SCHOOL OF EARTH, OCEAN AND ATMOSPHERIC SCIENCES

GOA UNIVERSITY

Exam: Roll No: 21P045006

LABORATORY CERTIFICATE

This is to certify that Mr. ~~Ms.~~ Avdrich D'souza has satisfactorily completed the course of practical for M.Sc in Applied Geology.

Experiments conducted are pertaining to paper GLC-122 (Geological Field Training) Practicals prescribed by the University for MSc Applied Geology Part-II class, during the academic year 2022 - 2023

DEAN
SEOAS

Faculty member in-charge

Dr. Anthony Viegas
Vice Dean (Academic),
School of Earth, Ocean
& Atmospheric Sciences,
Goa University,
Goa - 403 206.

GEOLOGICAL REPORT ON FIELD EXERCISE DONE IN GUJARAT AND RAJASTHAN

JANUARY 2023

BY:- AUDRICH DSOUZA | MSC APPLIED GEOLOGY PART-II | ROLL NUMBER:21P045006

CERTIFICATE

This is to certify that the record of work done by Mast. Audrich Dsouza of class MSc Applied Geology Part-2, Roll No. 21P045006, Year 2022-2023, contained in this report has been examined and signed and that the course of fieldwork in Geology prescribed by Department of Earth Science of Goa University has been satisfactorily carried out.

Head of the Department

Examiner's Signature

Date:

Abstract

The field exercise was done in areas of the state of Gujarat and Rajasthan, taking readings of strike and dip on field, identifying rocks and features exhibited. Also visited reputed institute like PRL, ONGC workplace, mine and quarry.

The objective of this was to get an idea about the outcrops and get a better idea about the types of jobs and workplaces. And after the study the geological history of the areas and the environmental conditions were deduced.

CONTENTS

Acknowledgement

The field work is an important part of geology as we get field experience from that and this field work was made possible for us for which I am thankful and would like to acknowledge the efforts that were put in and thank all the faculty members of earth science department of Goa University.

I am grateful to Dr. Poornima Dhawaskar, Dr. Nicole Sequeira for the knowledge and guidance and knowledge that they provided us. This field trip would not have been a success without the Teachers who accompanied us namely Dr. Anthony Viegas (vice dean), Dr. Niyati Kalangutkar (programme director), Prof. Mahesh Mayenkar and Prof. Pooja Ghadi. Their vast knowledge and interactive nature, humble attitude, care and guidance throughout the field trip. I would also like to appreciate the help received from the office and the Laboratory Assistant Ms. Heena for providing material required to carry for the field trip.

I would like to express my gratitude towards my fellow classmates for helping me wherever and whenever their help was needed during the field trip.

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INTRODUCTION

The geology of India is diverse it contains rocks belonging to different geologic periods, dating as far back as the Eoarchean Era. Some of the rocks are very deformed and altered. Other deposits include recently deposited alluvium that has yet to undergo diagenesis. Mineral deposits of great variety are found in the Indian subcontinent in huge quantity. Even India's fossil record is impressive in which stromatolites, invertebrates, vertebrates and plant fossils are included. India's geographical land area can be classified into the DeccanTraps ,Gondwana and Vindhyan.

LITHOSTRATIGRAPHIC TABLE

Group	System	Rock Type	Localities	Age in millions of years
Quaternary	Recent and subrecent	Alluvium, Blown sand, Silts of Rann and Banni, Tidal flats and raised beaches.	Alluvial plains of Gujarat, Rann, Banni & Coastal deposits.	0.01
	Pleistocene	Miliolites	(i) Saurashtra coast from Gopnath northwards extending beyond Porbandar. (ii) Kutch area.	1
Tertiary or Kainozoic	Pliocene	Dwarka beds, Manchhar beds, Gypsiferous clays and sandy foraminiferal limestones.	Dwarka, Okha, Piram Island, Kutch.	12
	Miocene	Gaj beds-Highly fossiliferous clays and limestones. Agate Bearing conglomerates. Kand formations.	Saurashtra coast, Kutch	25
	Oligocene	Tarkeshwar clays.	Tarkeshwar (District:Surat) and Kutch.	40
	Eocene	Nummulitic limestones and clays.	Tarkeshwar area and Kutch.	60
Secondary or Mesozoic.	Cretaceous Eocene	Deccan traps with inter trappeans.	Parts of Sabarkantha, Panchmahals, Baroda, Broach, Surat and major part of Bulsar and Dangs Districts. Major part of Saurashtra and small part of Kutch.	
	Cretaceous	Himatnagar sandstones, Lameta (limestones). Bagh beds. Songir sandstones, Nimar sandstones,Wadhavan sandstone (Infratrappeans), Bhuj and Umia series sandstones	Himatnagar, Kapadvanj, Balasinor, Parabia, Dohad, Gabat, Narmada valley, Songir.Near pavagadh. Wadhavan,Dhrangadhra,Bhuj etc.	110
	Jurassic	Katrol series, Chari series, Patcham series (sand-stones, shales and limestones).	Kutch.	150
	Purana (Algonkian & Part of Cambrian)	Erinpura granite (Post-Delhi).	Palanpur, Danta, Idar, Modasa, Taranga, Dharoi, Virpur, Wanakbori, Godhra, etc.	1500
		Delhi System-Alwar quartzites, schists, and calc-gneisses, calcschists of Ajabgarh series.	Parts of Sabarkantha and Banaskantha, and Mehsana Districts.	
Archaean or Azoic		Aravali System-Micaschists, Phyllites, quartzites, etc.	Sabarkantha, Panchmahals, Baroda, Banaskantha.	4000
		Banded gneissic complex.	Baroda District.	

GEOLOGY OF GUJARAT

Geomorphologically, the State can be divided into three distinct divisions.

a) Gujarat-Mainland: The well-known agriculturally rich alluvial basin of Gujarat rises from the estuarine tracts between Narmada and Tapi rivers and extends 402 km northwards merging into the desert plains of Rajasthan and the Rann of Kutch. It is roughly 121 km wide. The eastern border of the basin is bounded by Aravali, Vindhya, Satpura, and Sahyadri hill ranges. The eastern part of the south Gujarat bordering the alluvial tract has a typical Deccan trap up to Narmada valley. The hills show a wide plateau at top, and a step-like feature because of horizontal lava-flows and their differential weathering.

b) Saurashtra-Kathiawar Peninsula: The Saurashtra is bounded by Gujarat plains in the East and NE, by gulf of Kutch and Little Rann on the north, and on the SE by the Gulf of Cambay. The Arabian Sea borders the entire southern seaboard. The Central part of the region forms an elevated table land, from where most of the rivers rise and flow radially. The terrain generally slopes gently towards the peninsular margin to merge into the coastal plains and the great alluvial tract stretches to NE and east.

c) Kutch Peninsula: The mainland of Kutch is isolated by the Great Rann of the north and east, Little Rann on the SE, Gulf of Kutch on the south and rest by the Arabian Sea. The central portion of Kutch forms a table-land sloping on all sides, the shape of the region is like a tortoise and hence the name. In general, there are three hill ranges, trending almost east-west. North-flowing rivers disappear in the Rann; others join the sea. The Banni is formed by sediments deposited by the northern border of the mainland and is composed of fairly good soil. The Rann is a dry bed of the remnant of an arm of the sea, which formally connected the Narmada rift with Sind and separated Kutch from the mainland.

Geology of Rajasthan

Rajasthan is located in the north-western part of India between Latitude 23°03'-30°12' N and Longitude 69°29'- 78°17'E. It is the largest State in the country with an area of 342, 239 sq. km., encompassing about 11% of the total geographical area of the country.

Rajasthan's geographical area is marked with diversity of land type and is characterized by sand dunes, fertile plains, rocky undulating land and some forested regions. The Aravalli range is considered as the oldest in the world and runs diagonally across the State. Almost two-third State is enveloped by the Thar Desert with arid and semi arid climatic conditions. There are 33 districts in the State. The population of Rajasthan is about 7.23 crore. Out of the total State area of 342,239 sq km., forest area covers 32,744.4 sq. km. markedly the area under mining leases/licenses is approximately 1,846 sq km of total land cover of the State.

The State is also an important producer of marble, granite, sandstone & Kota stone of various shades Besides, it was the second leading producer of copper concentrates contributing 41%, petroleum (crude) 24% and kaolin 16% of the nation’s output for the year 2014-15 (IBM Year Book, 2015).

FIELD OBSERVATIONS

DAY 1

LOTHAL

22/01/23

Lat: 22’ 31’ 81” N

Log: 72’ 14’ 53”

Lothal is located along the Bhogava River, a tributary of Sabarmati, in the Gulf of Khambhat. Within the fortified layout, Lothal has two primary zones – the upper and the lower town. The remains of the town suggest that the area had a bead-making factory, cooking bhatti, market area labour house, water rete, bathroom and warehouse. At the north and southern end of the base are identified an inlet and an outlet which would have aided in maintaining the adequate water level to facilitate sailing. Stone anchors, marine shells and seals possibly belonging to the Persian Gulf mark the use of this basin as a dockyard where boats would have been sailed upstream from the Gulf of Cambay during high tide.

This location is very significant to learn about the sea level change.

Day 2

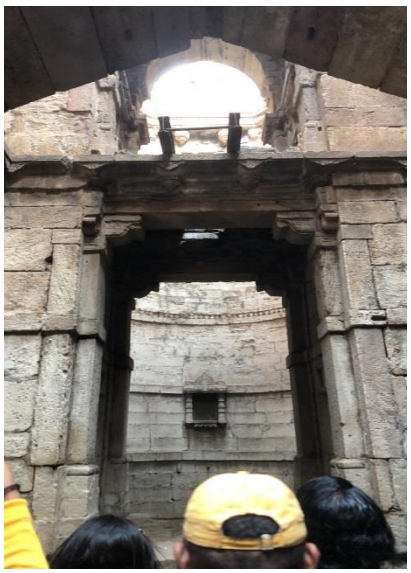
23/01/2023

Location 1: Amritavarshini Vav

Lat: 23.02.495°N

Long: 72.59.72°E

In the morning we went to the Amritavarshini Vav, which is also known as Panchkuva Stepwell or Katkhuni Vav, is a stepwell near the Panchkuva Darwaja in Ahmedabad, Gujarat. After which we visited the railway station for another such architecture.



Day 2

23/01/2023

Location 2: Physical Research Laboratory

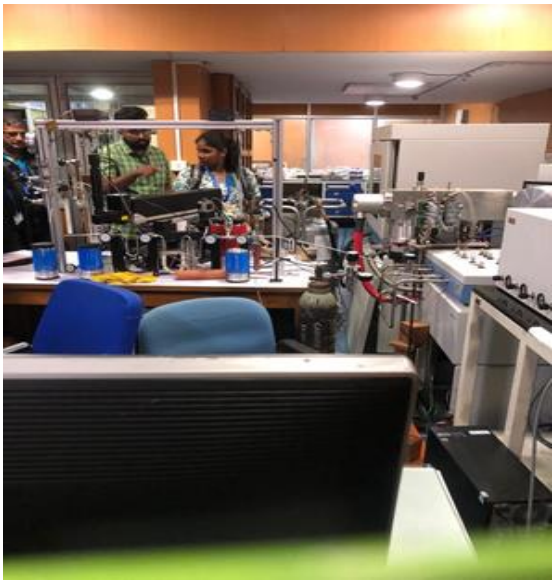
Lat: 23.03.56° N

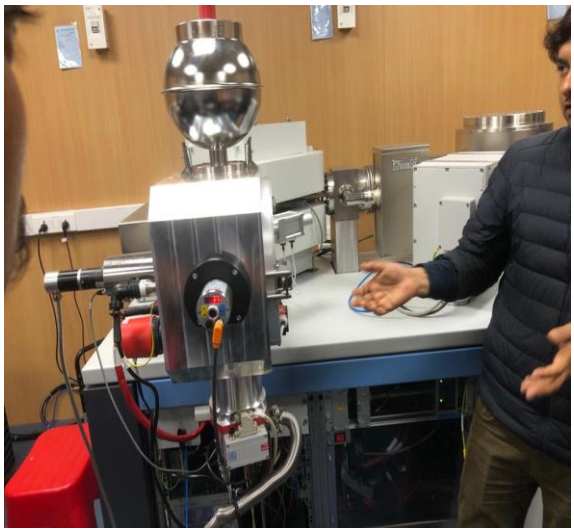
Long: 72.5435° E

The Physical Research Laboratory (PRL), is a research institute engaged in basic research in the areas of Astronomy and Astrophysics, Solar Physics, Planetary Science and Exploration, Space and Atmospheric Sciences, Geosciences, Theoretical Physics, Atomic, Molecular and Optical Physics and Astro-chemistry.

We had a talk followed by lab visits during which we came across MC-ICPMS (Multicollector-Inductively Coupled Plasma Mass Spectrometer) which is an instrument that measures isotopic ratios that are used in geochemistry, geochronology, and cosmochemistry. After that we saw the ICP MS section which gives the high resolution result and is used to search trace elements in water, next was TIMS lab (Thermal Ionization Mass Spectrometer) which uses mass difference to differentiate and uses isotopic ratios to know about the source material. Then we went to another lab where we saw IRMS in which we understood how the samples are converted to gas, an elemental analyzer that converts samples to gas. Then moved to AMS (Accelerator Mass Spectrometer) which works in vacuum and tells source by aging. Last we saw the old glass system for preparation of sample for carbon dating eg. Graphite.


PRL
PHYSICAL RESEARCH LABORATORY





Day 3

24/01/2023

Location 1: Rayoli

Lat N 22° 58’ 14”

Long E 73° 20’ 41”

Ahmedabad – Mahadev Temple

Lithology – Granitoid (Godra Granite)

Tors grey granite having coarse grains, biotite, quartz and feldspar plagioclase laths. The area observed exhibit exfoliation weathering. These are compact and massive. Large phenocrysts of Feldspar of about 2-5 cm were surrounded by finer matrix mainly composed of biotite, quartz, and orthoclase. At places these euhedral feldspars were aligned in a particular direction which is a characteristic of magmatic flow.

Location 2

Raiyoli Balasinor village

Lat; 22.95.3241 N

Long: 73.33.2550 E

The area had conglomerate with clast size as big as 25-30cm surrounded by fine grained matrix and we saw the tracer prints of oval shaped shell structure look like an egg. After that we went to the research area where fossils was found. The spots from where the fossils of dinosaurs are collected were explained by the Dahyabhai Gorabhai Chauhan. He also showed some bones and excavated eggs which were kept for museum purpose.









Day 4

Location: ONGC

25/01/2023

Lat: 23.02.625 N

Long: 72.5782° E

Collection process of oil and gas. Where we learned the process of collecting crude oil. There are 59 wells connected to this place by underground pipes, first there was water injectin pland other than that was the booster gas compressor plant which increases the pressure of low pressure gas and there were separators such as LP separator, Group separator, and Test Separator and Process plant from pipeline separator which have different work.

There are various provisions to maintain the machinery and pipelines along with various safety measures.

Day 5 (Udaipur, Rajasthan)

Location 1: Jhamarkotra Phosphorite mine

Lat: 24.4778° N

Long: 73.8360° E

Jhamarkotra belongs to the lower Aravalli Proterozoic. Jhamarkotra mine of Rajasthan state mine and Minerals Limited (RSMML) accounted for 88% of the total production in India. Rock phosphate mines at Jhamarkotra of mine are complex deposit. It has rock phosphate, limestone, ligmite and gypsum. The 35-36 percent is high grade ore. Most ore is the low grade ore which is why it is said to be the primary ore.

The mine area belongs to the lower Aravali supergroup hence the ancient life in Aravali is evident by the blue green algae found in the area. The host rock is dolomite and the water entered the area having NW-SE direction, the water carried dissolved phosphate which were taken in by the blue green algae.

Furthermore phosphate forms in center surrounded by waste, when water reacted with carbon dioxide forming carbonic acid this waste was dissolved leaving the high grade ore. This is in small amounts whereas most commonly it is found and excavated with waste hence lowering its grade. There is also secondary rock phosphate which was magma injected and has apatite.

Location 2: (Jameshwar Mahadev Temple)

Jameshwar Mahadev Temple is a well-known and revered temple located in the city of Udaipur, Rajasthan.The temple is known for its unique architecture, beautiful carvings, and the peaceful and serene atmosphere that surrounds it. The temple is placed inside a cave having Stalactite.

Day: 6

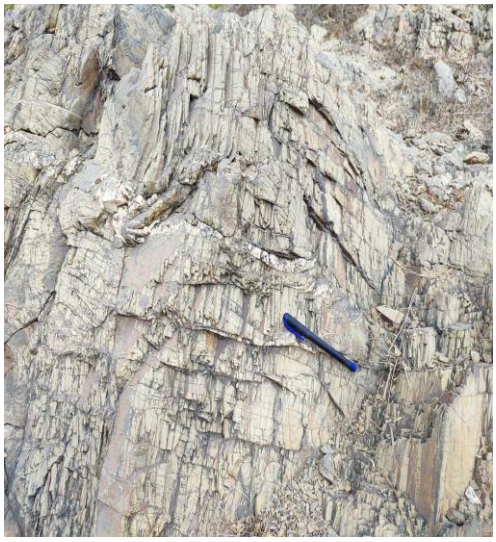
Location 1: Near the Berach River, Dagla khera Chauraha. Chittaurgarh.

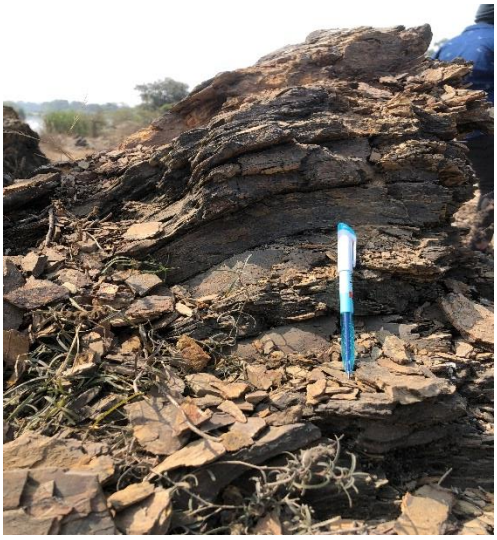
Lat: 24’ 54’ 19”

Log: 74’ 37’ 18”

Near the Berach river where we saw the Suket slate of Khorip Group of the Vindhyan super group. The shale is Reddish brown and fine grained and slaty cleavage are seen and it is folded having more than one generation of folds. The area is weathered and eroded and majorly trending N55E-S145W, In some places there was inclusion of Quartz vein. And we took several readings of the continuity. The readings are as follows:

`1. Strike:N 40^o Dip Direction: N130^o Amount of Dip: 60^o	`2. Strike:50^o Dip Direction: N145^o Amount of Dip:64^o
`3. Strike:N 570^o Dip Direction:N153^o Amount of Dip:41^o	`4. Strike:N 45^o Dip Direction: N135^o Amount of Dip: 65^o
`5. Strike:N 42^o Dip Direction: 136^o Amount of Dip: 44^o	`6. Strike:N 39^o Dip Direction: N130^o Amount of Dip: 51^o
`7. Strike:N 47^o Dip Direction: N138^o Amount of Dip: 23^o	8. (other limb) Strike:N 205^o Dip Direction: N295^o Amount of Dip: 64^o





Location 2: Near the Gamberi River, Gandhi Nagar. Chittaurgarh.

Lat: 24’ 52’ 55” N

Log: 74’ 37’ 57”E

Then after the suket slate we went to near the Gamberi River where we saw Limestone exposures the limestone and we took readings of the limestone exposures and they are like:

1. Strike:N 180^{o} Dip Direction: N 270^{o} Amount of Dip: 42^{o}	2. Strike:N 178^{o} Dip Direction: 270^{o} Amount of Dip: 47^{o}
3. Strike:N 174^{o} Dip Direction: N265^{o} Amount of Dip: 40^{o}	4. Strike: N180^{o} Dip direction: 270^{o} Amount of dip:45^{o}

Day: 7

Location: Rajsamand, Rajasthan

Lat: 25’ 5’ 43” N

Log: 73’ 51’ 37” E

On the last day we went to the Marble quarry where we observed the Marble with a grey deposit. And saw mica chlorite schist, folds seen in the schists, 2 sets of joints and vesicles which were green and white and the serpentine marble are (Saccharoidal).

Fold data:

1. Strike:N 134^{o} Dip Direction: N 214^{o} Amount of Dip: 26^{o}	2. Strike:N 136^{o} Dip Direction: N 223^{o} Amount of Dip: 28^{o}
3. Strike:N 128^{o} Dip Direction: N 217^{o} Amount of Dip: 34^{o}	4. Strike:N 138^{o} Dip Direction: N 24^{o} Amount of Dip: 35^{o}

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