FIELD REPORT OF GUJARAT AND RAJASTHAN

BY

AISWARIYA

MSC PART 2

APPLIED GEOLOGY

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Any accomplishment requires support of many people. This report was no different event. Through the completion of the report, the efforts that went in to it, the hardwork that was put in was all guided and supported by many. I would like to take this opportunity to extend my gratitude to all of them.

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Last but not the least I would like to thank my friends for their valuable support and constant motivation throughout the field work.

Geology of India

The geology of India is diverse. Different regions of India contain rocks belonging to different geologic periods, dating as far back as the Eo archean 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.

The Deccan Traps covers almost all of Maharashtra, apart of Gujarat, Karnataka, MadhyaPradesh and Andhra Pradesh marginally. During its journey northward after breaking off from the rest of Gondwana, the Indian Plate passed over a geologic hotspot, the Réunion hotspot, which caused extensive melting underneath the Indian Craton. The melting broke through the surface of the craton in a massive flood basalt event, creating the DeccanTraps. It is also thought that the Reunion hotspot caused the separation of Madagascar and India.

The Gondwana and Vindhyan include within its fold parts of Madhya Pradesh, Chhattisgarh, Odisha, Bihar, Jharkhand, West Bengal, Andhra Pradesh, Maharashtra, Jammu and Kashmir, Punjab, Himachal Pradesh, Rajasthan and Uttarakhand. The Gondwana sediments form a unique sequence of fluviatile rocks deposited in Permo-Carboniferous time. The Damodar and Sone river valleys and Rajmahal hills in eastern India Contain a record of the Gondwana rocks.

The Indian Craton was once part of the super continent of Pangaea. At that time, what is now India's south west coast was attached to

Madagascar and southern Africa, and what is now its east coast was Attached to Australia. During the Jurassic Period about 160Ma(ICS 2004), rifting caused Pangaea to break apart into two super continents, Namely Gondwana (tothesouth) and Laurasia (to the north). The Indian Craton remained attached to Gondwana, until the super continent began to rift apart about in the early Cretaceous, about 125 million 5 years ago (ICS2004). The Indian Plate then drifted northward towards the Eurasian Plate, at a pace that is the fastest known movement of any plate. It is generally believed that the Indian Plate separated from Madagascar About 90 Million years ago (ICS2004), however some biogeographical and geological evidence suggests that the connection between Madagascar and Africa was retained at the time when the Indian Plate collided with the Eurasian Plate about 50 Million years ago (ICS2004). This orogeny, which is continuing today, is related to closure of the Tethys Ocean. The closure of this ocean which created the Alpsin Europe and the Caucasus range in western Asia, created the Himalaya Mountains and the Tibetan Plateau in South Asia. The current orogenic event is causing parts of the Asian continent to deform westward and Eastward on either side of the orogen. Concurrently with this collision, The Indian Plates utured on to the adjacent Australian Plate, for minga new larger plate, the Indo Australian Plate.

The earliest phase of tectonic evolution was marked by the cooling and Solidification of the upper crust of the earth's surface in the Archaean Era (prior to 2.5 billion years) which is represented by the exposure of gneisses and granites especially on the Peninsula. These form the core of the Indian Craton. The Aravalli Range is the remnant of an early Proterozoic orogeny called the Aravali-Delhi Orogen that joined the two older segments that make up the Indian Craton. It extends

approximately 500 kilometres (311mi) from its northern end to isolated hills and rocky ridges into Haryana, ending near Delhi.

Early Paleozoic rocks are found in the Himalayas and consist of southerly derived sediment seroded from the crystalline craton and deposited on the Indian platform. During the Jurassic, as Pangea began to rift apart, large grabens formed in central India filling with Upper Jurassic and Lower Cretaceous sandstones and conglomerates. By the Late Cretaceous India had separated from Australia and Africa and was moving northward towards Asia. At this time, prior to the Deccan eruptions, uplift in southern India resulted in sedimentation in the adjacent Indian Ocean. Exposures of these rocks occur along the south Indian coastat Pondicherry and in Tamil Nadu. At the close of the Mesozoic one of the greatest volcanic eruptions in earth's history occurred, the Deccan lava flows. Covering more than 500,000 square kilometres (193,051 sq mi) area, the sea mark the final break from Gondwana.

Geology of Gujarat

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

a) Gujarat-Mainland.

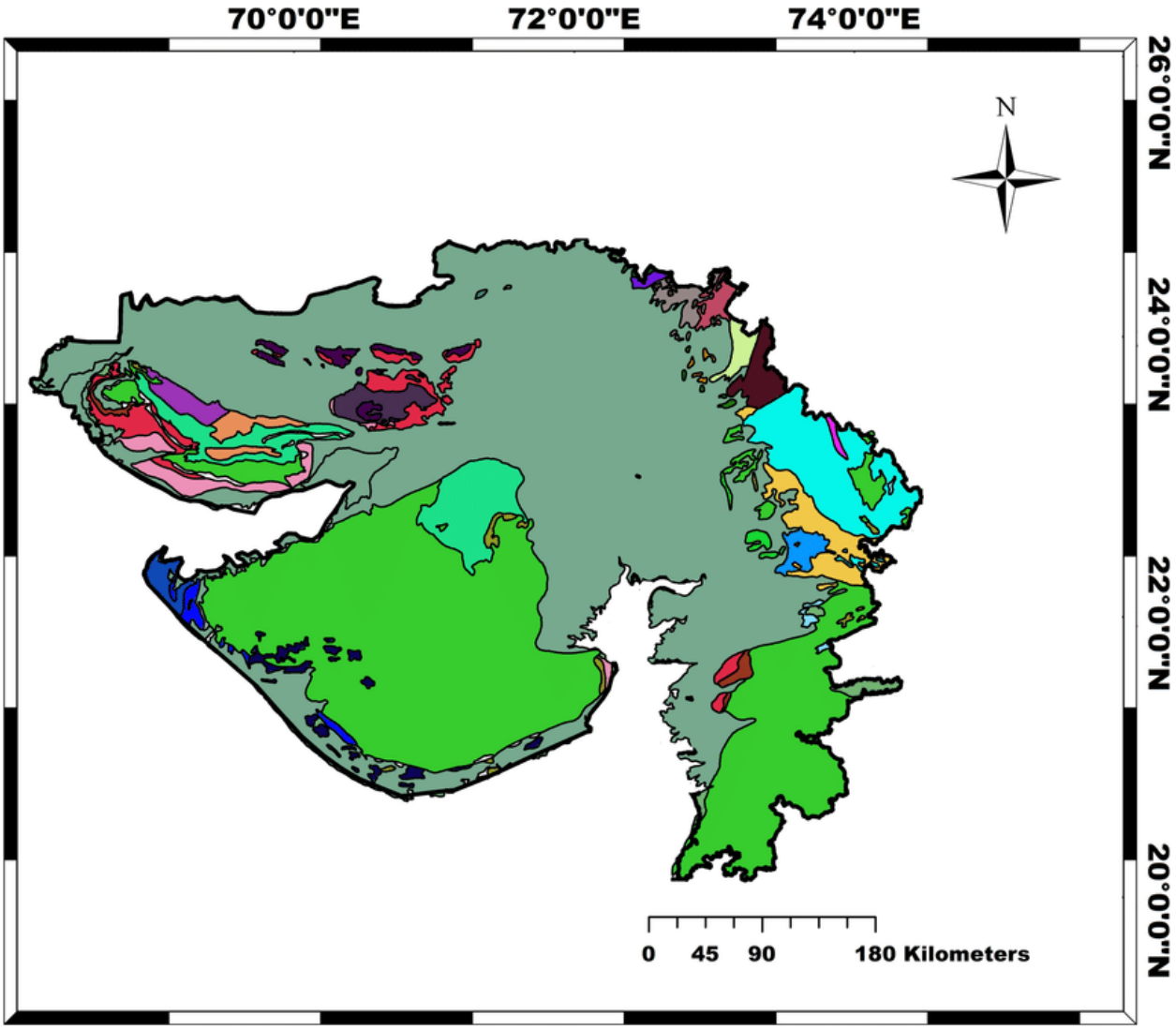
b) Saurashtra-Kathiawar Peninsula, and

c) Kutch Peninsula.

a) Gujarat-Mainland. The well known agriculturally rich alluvial basin of Gujarat rises from the estuarine tracts between Narmada and Tapi rivers and extends 250 miles (402 km) northwards merging into the desert plains of Rajasthan and the Rann of Kutch. It is roughly 75 miles (121 km) wide. The eastern border of the basin is bounded by Aravali, Vindhya, Satpura, and Sahyadri hill ranges. The topography of the land is obviously controlled by the geological formations. The eastern part of the south Gujarat bordering the alluvial tract has a typical Deccan trap scenery up to Narmada valley. The hills are formed by circumdenudation leaving 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. The sedimentary rocks along the coast form almost a low flat country.

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 7 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 northern border of the main land 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.



EXPLANATION

Geology Map of Gujarat

- Sendra-Ambaji Granite and Gneiss
- Deccan Traps
- Lunavada Gp
- Chanpaner Gp
- Sirohi Gp
- Jharol Gp
- Gogunda Gp
- Rajpura-Dariba Gp
- Madh Fms
- Berwali Fm
- Tiruchirapalli Fm
- Udaipur Gp
- Undiff. fluvial/aeolian/coastal and glasial sediments
- Undiff. Middle Jurassic Fms
- Jumara Fms
- Bagh Gp
- Lamera Fm
- Kankawati Fm
- Dwarka bed
- Gaj Fm
- Fatehgarh Fm
- Khari Fm
- Himmatnagar Fm
- Jhuram Fms
- Kumbalgarh Gp
- Miliolite Limestone
- Phulad Ophiolite Complex
- Malani Plutonic Suite
- Godhra Granite
- Erinpura Granite
- Lathi Fm
- Bhuj Fm

Geology of Rajasthan

Rajasthan is a state located in northwestern India, covering an area of 342,239 square kilometers. The state has a diverse geological history, spanning from the Archean to the Quaternary periods, which has shaped its landscape, mineral resources, and groundwater potential.

The geological features of Rajasthan are diverse and include the following:

1. Aravalli Range: The Aravalli Range is a mountain range that extends through the states of Rajasthan, Haryana, and Gujarat. It is the oldest mountain range in India and is composed of ancient rocks dating back to the Precambrian era. The range is known for its rich mineral deposits, including copper, zinc, lead, and silver.

2. Vindhyan Supergroup: The Vindhyan Supergroup is a group of sedimentary rocks that cover a large part of central India, including Rajasthan. The rocks date back to the Mesoproterozoic and Neoproterozoic eras and are known for their unique fossils, including stromatolites, which provide important information about the evolution of life on Earth.

3. Thar Desert: The Thar Desert, also known as the Great Indian Desert, is a large arid region that covers a significant part of Rajasthan. It is composed of sand dunes, interdune plains, and desert pavement, which are formed due to the wind erosion of rocks and sediments. The region is known for its unique wildlife, including the Indian bustard and the desert fox.

4. Sambhar Lake: Sambhar Lake is a large saltwater lake located in the eastern part of Rajasthan. It is a unique geological feature that is

formed due to the evaporation of seawater over thousands of years. The lake is a major source of salt production and is also an important habitat for migratory birds.

5. Jaisalmer Formation: The Jaisalmer Formation is a geological formation that is located in the Jaisalmer district of Rajasthan. It is composed of sandstone and is known for its unique rock formations, including the famous Jaisalmer Fort, which is built entirely out of yellow sandstone.

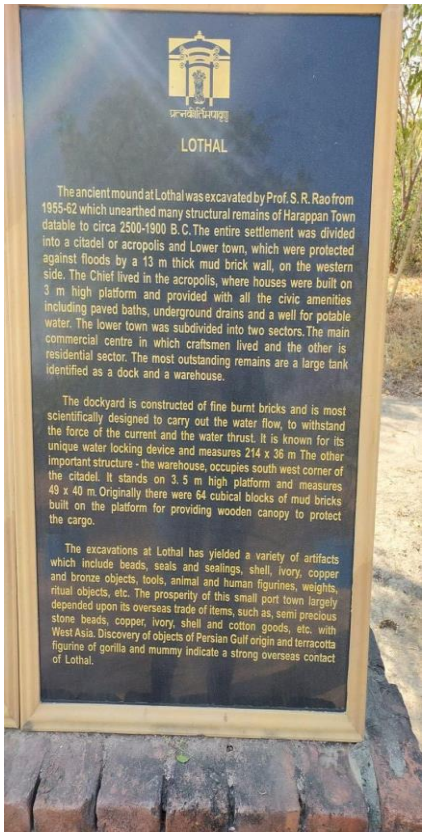
In terms of mineral resources, Rajasthan is known for its rich deposits of copper, zinc, lead, silver, limestone, and marble. The state is also home to several important industrial areas, including the city of Jaipur, which is known for its textile industry, and the city of Udaipur, which is known for its mining and mineral processing industry.

Overall, the geology of Rajasthan is a rich and diverse subject, with a long and complex history that has shaped the state's landscape, resources, and cultural heritage.

DAY 1

Location- Lothal

22.4654° N, 72.2327° E.



Lothal is an archaeological site in the Indian state of Gujarat. It was an important port city in the ancient Indus Valley civilization, established around 2600 BCE to 1900 BCE.

The site has been studied by archaeologists for many years, but its geology and the presence of foraminifera have also provided important clues about its history.Geologically, Lothal lies on the eastern flank of the Kathiawar Peninsula, which is part of the Saurashtra Block. The Saurashtra Block is a tectonic block that is part of the Indian subcontinent, bounded by the Arabian Sea to the west and mainland India to the east.The geology of the Saurashtra Block is complex, with a

variety of sedimentary rocks and metamorphic rocks occurring in the region.

The presence of foraminifera is particularly important in understanding Lothal's geological history. Foraminifera are small marine organisms that secrete a calcareous shell and are commonly used as bioindicators in paleoenvironmental studies. Foraminifera found in Lothal suggest that the site was once a marine environment with the Indus Delta nearby.

foraminifera also indicate that sea levels were higher in the past and that the site was submerged at one point. This is supported by the presence of marine sediments at the site that contain fossils of marine animals such as molluscs and crustaceans.

Overall, the geology and occurrence of foraminifera at Lothal provide

important clues about the site's past. They suggest that the site was once a thriving port city in a
marine environment that eventually became submerged due to sea level changes. This information helps us better understand the history of the Indus Valley Civilization and the way humans have interacted with their environment over time.

DAY 2

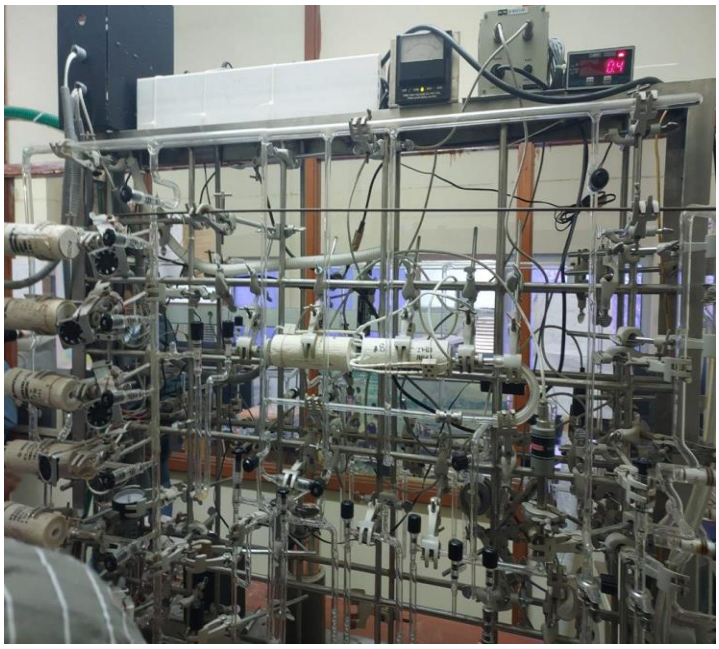
Physical Research Laboratory, Ahmedabad, Gujarat.

23.1688° N, 72.5451° E.

The Geosciences Division of the Physical Research Laboratory (PRL) in India is an important research institution that focuses on the study of the earth and its various components. It is one of the largest and most prestigious organizations in the country dedicated to the field of geosciences.

Established in 1947, the Geosciences Division of PRL is located in Ahmedabad, Gujarat, and has been instrumental in advancing our understanding of the earth's structure, composition, and dynamics. The division is home to a team of highly qualified and experienced researchers who work on various aspects of earth science, including seismology, geodynamics, geodesy, atmospheric science, oceanography, and paleoclimate.

The Geosciences Division of PRL has a wide range of research facilities and state-of-the-art equipment that are used to conduct cutting-edge research.



Here's a brief explanation of how MC-ICPMS works:

1. Sample introduction: A small amount of sample material is introduced into an inductively coupled plasma (ICP) source, where it is vaporized and ionized.

2. Ionization: The ions produced in the ICP are extracted and focused into a beam, which is then sent through a series of magnetic fields. The magnetic fields cause the ions to bend, and the degree of bending depends on their mass-to-charge ratio (m/z).

3. Separation: The ion beam is separated into its various isotopes by a mass spectrometer. This allows the different isotopes of an element to be measured separately.

4. Detection: The ion beam is then directed towards a detector system which consists of multiple collectors, each of which collects a specific isotope of interest. By measuring the isotopic ratios of the different collectors, the relative abundances of the different isotopes can be determined with high precision.

Overall, MC-ICPMS is a highly sensitive and precise analytical technique that is used in a wide range of applications, from studying the geochemistry of rocks to analyzing trace elements in biological samples.

TIMS

TIMS stands for "thermal ionization mass spectrometry" and it is a powerful analytical technique used for high precision isotopic analysis of a wide range of elements.

Here's a brief explanation of how TIMS works:

1. Sample introduction: A small amount of sample material is loaded onto a filament, which is then heated to a high temperature. The heat causes the sample to vaporize and form ions.

2. Ionization: The vaporized sample is ionized by bombarding it with electrons. The ionized sample is then accelerated through a series of electric fields and sent towards a mass spectrometer.

3. Separation: The ion beam is separated into its various isotopes by a mass spectrometer. This allows the different isotopes of an element to be measured separately.

4. Detection: The ion beam is then directed towards a detector system which measures the number of ions hitting it. By measuring the isotopic ratios of the different ions, the relative abundances of the different isotopes can be determined with high precision.

Overall, TIMS is a highly sensitive and precise analytical technique that is used in a wide range of applications, from studying the geochemistry of rocks to analysing trace elements in biolFogical samples. TIMS is often used for measuring isotopic ratios of elements that have low natural abundance, such as uranium and lead.

DAY 3

Spot 1
22°97’07’’ N, 73 34’ 64’’ E

Aravalli craton covers almost entire state of Rajasthan, part of Gujarat, Madhya Pradesh and fringes of Delhi and Haryana.

The Aravalli Supergroup is ~2.5 Ga old. The general trend of the Aravalli sediment is NE-SW. The closure phase of the Aravalli craton is characterized by widespread granitic activity. Most granitic bodies intruded in the 730 to 830 Ma time span as evidenced by a Rb-Sr age group.The Godhra granite is one of the granitic intrusions that occurred during the closure phase of the Aravalli craton. The Godhra granite has invaded the Champaner and Lunavada Groups of the Aravalli Supergroup.GraniteGodhra is a porphyry to granodiorite granite with associated pegmatite. It shows the presence of feldspar minerals, quartz, mica (biotite and muscovite). Muscovite and biotite are present as approximately 0 phenocrysts 0.5-5cm. MME was also there. Mafic magma enclaves are formed through the process of cogenetic mixing of magma. In addition, Perthitic texture was observed.

A shear zone passing through the foliation was also seen. The readings are as follow: -

Strike Direction – 155^0N
Dip Amount – 73^0 NE

Xenoliths(Mafic - biotite ± hornblende) are also present which are mafic in nature. Cave structure in the outcrops can be seen which is formed

due to removal of xenoliths by weathering. Joints were also seen, following are some readings: N290°, N300°, N9°

Rhyoli
23 05’ 62’’ N, 73 34 35’’ E

The Raiyoli Dinosaur Fossil Park is a dinosaur museum and fossil park located in Balasinor, Gujarat, India. It is also known as the Balasinor Dinosaur Fossil Park. The park is situated about 80 km from Ahmedabad and covers an area of approximately 72 acres.

The Raiyoli Dinosaur Fossil Park is home to one of the largest dinosaur egg hatcheries in the world, and the largest dinosaur fossils site in India. The park is believed to have been inhabited by dinosaurs about 65 million years ago. It has over 10,000 dinosaur fossils, including bones, eggs, and other remains that were found during excavations conducted by the Geological Survey of India (GSI) and the Gujarat Ecological Education and Research (GEER) Foundation.

The park features a museum where visitors can see life-sized dinosaur models, skeletons, and various exhibits about the evolution of dinosaurs.

Visitors can also take a guided tour of the park to see the actual excavation sites and learn about the different types of dinosaurs that once roamed the area. The park offers a unique experience for visitors to explore the prehistoric world and learn about the history of these magnificent creatures.

The Raiyoli Dinosaur Fossil Park is a popular tourist attraction in Gujarat and draws visitors from all over the world. It provides a unique opportunity for visitors to witness the rich and diverse geological history of India and explore the ancient world of dinosaurs.

Rhyoli Dinosaur Museum

In 1980s Paleontologists accidently came across the fossil remains and bones in the village of Rayioli in Balasinor. Since then, the place has been flooded with researchers and a number of excavations have taken place in the area the findings of which revealed the fact that there were more than 13 species of dinosaurs that thrived around 65 million years ago. The fossil park here contains life sized statues of those giant creatures and further excavations have found that a squat, thick-legged, heavy-bodied carnivorous dinosaur with a crested horn, RajasaurusNarmandensis, King of Narmada, (the first half of the name

comes from Raja or King due to the crested horn and the second half of the name originates due to its geographical location which was near the river Narmada). This creature belonged to the carnivore family of Tyrannosaurus Rex.

A visit to the fossil park will surely make you dig deep into the history of dinosaurs in Gujarat. And in order to quench your thirst for the same, state government came up with a Dinosaur Museum. The museum is spread in an area of over 25,000 sq. feet with 10 galleries spread in the basement and the ground floor depicting various forms of displays (films and exhibitions). An exclusive 3-D film is prepared on Rajasaurus Narmadensis. Other galleries display details on Dinosaurs of India and Gujarat, Fossil Exhibits and many other features that will bring out the child in you. One can relish this museum through digital, print and static form. The state government has not only catered to those seeking information on dinosaurs and their fossils, but also a Time Machine, 3-D film, an Interactive and amusing Dino fun for kids area, a vivid display of Mesozoic times, souvenir shop etc. The museum will depict as many as 40 sculptures that will throw on a light on their size, shape, habits and habitat. The atrium features an exact replica of the habitat of these creatures. A step in the atrium will transport you 65 million years back.

DAY 4

ONGC Ahmedabad Asset GGS-Motera

23 11 31 N, 72 59 79 E.

ONGC GGS Motera is a gas gathering station located in Motera, Gujarat, India, operated by the Oil and Natural Gas Corporation (ONGC). The primary function of the station is to collect and process natural gas from nearby oil fields and deliver it to various customers such as fertilizer plants, power plants, and city gas distribution networks.

The gas gathering process involves separating the natural gas from crude oil and water, compressing it to increase its pressure, and then transmitting it through pipelines to various consumers. The station is

equipped with advanced technology and equipment to ensure safe and efficient operations.

In addition to gas gathering, ONGC GGS Motera also undertakes maintenance and repair work on pipelines and other equipment, as well as implementing various environmental and safety measures to minimize the impact of its operations on the surrounding environment.

Mr. Gaurav Kumar, Safey Inspector at this facility was kind enough to show us around and explain the kind of work that they undertake.

ONGC GGS Motera uses advanced technology and equipment to ensure safe and efficient gas gathering and transmission. Some of the key technologies used at the station are:

1. Gas Chromatography: Gas chromatography is used to separate and analyze the various components of the natural gas mixture. This technology helps to determine the quality and composition of the gas being processed, which is critical for maintaining the efficiency and safety of the gas gathering process.

2. Compressors: Compressors are used to increase the pressure of the natural gas so that it can be transmitted through pipelines to various customers. The compressors used at ONGC GGS Motera are designed to operate at high efficiency and with minimal maintenance requirements.

3. SCADA System: SCADA (Supervisory Control and Data Acquisition) system is used to monitor and control the various components of the gas gathering and transmission process. This system provides real-time data on gas flow rates, pressure levels, and equipment

status, allowing operators to make adjustments and ensure safe and efficient operations.

4. Pipeline Inspection: Regular inspection of pipelines is critical to ensure safe and reliable gas transmission. ONGC GGS Motera uses various inspection technologies, including smart pigs (devices that travel inside pipelines to detect defects) and remote sensing techniques, to detect and repair any pipeline damage.

5. Environmental Monitoring: ONGC GGS Motera also uses advanced environmental monitoring systems to track air and water quality around the station. This helps to ensure compliance with regulatory requirements and minimize the impact of the station's operations on the environment.

Overall, the advanced technologies used at ONGC GGS Motera help to ensure safe, reliable, and efficient gas gathering and transmission, while also minimizing the environmental impact of the station's operations.

DAY 6

Jhamarkotra Opencast Mine (Spot 1)

24 58 25 N, 73 51 71 E.

(Started 1968, has 4 strategic units – Phosphate, Limestone Lignite and Gypsum. IN which Phosphate is used for chemical fertilization. 16 km Strike, has a zigzag string and the ore body is situated in East-West Direction. Ore body is assumed that it is not ending since similar pattern is found in Jabuar MP. Stromatolites)

Rajasthan State Mines & Minerals Limited (RSMML) is a public sector enterprise of the Government of Rajasthan and primarily engaged in Mining and Marketing of High-Grade Rock phosphate, Lignite, Limestone & Gypsum (Non-Metallic minerals) through its mines located at various locations in Rajasthan. In 1969 after discovery of rock phosphate in Jhamarkotra (Udaipur), BGL took over operations at Jhamarkotra mines. The major activity of RSMML is the mining of Rock phosphate ore. It operates one of the largest and fully mechanised mines in the country at Jhamarkotra, 26 Kms. from Udaipur. Jhamarkotra plays an important role by contributing 98% of rock phosphate production of India. With an annual rock handling of about 20 million tonnes, Jhamarkotra is probably the largest open cast mine in India outside the steel and coal sectors. The geometry of the ore body i.e thin and sharply dipping had resulted in long and narrow pits with great depth extension, which involves very high stripping ratio with high lead and lift for waste and mineral.

If an entity starts falling down the 12m bench stops it from rolling further down. The rock phosphate occurs in metasedimentary rocks of Aravalli Supergroup (Precambrian age). It is of algal origin. The deposit extends over a strike length of 16 kms in horse-shoe shape with average thickness of 15 meters. A reserve of 77 million tonnes of rock phosphate has been proved on the basis of 60,000 mts. drilling in 500 boreholes. Out of these 17 million tonnes is of +30% P2O5 grade and rest is of 12 0 30% P2O5 grade. A beneficiation plant of 1500 TPD (Tonnes Per Day) capacity has been installed to upgrade the low-grade phosphate ore.

Extent of Jhamarkotra Deposit

Total lease area is 13sqkm2. In Jhamarkotra, the strike length of the phosphorite bed including the discontinuous outcrop extending over a linear distance of 16 km. The highest point of the phosphate bed outcrop at 600 MRL at Jhamarkotra and along the downdip direction the extension of the phosphate has been proved up to a little below 250 MRL. Ore body dips at angle of 45-55°.The phosphate bed shows an extremely variable thickness showing persistence only over a limited strike length. Thus, in Jhamarkotra, the 15 km average thickness of the phosphate bed could be traced over 6km of continuous strike length. In some portions, ore body shows pinching and swelling structure, hence the thickness of ore body varies from 5-35m. For the sake of convenience in prospecting and mining the deposit has been divided into 12 blocks viz. A-Extension, A, B, C, D, E, F, G, H, I, J and K.
The ore to overburden ratio in the Jhamarkotra Phosphate Mine is kept as 1:16.

Grade of the Deposit

At Jhamarkotra deposit, generally a Bi-modal grade distribution pattern viz.+30 % (37- 38%) P2O5 designated as High-Grade Ore (HGO) and 16 to 22 % P2O5 designated as Low-Grade Ore (LGO) could be deciphered. However, at places near the contacts of the above grade of phosphate bed, some transitional zones exist which are designated as Mixed / Medium Grade Ore (MGO). The marketable grade of ore is 31.5% & 30% P2O5, but a large resource of low-grade ore also occurs in the area. Looking at great demand of phosphate fertilizer and to reduce its import, the low-grade ore is being upgraded through froth flotation in beneficiation plant

The mineral phase of apatite, which makes phosphorite, is considered to have formed by three mechanisms (i) direct inorganic precipitation, (ii) primary biogenic precipitation, and (iii) diagenetic precipitation/replacement. Diagenetic precipitation of apatite is considered as an important mechanism involved in phosphorite formation. Apatite of this origin commonly occurs as void filling and cementing material in the associated sediments. It is said that the organic matter, which collects on the shelf regions, on decay, causes very high concentration of phosphorous below the sediment water interface, leading to precipitation of apatite. During this process carbonate constituents of the sediment are also phosphatised due to the replacement

Mining Method: The open pit mining method is being followed at Jhamarkotra Mine for exploitation of the mineral. The working levels are kept dry by continuous pumping of ground water through tube-wells constructed on periphery of the pit limit.The bench height in this extent of mine is given at 7m consecutively for a couple of times with alternating 12 m heighted bench. (7m,7m,12m).

Spot 2 – Jhameshwar Mahadev Temple, Jhamarkotra

Stalactites are type of formation that hangs from the ceiling of caves, hot springs. They are developed downwards, grow from dripping walls and ceilings. The fundamental form is the ‘straw’ stalactite, a monolayer crystal sheath enclosing a feedwater canal and growing downwards only. Leakage from the canal may over plate the sheath, creating tapered (carrot-like) stalactites up to one metre in diameter and several in length.

Accelerated deposition on protuberances can add a myriad of subsidiary forms such as crenulations, corbels, drapes and lesser stalactites. A ‘column’ is a stalactite–stalagmite pair grown together.

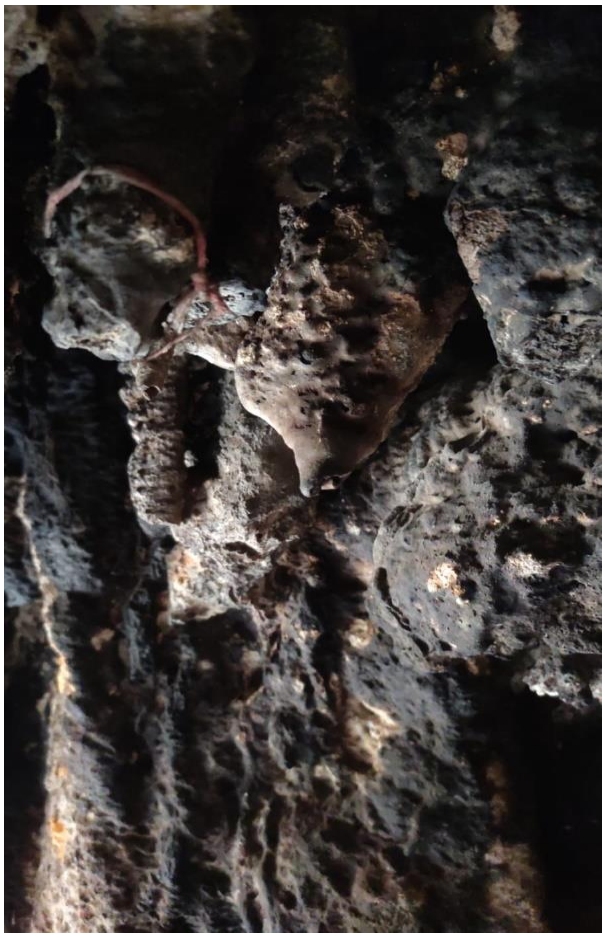


FIG . STALACTITE

DAY 7

Rock Type – Suket Shale- Phyllite

24 47 40 N, 73 51 71 E.

Spot 1

Chittorgarh district is generally characterised by undulating topography with hills belonging to the Aravalli range. The district comprises of rocks of Bhilwara supergroup, Vindhyan supergroup and Deccan traps. The field area is occupied by Vindhyan sediments like conglomerates and rocks of Bilwara supergroup, both separated from each other by great boundary fault. Berach River flows parallel to the great boundary fault. Bilwara supergroup is present at the west side of the river. Bilwaa supergroup is divided into 3 tectono-stratigraphic units which are Hindoli group, Mangalwar complex together with isolated mineralised belts and Sandmata complex. Hindoli group mainly consists of greywackes and phyllites. These phyllites haves been folded into large-scale low plunging folds trending parallel to the GBF. Increase in the tightness and asymmetry of the folds near the fault suggests that these are fault related folds. They are highly compressed and joint sets are closely spaced than the joints present away from the river that is away from the GBF. Slicken sides are observed, which indicates the presence of fault and quartz veins are also present which may be either syngenetic or post genetic. The Suket Shale-Phyllite shows various stages of predominant folding from which possible readings were taken with respect to the hinge plan

	STRIKE DIRECTION	AMOUNT OF DIP
LIMB 1	240°N	38
LIMB 2	135°N	24
HINGE PLAIN	200°N	28

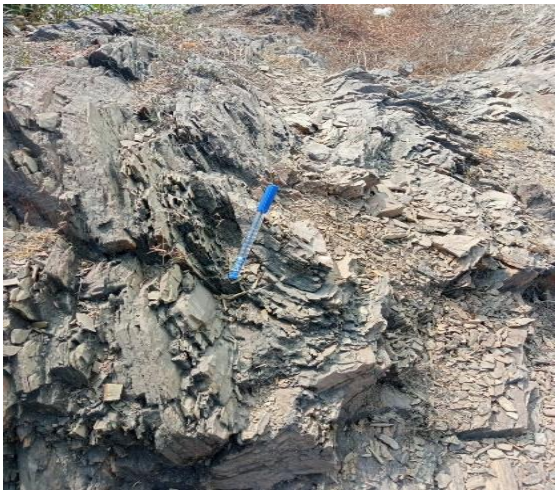
	STRIKE DIRCTION
JOINT SET 1	140°N
JOINT SET 2	100°N

Nimbara Limestone

Nimbara Limestone is a type of sedimentary rock that is primarily composed of calcium carbonate. It is commonly found in the Nimbara region of Rajasthan, India, and is a popular building material due to its durability, strength, and natural beauty.

This limestone is typically light gray in color and contains fossilized marine organisms, including shells and corals, which are visible on its surface. It is formed through the accumulation of calcium carbonate-rich sediment that has been compressed over millions of years, often in marine environments. We had the opportunity to take the readings of the Nimbara Limestone near Chittorgarh Fort and here are some readings: -

	STRIKE DIRECTION	AMOUNT OF DIP
SPOT 1	N	45
SPOT 2	N	60



DAY 8

In the Indian state of Rajasthan, limestone of the Nathwara variety can be found. It has the name of the Rajasthani town of Nathwara, which is situated in the Udaipur district. This limestone is a fine-grained, light-colored rock that mostly consists of calcium carbonate. It is frequently quarried in the Nathwara region and utilised for both aesthetic and building purposes.

Lithology - Marble, Schist

Marble	Strike Direction	Dip Amount with Direction
Spot 1	130° N	32° SW
Spot 2	360° N	26° E

The schist bed beneath the marble strata was also inclined. There was extensively weathered schist present. A modest crenulation folding sequence started a few marble joints on the marble bed, which was inclined. The silica grains in the marble that had recrystallized indicated

that the next succession had experienced contact metamorphism. It was suggested that the schist be called mica schist since it possessed an alternative augen gneiss structure and dominant minerals including chlorite and tremolite. The mica schist also has an elongated acicular structure, with tremolite making up the needle-like structure.

References

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