 55 genera. Sampling was conducted at various altitudes, specifically at 560, 800, 1130, 1360, 1740, 1930, 2025, 2300, and 2600 meters above mean sea level. The number of ant species decreased exponentially without evidence of a peak in species richness at mid-elevation. In their study, Ali and Ganeshaiah (1998) endeavored to map the diversity of ants and root grubs primarily using data obtained from various institutes across India. They concluded that such maps hold significant

MATERIAL AND METHODS

MATERIALS AND METHOD

Sampling spots and habitat: Intensive ant samples were collected from different ecological habitats such as human, vegetative, agricultural, and dry land in and around Armori Tehsil, Maharashtra, India.

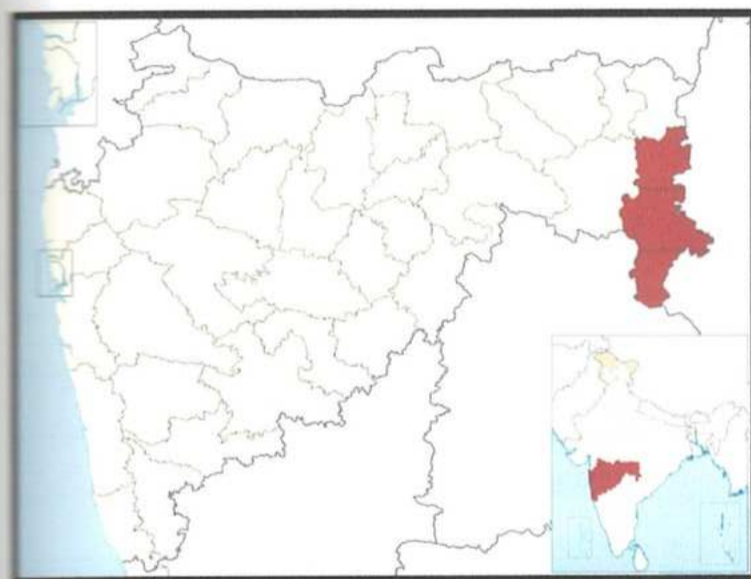
Field work was carried out in and around Armori Tehsil. Armori is between 20°28'0" N and 79°59'0" E, located in eastern Maharashtra, Gadchiroli district is a large historic town and an administrative capital of the same name district, with about 55,000 people living there. The city is famous with its university, established in 2011. There are also a few junior and senior colleges in the town. Tourist attractions include Vairagad Fort, Markhanda Temple, Chapral Wildlife Sanctuary, Five Crved Stones, etc. Human activities are nearly nil from this area. is region of forest having large number of trees, shrubs, grass-es and good canopy cover. Forest has high litter content as that of disturbed forest site.

Methodology: For this study Ants were sampled from month January to March 2024, samples were collected between 8 a.m. to 10 a.m. and 3 p.m. to 5 p.m. at 15-day intervals. Because, mornings and evenings gave best results for all out-search method. The information about Date and time of collection, habitat, locality, was also recorded at the time of collection. The direct and indirect sampling technique was applied for ant collection. The direct sampling includes AOS (All out search), where ant samples are randomly collected through hand collection using forceps and brush.

The ant samples collected are taken in the killing jar and then preserved in 70% alcohol, or the ant sample is directly taken in the 5-ml vial containing 70% alcohol. An indirect sampling includes pitfall and bait traps. The baits used are peanut butter, sugar solution, honey solution, and cookies. The collected ant specimens are cleaned and preserved in 70% alcohol.

Identification of the species of Ants: Later the preserved specimens are pinned and labelled for further identification. Ant samples were examined under stereo zoom binocular microscope, and the photographs of Ants were used for the identification of the species of Ants. Color patterns, sizes and shapes as well as their designs were considered in identification of the species of Ants with the help of entomologist expert and relevant available literature as well as photographs.

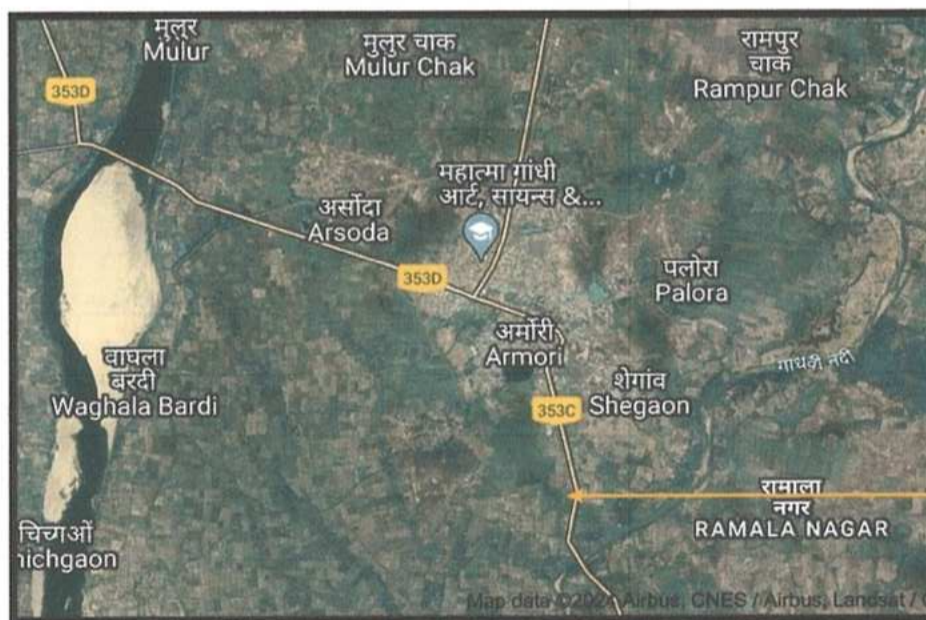
Photo Plate-A



Map of Maharashtra, Gadchiroli



Map of Gadchiroli District



Satellite map of Armori

Fig. 1 Map of Study Area, Armori Dist. Gadchiroli, Maharashtra, India

OBSERVATION

OBSERVATION:

During the study, ten species were recorded in and around Armori area, Dist. Gadchiroli, represented in the following table.1

Table 1. Ant Species recorded from Armori, Dist. Gadchiroli.

Sr. No.	Name of Species	Classification	Description
1	<i>Wasmannia auropunctata</i>	Kingdom: Animalia Phylum: Arthropoda Class: Insecta Order: Hymenoptera Family: Formicidae Subfamily: Myrmicinae Genus: <i>Wasmania</i> Species: <i>W. auropunctata</i>	The little fire ant (<i>Wasmannia auropunctata</i>), also known as the electric ant, light to golden brown (ginger) social ant. The ants are typically small to medium-sized, with the workers ranging from 1-2 mm. It is light to golden brown in color. The gaster is often darker. The pedicel, between the thorax and gaster, has two segments; the petiole and postpetiole. The petiole is "hatchet-like", with a node that is almost rectangular in profile and higher than the postpetiole. The antennae have 11 segments, with the last two segments greatly enlarged into a distinct club.
2	<i>Camponotus ligniperda</i> ,	Kingdom: Animalia Phylum: Arthropoda Class: Insecta Order: Hymenoptera Family: Formicidae Subfamily: Formicinae Genus: <i>Camponotus</i> Species: <i>C. ligniperda</i>	<i>Camponotus ligniperda</i> , the brown-black carpenter ant, is a common species of carpenter ant distributed widely throughout Europe. Found in a variety of woodland habitats, they commonly nest on the ground in dry tree stumps, dead fallen trees, or beneath stones and wooden logs that are partially buried. <i>C. ligniperda</i> is an ecologically dominant species wherever it is found due to both its large size and particularly aggressive nature

RESULT AND DISCUSSION

RESULT AND DISCUSSION

During our research, we cataloged ten species of ants spanning three distinct families: Myrmicinae, Formicinae, and Dolichoderinae. Among these, Myrmicinae showcased the highest diversity, notably dominated by various species of *Crematogaster*. Within Myrmicinae, we identified 6 genera and 10 species, followed by Formicinae with 3 genera and 8 species, and Dolichoderinae with 1 genus and 3 species. Noteworthy, *Crematogaster* and *Camponotus* emerged as the most prolific genera. The species *Oecophylla smaragdina* held the highest frequency, appearing independently 37 times, followed by *Pheidole* with 32 occurrences. Furthermore, *Crematogaster* (42 occurrences) and *Camponotus* (40 occurrences) were sighted in eight transects each. Additionally, several other genera such as *Wasmannia* (12), *Polyrhachis* (10), *Tetramorium* (8), *Tapinoma* (7), *Monomorium* (7), and *Solenopsis* (6), occurrence were observed.

Dominance of Myrmicinae in terms of diversity was common at Maharashtra Nature Park. Dominance of Myrmicinae at urban sites was also recorded by, Kumar and Mishra (2008) at Vadodara, Barve and Davidar (2008) at Bangalore, Chavhan and Pawar (2011) at Amravati and Bhagat *et al.*, (2008) at IIT Campus, Mumbai.

Regarding nesting behavior, nine ant species' nests were observed in the Armori area. *Tetraoponera rufonigra*, the arboreal bicoloured ant is reported to nest in dead wood of trees and posts (Narendra and Kumar, 2006). During this study, it showed lignicolous nests in Armori. Similar observations were recorded by Arnarasinghe, (2006). Kumar and Mishra (2008), observed its nesting on *Caesalpinia crista* at Vadodara. Few other ant species also showed arboreal nesting. Narendra and Kumar, (2006) stated that feathers are taken for nests decoration.

We observed *Crematogaster* sp as one of the species taking feathers in arboreal nest on *Barringtonia* tree. However, these feathers contrary to the observation of Narendra and Kumar (2006) were not being used for decoration of the nest entrance to act as visual signal; but the feathers were taken inside the nest, the reason is unknown and needs further study.

In Armori, various ant species were observed in association with plants, either for foraging or nesting purposes. Several species of *Crematogaster* ants and generalist species were noted to associate with plants for shelter or food, with four species demonstrating high adaptability and associating with a maximum number of trees.

CONCLUSION

CONCLUSION

Ants fulfill numerous ecological functions, providing various benefits to humans, including the control of insect populations. Their widespread distribution and significant biomass make them essential components of terrestrial ecosystems. Among social insects, ants exhibit remarkable diversity. They contribute significantly to ecosystem health by enhancing soil quality, aiding in decomposition, and serving as indicators of environmental conditions due to their mutualistic interactions with plants and animals. Over time, Maharashtra state has experienced substantial transformations, reflecting the diversity of ant species and serving as a microcosm illustrating habitat persistence.

REFERENCES

REFERENCES

- ABERA-KALIBATA, A. M., GOLD, C. S., & VAN DRIESCHE, R. (2008).** Experimental evaluation of the impacts of two ant species on banana weevil in Uganda. *Biological Control*, 46(2), 147-157.
- AGOSTI, D., & ALONSO, L. E. (2000).** The ALL protocol. ANTS: standard methods for measuring and monitoring biodiversity. Smithsonian Institution Press, Washington DC, 204-206.
- ALI, T. M. (1991).** Ant fauna of Karnataka-1. *Newsletter of IUSSI Indian Chapter*, 5(1-2), 1-8.
- ALI, T. M. (1992).** Ant fauna of Karnataka-2. *Newsletter of IUSSI Indian Chapter*, 6(1-2), 1-9.
- ALONSO LE.** Ant conservation: current status and a call to action. *Ant ecology*. 2010:59-74.
- ANDERSEN, A. N., & SPARLING, G. P. (1997).** Ants as indicators of restoration success: relationship with soil microbial biomass in the Australian seasonal tropics. *Restoration ecology*, 5(2), 109-114.
- ANTONY A, G. PRASAD, MANOJ KRIPAKARAN, RACHEL JACOB (2018)** First record of six new species of ants (Hymenoptera: Formicidae) from Kerala. *International Journal of Entomology Research* ISSN: 2455-4758 Volume 3; Issue 1; January 2018; Page No. 78-81.
- ANU, A., & SABU, T. K. (2007).** Biodiversity analysis of forest litter ant assemblages in the Wayanad region of Western Ghats using taxonomic and conventional diversity measures. *Journal of Insect Science*, 7(1), 6.
- ARAÚJO, L. M., & FERNANDES, G. W. (2003).** Altitudinal patterns in a tropical ant assemblage and variation in species richness between habitats. *Lundiana: International Journal of Biodiversity*, 4(2), 103-109.
- ARMBRECHT I, PERFECTO I.** Litter-twig dwelling ant species richness and predation potential within a forest fragment and neighboring coffee plantations of contrasting habitat quality in Mexico. *Agriculture, ecosystems & environment*. 2003;97(1-3):107-15.
- HÖLLDOBLER, B., & WILSON, E. O. (1990).** The ants. Harvard University Press.
- BALACHANDAR (2017)** Diversity and distribution of Ant species (Hymenoptera: formicidae), in Pachaiyappa's college Kanchipuram, Tamil Nadu, India. *Journal of Entomology and Zoology Studies*. Volume 5, Issue 1, 459-464. E-ISSN: 2320-7078.

**“Study of Diversity of Ants (Hymenoptera: Formicidae) in and
Around Armori City of District. Gadchiroli, Maharashtra,
India”**

PROJECT REPORT SUBMITTED

To

GONDWANA UNIVERSITY GADCHIROLI

FOR THE DEGREE OF

MASTER OF SCIENCE (ZOOLOGY)

SUBMITTED BY

MISS VAISHNAVI A. MESHRAM

(M.Sc. Zoology Sem -IV)

UNDER THE SUPERVISOR OF

PROF. S.B. KUMRE

Assistant Professor

P. G. Department of Zoology

Mahatma Gandhi Arts, Science & Late. N. P. Commerce

College Armori, Dist. Gadchiroli

2023-2024

DECLARATION

I declare that this project work of "STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" was done by me in M.G. Arts science and Late N. P. Commerce collage, Armori during the academic session 2023-2024 this project work has not been submitted earlier to any university or institution for the award of any diploma or a degree.

Place: Armori

Date: 15/04/2024

V.A. Meshram
Miss: Vaishnavi A. Meshram
(M.SC. ZOOLOGY SEM IV)

CERTIFICATE

This is to certify that Miss Vaishnavi A. Meshram has carried out this project work on the topic entitled "STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" during the academic session 2023-24 under my supervision in the post Graduate Department of Zoology, M. G. Arts Science and Late N. P. Commers College, Armori this research work presented in this project is the own work of the candidate.

V.A. Meshram
Miss. Vaishnavi A. Meshram
C.M.Sc II year Sem-IV

Place: Armori

Date: 15/04/2024

S.B. Kumre
Prof. S. B. Kumre
(supervisor)

J.N. Papadkar
Dr. J.N. Papadkar
(Head)
HEAD
Dept. of Zoology
M. G. College, Armori

J.N. Papadkar
Internal Examiner

A. K. Kulkarni
15/04/2024
External Examiner

Mahatma Gandhi Arts, Science & Late. N. P. Commerce College Armori,

Dist. - Gadchiroli

2023 – 2024

CERTIFICATE

This is to certify that Miss Vaishnavi A. Meshram has carried out this project work on the epic entitled “**STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA**” during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date: 15/04/2024

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGMENTS

I would like to thank sincerely to my supervisor Prof. S. B. Kumre professor P. G. Department of Zoology M.G. Arts Science and Late. N. P. Commers College Armori not only guided me in my project but also Unlimited help provided to me in this constructive project work.

I express my special thanks to the principal of the college Dr. Lalsingh Khalsa and the head of Department of zoology Dr. J. N. Papadkar for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in my day-to-day work. I also like to thank my family to support me in every decision to study. I also take this opportunity to convey my gratitude to my friends of the M.Sc. group for giving me support in every step provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude toward my all well-wishers.

CONTENT

Chapter No.	Chapter Name	Page No.
I	Introduction	1-3
II	Review of Literature	4-6
III	Material and Methods	7
IV	Photo Plate A	8
V	Photo Plate B	9-10
VI	Observation	11-14
VII	Graph	15
VIII	Result and Discussion	16
IX	Conclusion	17
X	References	18-23

**“Study of Diversity of Ants (Hymenoptera: Formicidae) in and
Around Armori City of District. Gadchiroli, Maharashtra,
India”**

PROJECT REPORT SUBMITTED

To

GONDWANA UNIVERSITY GADCHIROLI

FOR THE DEGREE OF

MASTER OF SCIENCE (ZOOLOGY)

SUBMITTED BY

MISS Pallavi P. Kawale

(M.Sc. Zoology Sem -IV)

UNDER THE SUPERVISOR OF

PROF. S.B. KUMRE

Assistant Professor

P. G. Department of Zoology

Mahatma Gandhi Arts, Science & Late. N. P. Commerce

College Armori, Dist. Gadchiroli

2023-2024

DECLARATION

I declare that this project work of "STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" was done by me in M.G. Arts science and Late N. P. Commerce collage, Armori during the academic session 2023-2024 this project work has not been submitted earlier to any university or institution for the award of any diploma or a degree.

Place: Armori

Date: 15-04-2024

P.P. Kawale.
Miss: Pallavi P. Kawale
(M.SC. ZOOLOGY SEM IV)


CERTIFICATE


This is to certify that Miss Pallavi P. Kawale has carried out this project work on the topic entitled "STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" during the academic session 2023-24 under my supervision in the post Graduate Department of Zoology. M. G. Arts Science and Late N. P. Commers College, Armori this research work presented in this project is the own work of the candidate.

p.p.kawale
Miss. pallavi p. kawale
(M.Sc II year sem IV)

Place: Armori

Date: 15-04-2024


Prof. S. B. Kumre
(supervisor)


Dr. J.N. Papadkar
HEAD
Dept. of Zoology
M. G. College, Armori


Internal Examiner


15/04/2024
External Examiner

Mahatma Gandhi Arts, Science & Late. N. P. Commerce College Armori,

Dist. - Gadchiroli

2023 - 2024

CERTIFICATE

This is to certify that Miss Pallavi P. Kawale has carried out this project work on the epic entitled **“STUDY OF DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN AND AROUND ARMORI CITY OF DISTRICT GADCHIROLI, MAHARASHTRA, INDIA”** during the academic session 2023-24. Under my supervision in the Post Graduate Department of Zoology M. G. Arts Science and Late. N. P. Commerce College Armori this research work presented in this project is own work of the candidate.

Place: Armori

Date: 15-04-2024

**Dr. L. H. Khalsa
(Principal)
Mahatma Gandhi College,
Armori.**

ACKNOWLEDGMENTS

I would like to thank sincerely to my supervisor Prof. S. B. Kumre professor P. G. Department of Zoology M.G. Arts Science and Late. N. P. Commers College Armori not only guided me in my project but also Unlimited help provided to me in this constructive project work.

I express my special thanks to the principal of the college Dr. Lalsingh Khalsa and the head of Department of zoology Dr. J. N. Papadkar for constant support and providing necessary facilities.

I am so much thankful to the non-teaching staff for their valuable help in my day-to-day work. I also like to thank my family to support me in every decision to study. I also take this opportunity to convey my graduate to my friends of the M.Sc. group for giving me support in every step provided the physical and moral support without support this project work would not have been materialized.

Lastly, my sincere gratitude toward my all well- wishers.

CONTENT

Chapter No.	Chapter Name	Page No.
I	Introduction	1-3
II	Review of Literature	4-6
III	Material and Methods	7
IV	Photo Plate A	8
V	Photo Plate B	9-10
VI	Observation	11-14
VII	Graph	15
VIII	Result and Discussion	16
IX	Conclusion	17
X	References	18-23

**"TO STUDY BIODIVERSITY AND SUSTAINABLE
MANAGEMENT OF LAKE BHANDARA DISTRICT
MAHARASTRA, INDIA"**

A PROJECT REPORT

SUBMITTED TO
GONDWANA UNIVERSITY OF GADCHIROLI

IN PARTIAL FULFILMENT FOR
DEGREE OF MASTER OF SCIENCE IN ZOOLOGY



SUBMITTED BY

Miss. Naz fatima Nasir Qureshi

M.Sc.II (Semester IV)

SUPERVISOR

Prof. Dr. JAYESH N. PAPADKAR

Assistant Professor

GUIDED BY

Prof. DHAMMADIP SAHARE

Assistant Professor

2023 - 2024

PG DEPARTMENT OF ZOOLOGY

Mahatma Gandhi College Of Arts And Science

Armori Dist: Gadchiroli

DECLARATION

I declare that project "TO STUDY BIODIVERSITY AND SUSTAINABLE

MANAGEMENT OF LAKE BHANDARA DISTRICT MAHARASHTRA , INDIA"

was done by me in Mahatma Gandhi Art , Science late N.P. commerce college , Armori during the academic session 2023 – 2024 . This project work has not been submitted earlier to any University or institution for the award of any diploma or a degree .

Date : 15-04-2024

Place : Armori




Miss. Naz fatima Nasir
Qureshi.
(M.Sc.II semester IV)

C E R T I F I C A T E


This to certify **Miss. Naz fatima Nasir Qureshi** has carried out his project work on the topic entitled " **TO STUDY BIODIVERSITY AND SUSTAINABLE MANAGEMENT OF LAKE BHANDARA DISTRICT MAHARASHTRA, INDIA**" during the academic session 2023 - 2024 under my supervision in the Post Graduate Department Of Zoology .M.G Art Science and late N.P . Commerce College Armori .This research work presented in this project is own work of the candidate .

Date : 15-04-2024

Place : Armori

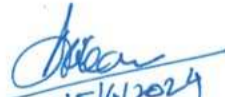

Prof. Jayesh N. Papadkar
(Project Supervisor)
Department Of Zoology

Forwarded


Dr. J. N. Papadkar
HEAD
Dept. of Zoology
HOD, Department Of Zoology
M. G. College, Armori
M.G. Art Science And Late N. P Commerce College
Armori Dist: Gadchiroli


PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli


Internal Examiner


15/4/2024
External Examiner

ACKNOWLEDGEMENT

I express my deep sense of gratitude and sincere thanks to my supervisor professor J.N. Papadkar department of zoology M.G. Art Science and Late N. P Commerce College , Armori Gondwana University Gadchiroli for his valuable guidance ,constant encouragement and keep interest in the development of this work . I am very grateful to Dr. Lalsingh Khalsa , Principal M.G. Art Science and Late N. P Commerce College , for providing lab and necessary equipment for this project . I am much grateful to Prof. J. N. Papadkar , Department Of Zoology M.G. Art Science and Late N. P Commerce College for their cordial support, valuable information and guidance , which helped me in completing this task through various stages and also thanks to all faculty members who have given me inspiration and advice during the course of the work . Last but not the least , no words can explain my feelings towards the person behind the success , support and understanding from, my family and my friends , non-teaching staff during my research study . They are my strength to strive for excellence . They have always supported me during the course of my life .

Date: 15-04-2024

Place : Armori.

Miss. Naz fatima Nasir

Qureshi.

M.Sc II (Sem IV)

Introduction

Biodiversity is the variation among living organisms from different sources including terrestrial, marine and desert ecosystems, and the ecological complexes of which they are a part (Jackson and Willson 2001). Biodiversity affects many ecosystem functions and services where mammalian communities play a significant role in maintaining ecological integrity. Mammals provide various ecosystem services that are crucial for human well-being ranging from maintaining energy flow and productivity through herbivory, predation and granivory to shaping other biodiversity and their habitats from pollination, seed dispersal, insect-pest control and ecosystem engineering (Lacher et al., 2019). Despite the crucial role of mammals in ecosystems, approximately 25% of mammals are threatened with extinction and the major threats to their survival are habitat loss and degradation, and biological resource extraction (Schipper et al., 2008; Ceballos et al., 2020). Many species of mammals went extinct in the last century and many more are on the verge of extinction (Ceballos et al., 2020). Biodiversity distribution is not limited to political boundaries. The conservation features such as the endangered species and their habitats are often spread over large spatial scales and cross multiple political boundaries (Kark et al., 2015; Liu et al., 2020; Mason et al., 2020). As many as 55.6% of all terrestrial mammals are distributed across national borders (Mason et al., 2020).

They are imperiled due to existing physical barriers, uncoordinated management and a lack of joint collaboration efforts among the neighboring countries (Liu et al., 2020; Mason et al., 2020; Thornton et al., 2018). Global initiatives such as the Convention on Biological Diversity (CBD, 2010, 1992), Intergovernmental Science-Policy Platform on Ecosystem Services (IPBES 2019), and Sustainable Development Goals (UN, 2015) all encourage the adoption of a landscape approach to avert biodiversity loss. Regional biodiversity conservation initiatives beyond national borders thus have gained momentum in recent years (Gurung et al., 2019; ICIMOD, 2009). The vast landscape at the easternmost part of the Himalayas that spans from north-west Yunnan of China to north-east India through northern Myanmar is among the most biologically and culturally diverse regions of the earth (CEPF, 2020; ICIMOD, 2015). The landscape is located at the confluence of two biogeographically realms; the Indo-Malayan realm in the lowlands and the elevated Palearctic realm to the north (Olson et al., 2001; WWF, 2012).

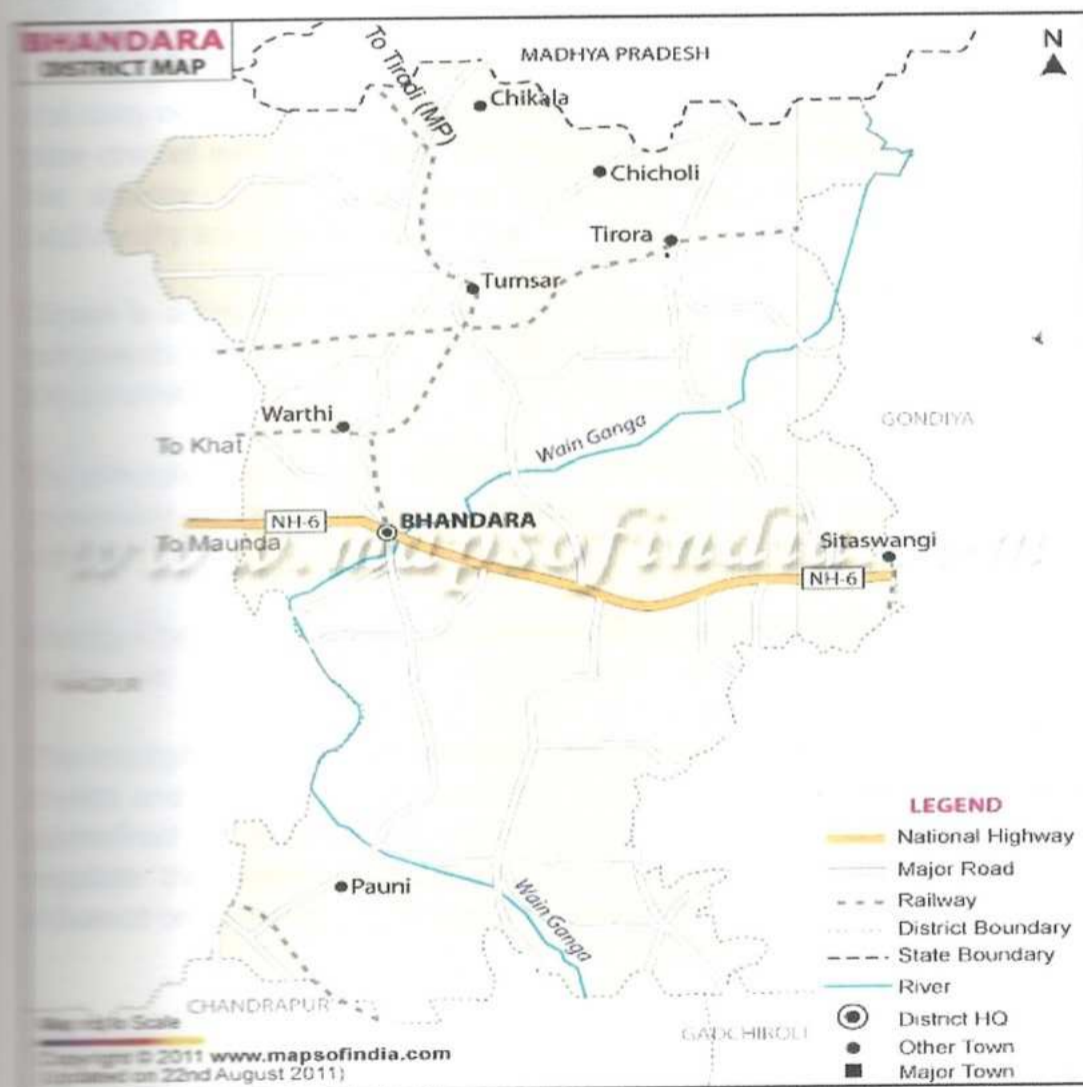
Review of Literature

We review the biodiversity and sustainable management of lake of bhandara district . Present study deals with the inventorization of fish species in District Bhandara of Maharashtra India. The study area is well known as a district of lakes. About 30 lakes, ponds, reservoir and some river habitats at rural and forests areas, are explored to collect the fish species and studied their habitat conditionss. In previous literature about 38 species are reported in the study area of which all are collected and reported in terms of low, moderate and optimum distribution according to their availability in the nearby markets. During study period 23 more species are collected from the rural water bodies. Identification of species is done by the literature of Day and Jairam. Mostly human interference in the lakes and rivers are mainly responsible for the less distribution of fishes, pollution load and intense hot climatic conditions affects the growth and distribution fishes. Pollution load during the months of summer turns the fish species to develop certain adaptations. The species having more adaptive capabilities showed more in quantities; however some fish fauna is going on the way of scrub down from the study area. Careless management of some lakes and river and agricultural practices in lakes and river basins pollutes the water which creates hazards for eggs and fries to grow up in the adult fishes. Use of certain manures and insecticides in the lake water harms the fish fauna.

Methodology

STUDY AREA

Bhandara is one of the major administrative districts in Maharashtra, and is located in the Nagpur division at $21^{\circ}10'N$ $79^{\circ}39'E$. The district is enveloped by Balaghat district of Madhya Pradesh in the north and Chandrapur in the south, smallest border with Gadchiroli in the southeast while Gondia and Nagpur mark its eastern and western borders respectively.



Observation

The study is carried out at Shivnibandh Lake of Sakoli Tehsil of Bhandara district in Maharashtra state in India. Study area is lies between 21.003397° N, 79.9903° E (Figure 1) is located near the forest corridor of NNTR, connecting Nagzira Wildlife Sanctuary in northern side and Navegaon National Park in eastern side in central Indian landscape[15]. Submerged area of Shivnibandh lake is 489.60 hectare and the irrigation potential is 1852 hectare. The adjoining forest is dry deciduous type. This is one of the Largest Wetland in Sakoli Tehsil of District Bhandara. Also, it is famous tourist spot located approximately 8 km from the Sakoli city in District Bhandara for its scenic beauty.

It has a mixed economy including agriculture, aquaculture, bricks manufacturing, lotus root removal etc.[16] Moreover, particularly both Bhandara and Gondia district is known for its Wetlands and Paddy fields (main agriculture crop), forest and mineral resources. Therefore, the study area has an ecologically enormous potential to carry out further research concerned. Several ancient temples and historical monuments, along with Lakes, Parks and Sanctuaries etc. Sakoli is well surrounded by hills, forest, lakes, ponds and rivers [15], [17], [18].



Observation

Shivnibandh Lake areas are subject to anthropogenic pressures, including transformation of catchment area into agricultural land, road construction, sedimentation into the wetland, and over exploitation of their natural resources. To separate the surface water using Geospatial technique from land and other features to mapping and assessment of the surface water correctly. NDWI based result shows that, during last three decades, surface area of water body of Shivnibandh Lake decreased from 304.65 Hectare to the 154.98 Hectare, which is suspected by NDWI based remote sensing and GIS

This wetland is suffered from encroachment for Agricultural practices in core and peripheral area and it is major issue at proposed site. Land acquisition by encroachment for Agricultural practices, construction of road in catchment area, cattle grazing, increase of invasive species, etc resulting into decrease in water holding capacity of wetland which causes sometimes flash flood at study site. Wetland dependency mainly for Irrigation of Agricultural practices, Fishing, Trapp cultivation, and its resource-based economy etc .

Shivnibandh lake not only contribute to the household economy of wetland depended group of people, but also become a vital source of livelihood for fishing communities to technique in 1989 and 2019 respectively During field visit at study site and discussion with local wetland dependent communities it is noticed that, local peoples are lack of awareness about wetlands resource as well as its potential values, its importance for livelihood of stakeholders and maintaining climatic sustainability too. Identified anthropogenic pressure study was conducted during field visit. Before some decade, the study area has more significantly rich aquatic flora and fauna. Therefore, the objective of this study is to assess and monitor of entire wetland status of shivnibandh lake in Sakoli Tehsil of Bhandara district in Maharashtra.

Discussion and Conclusion

Many of the wetlands in India supports the livelihood of thousands of people every day; however, an increasing population and encroachment is a major problem with concerned issues suggested the overall water bodies, its water holding capacity and areas are decreasing continuously.

The conclusion of this study is that the Shivnibandh Lake is facing severe problems due to anthropogenic pressure. Most of the nearby communities are dependent on wetland resources for their daily livelihoods and they are willing to conserve it in cooperation with the local administration people participation. Therefore, an inclusive and collaborative approach should be initiated to conserve this important wetland, without any compromising the interests of local peoples with the following recommendations: The inlet channel of the wetland should be cleaned to allow flowing rain water from forest, hills, etc by barrage to maintain

- the perennial source water for the maximum time. An immediate weed removal program should be undertaken in participative manner
- A clear-cut boundary demarcation should be made for the Shivnibandh Lake by local the administration.
- Illegal land acquisition, agriculture, land digging, waste disposal, and bird trapping in the wetland should be should be
- strictly prohibited. Conflicts among different sections of society for the utilization of the Shivnibandh Lake resources should be resolved.
- Awareness programs by NGO or Governmental level should be initiated to make people aware of the socio-economic
- importance and value addition of wetlands in society. Eco-tourism should be promoted to provide alternative livelihood options for local people.
- The sustainable use of water resources should be practice and it should be the part of conservation policy

References

- [1] D. J. Gilvear and C. Bradley, "Hydrological monitoring and surveillance for wetland conservation and management; a UK perspective," *Physics and Chemistry of the Earth, Part B: Hydrology, Oceans and Atmosphere*, vol. 25, no. 7-8, pp. 571-588, Jan. 2000, doi: 10.1016/S1464-1909(00)00068-X.
- [2] J. K. Garg, "Wetland assessment, monitoring and management in India using geospatial techniques," *Journal of Environmental Management*, vol. 148, pp. 112-123, Jan. 2015, doi: 10.1016/J.JENVMAN.2013.12.018.
- [3] N. Levin, E. Elron, and A. Gasith, "Decline of wetland ecosystems in the coastal plain of Israel during the 20th century: Implications for wetland conservation and management," *Landscape and Urban Planning*, vol. 92, no. 3-4, pp. 220-232, Sep. 2009, doi: 10.1016/J.LANDURBPLAN.2009.05.009.
- [4] J. G. Robinson, "The Limits to Caring: Sustainable Living and the Loss of Biodiversity," *Conservation Biology*, vol. 7, no. 1, pp. 20-28, Mar. 1993, doi: 10.1046/J.1523-1739.1993.07010020.X.
- [5] R. Dirzo and P. H. Raven, "Global State of Biodiversity and Loss," <https://doi.org/10.1146/annurev.energy.28.050302.105532>, vol. 28, pp. 137-167, Nov. 2003, doi: 10.1146/ANNUREV.ENERGY.28.050302.105532.
- [6] Y. Mu et al., "Rapid landscape assessment for conservation effectiveness of wetland national nature reserves across the Chinese mainland," *Global Ecology and Conservation*, vol. 31, Nov. 2021, doi: 10.1016/j.gecco.2021.e01842.
- [7] L.M.Rebelo,C.M.Finlayson,andN.Nagabhatla,"Remotesensingand GIS for wetland inventory, mapping and change analysis," *Journal of Environmental Management*, vol. 90, no. 7, pp. 2144-2153, May 2009, doi: 10.1016/J.JENVMAN.2007.06.027

**“TO STUDY FISH DIVERSITY OF RIVER WAINGANGA,
NEAR ARMORI, DISTRICT GADCHIROLI,
MAHARASHTRA, INDIA”**

**A Project Submitted To Gondwana University, Gadchiroli As
Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submitted by

Miss. KHUSHABU ASHOK SHAHARE

M.Sc. II year

(Semester IV)

Under The Guidance Of

**Dr. Jayesh Papadkar
(Assistant Professor)**

**Mr. Dhammadip Sahare
(Assistant Professor)**



**Post Graduate Teaching Department Zoology
Mahatma Gandhi Arts, Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**

2023-2024

CERTIFICATE

This is to certified that project entitle "TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR ARMORI, DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" submitted by Miss. Khushabu Ashok Shahare as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.

The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of science, Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place :- Armori

Date :- 15-04-2024

Miss. Khushabu A. Shahare
M.SC. II Year
(SEM. IV)

Dr. J. N. Papadkar
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

Prof. Dhammadip W. Sahare
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

Forwarded by

Dr. J. N. Papadkar
Head Of Department
Mahatma Gandhi Science College
Armori, Gadchiroli.
HEAD
Dept. of Zoology
M. G. College, Armori.

Dr. L. H. Khalsa
Principal
Mahatma Gandhi Science College
Armori, Gadchiroli.
PRINCIPAL
M. G. Arts, Science &
Commerce College
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli

Internal Examiner

External Examiner

DECLARATION

I here declare that, the piece of work presented in the project entitled "TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR ARMORI, DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" has been carried out under the guidance of Prof. Dhammadip Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli.

The work presented in this dissertation has not been submitted in part or in full, for any degree, diploma or a certificate to any University.

Place :- Armori

Date :- 15-04-2024



Miss. Khushabu A. Shahare

M.SC. II Year

(SEM. IV)


ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of Prof. Dhammadip Sahare sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to insufficient to express my gratitude towards him, which will remains inhibited in my memory and carrier. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provide in the department by him have given impetus to work on challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestion on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmates Mamta D. Kalbande, Shubhangi Thakare, Tejashwini, the entire laboratory, library, office bearers of the department for their complete cooperation throughout the completion of my project.


Miss. Khushabu A. Shahare
M.Sc. II Year
(Semester - IV)

Sr. No.	Contents
1	Introduction
2	Review Of Literature
3	Materials And Methods
	A) Study Area
	B) Sampling Method
4	Observation And Result
5	Discussion
6	Conclusion
7	References

**“TO STUDY POULTRY FARMING AND MANAGEMENT
SYSTEM IN POULTRY FARM, NEAR VAIRAGAD
TALUKA ARMORI, DISTRICT GADCHIROLI,
MAHARASHTRA, INDIA”**

**A Project Submitted To Gondwana University, Gadchiroli As
Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submitted by

Miss. RASHMI DILIP NANDESHWAR

M.Sc. II year

(Semester IV)

Under The Guidance Of

**Dr. Jayesh Papadkar
(Assistant Professor)**

**Mr. Dhammadip Sahare
(Assistant Professor)**



**Post Graduate Teaching Department Zoology
Mahatma Gandhi Arts, Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**


CERTIFICATE


This is to certified that project entitle "TO STUDY POULTRY FARMING AND MANAGEMENT SYSTEM IN POULTRY FARM, NEAR VAIRAGAD, TALUKA ARMORI, DISTRICT GADCHIROLI, MAHARASHTRA, INDIA" submitted by Miss. Rashmi Dilip Nandeshwar as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.


The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of science, Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place :- Armori


Date :- 15-04-24



Miss. Rashmi Dilip Nandeshwar
M.SC. II Year
(SEM. IV)



Dr. J. N. Papadkar
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

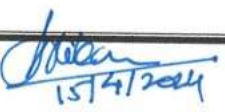

Prof. Dhammadip W. Sahare
Project Supervisor
Department of Zoology
Mahatma Gandhi Science College Armori

Forwarded by


Dr. J. N. Papadkar
Head Of Department
Mahatma Gandhi Science College
Armori, Gadchiroli.
HEAD
Dept. of Zoology
M. G. College. Armori


Dr. L. H. Khalsa
Principal
Mahatma Gandhi Science College
Armori, Gadchiroli.
PRINCIPAL
M. G. Arts, Science &
Late N. P. Commerce College
ARMORI, Dist. Gadchiroli


Internal Examiner


External Examiner

DECLARATION

I here declare that, the piece of work presented in the project entitled " To study poultry farming and management system in poultry farm ,near vairagad ,taluka armori , dist. Gadchiroli (M.S.) India " has been carried out under the guidance of Prof. Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli.

The work presented in this dissertation has not been submitted in part or in full, for any degree , diploma or a certificate to any University.

Place :- Armori

Date :- 15-04-24


Miss. Rashmi D. Nandeshwar

M.SC. II Year

(SEM. IV)

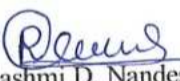
ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of **Prof. Dhammadip Sahare** sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to insufficient to express my gratitude towards him, which will remains inhibited in my memory and carrier. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provide in the department by him have given impetus to work on challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestion on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmates Chhagan B. Bodane, Komal Y. Bharre, the entire laboratory, library, office bearers of the department for their complete cooperation throughout the completion of my project.


Miss. Rashmi D. Nandeshwar
M.Sc. II Year
(Semester - IV)

2023-2024

Sr. No.	Contents
1	Introduction
2	Review Of Literature
3	Materials And Methods
	A)Study Area
	B)Sampling Method
4	Observation And Result
5	Discussion
6	Conclusion
7	References

**“TO STUDY FISH DIVERSITY OF RIVER WAINGANGA,
NEAR ARMORI, DISTRICT- GADCHIROLI,
MAHARASHTRA,INDIA”**

**A Project Submitted To Gondwana University,Gadchiroli
As Partial Fulfilment Of The Requirement For Degree Of**

Master of Science

In zoology

Submittedby

Miss.Tejashwini D.Kurzekar

M.Sc. II year

(SemesterIV)

Under The Guidance Of

**Dr. Jayesh Papadkar
(Assistant Professor)**

**Mr.Dhammadip Sahare
(Assistant Professor)**



**Post Graduate Teaching Department Zoology
Mahatma Gandhi Arts,Science & Late N.P Commerce
College Armori, Dist. Gadchiroli (M.S.)**

2023-2024

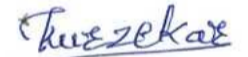
CERTIFICATE

This is to certified that project entitle "TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR-ARMORI, DISTRICT-GADCHIROLI, MAHARASHTRA, INDIA" submitted by Miss. Tejashwini D. Kurzekar as partial fulfillment of the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) to Gondwana university, gadchiroli. It is bonafide research work carried out by her under my supervision and guidance.

The project fulfilment for the requirement pertaining to the nature and standard of work for the M.Sc. Degree (Zoology) in the faculty of science, Gondwana university. The work embodied in this project has not been submitted for any degree or diploma.

Place:- Armori

Date :- 15/04/2024



Miss. Tejashwini D. Kurzekar

M.Sc. II Year

(SEM. IV)



Dr. J. N. Papadkar

Project Supervisor

Department of Zoology

Mahatma Gandhi Science College, Armori



Prof. Dhamadip W. Sahare

Project Supervisor

Department of Zoology

Mahatma Gandhi Science College, Armori

Forwarded by



Dr. J. N. Papadkar

Head Of Department

Mahatma Gandhi Science College

Armori, Gadchiroli.

HEAD

Dept. of Zoology

M. G. College. Armori



Dr. L. H. Khalsa

Principal

Mahatma Gandhi Science College

Armori, Gadchiroli.

PRINCIPAL

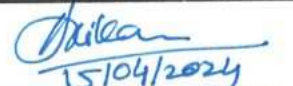
M. G. Arts, Science &

Late N. P. Commerce College

ARMORI, Dist. Gadchiroli



Internal Examiner



External Examiner

DECLARATION

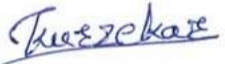
I here declare that, the piece of work presented in the project entitled "**TO STUDY FISH DIVERSITY OF RIVER WAINGANGA, NEAR ARMORI, DISTRICT-GADCHIROLI, MAHARASHTRA, INDIA**" has been carried out under the guidance of Prof. Dhammadip Sahare sir Department of zoology , M.G. College Armori.

The work was carried out at the M.G. College Armori and Submitted for the partial fulfillment for the degree in master of science, Gondwana University Gadchiroli.

The work presented in this dissertation has not been submitted in part or in full, for any degree, diploma or a certificate to any University.

Place :- Armori

Date :- 15/04/2024


Miss. Tejashwini D. Kurzekar
M.SC. II Year
(SEM.IV)

ACKNOWLEDGMENT

It gives me an immense pleasure to have worked under the valuable guidance of **Prof. Dhammadip Sahare** sir, Post graduate teaching Department of Zoology, Gondwana University, Gadchiroli. Right from the selection of topic to the completion of project, he was always been a guiding factor which was a great source of inspiration and motivation for me to undertake such a challenging project.

The test is always going to be insufficient to express my gratitude towards him, which will remain inhibited in my memory and career. His valuable suggestion and constructive criticism have come very handy during the time of distress and disappointment. Her conforming words and moral support have led to the successful completion of the project. Her aptitude to achieve excellence and uncompromised attitude for the minutest of details has made me to work systematically with total dedication. The infrastructure and the facilities provided in the department by him have given impetus to work on a challenging project.

I extended my thanks also to Prof. Dhammadip Sahare sir who has always been supportive with his always ready to help nature during the difficulties and suggestions on the project which made the challenge to achieve this project quite easier.

I also thank Prof. Dhammadip Sahare Sir My Classmates Mamta D. Kalbande, Shubhangi Thakare, Khushbu Sahare, the entire laboratory, library, office bearers of the department for their complete cooperation throughout the completion of my project.

Tejashwini D. Kurzekar

Miss. Tejashwini D. Kurzekar

M.Sc. II Year

(Semester - IV)

Sr. No.	Contents
1	Introduction
2	Review Of Literature
3	Materials And Methods
	A) Study Area
	B) Sampling Method
4	Observation And Result
5	Discussion
6	Conclusion
7	References