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I bow humbly before God, together with all of creation. The most forgiving and caring who manages and controls everything. It is a great pleasure for me to express my utmost gratitude to-

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Department of Geology & Mining
University of Barishal.

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Assistant Professor
Department of Geology & Mining
University of Barishal.

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Associate Professor
Department of Geology & Mining
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Professor
Department of Geology & Mining
University of Dhaka.

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We are also thankful to the institutions and authorities that helped us, both directly and indirectly, finish our fieldwork at Kaptai, Rangamati. They are-

- Department of Geology and Mining.
- Director of Forestry Development and Training Centre (FDTC) for providing our accommodation.
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At last, I would like to thank my group members and some of my classmates who were in the arranging committee specially the Transport Committee and food committee, for their support and co-operations throughout the fieldwork.

EXECUTIVE SUMMARY

The terms "field geology" and "field work" relate to the observation, study, and evaluation of natural products, features, occurrences, and processes utilizing a range of methods, techniques, and tools in their natural contexts

The field report is the culmination of all the scientific proof, facts, and data gathered during the field at Kaptai Rangamati Road-Cut Section.

Field research is an integral aspect of our academic studies. Theoretical research is incomplete without field research. It's almost like a class for pupils, where they may witness the interaction between “Physiographic” and "Geomorphic" features and, observing the geoenvironment and geological places, tectonic activities are shown as a part of field work and learn why the earth's surface is so diverse.

Students in the department of Geology and Mining, University of Barishal are required to conduct a course named GMF-318: Field Geology III in a number of locations with geological significance. Field work is one of the most significant and fundamental components for a student of Geology and Mining who need practical experience.

To accomplish our aim, we left our university campus and reached Forestry Development and Training Center (FDTC) Kaptai. According to the given routine, we visited various significant places of Kaptai under the due mentorship of the honorable teachers. It can specially be mentioned that every day while observing those geologically important and significant places, we gathered vast knowledge about the geological structures and geomorphic features of those places from our teachers. The detailed descriptions of these places are presented in this report

The Sitapahar Anticline is in the Rangamati district. The anticline is about 70 km (N-S) long and 12 km (E-W) wide. It covers about 550 square kilometers area. The area is located about 50 km northeast of Chittagong town and is situated in the southern part of Chittagong Tripura folded belt. This anticline is an asymmetrical fold with steeper western flank and gentler eastern flank. In terms of lithostratigraphy, the area can be divided into 5 major rock units.

At last, it can be said that, this geological field work activity has been succeeded from all aspects.

It also has certain aesthetic qualities. There were various joints, faults, anticlines, and valleys there that we noticed. Streams, pools, riffles, rapids, slumps, water falls, gas seepage, and potholes were discovered. However, due to the structural elevation problem, there were some constraints to taking samples and examining rock characteristics, and it was sometimes too unsafe.

Figure 01: Base Camp (FDTC)

Figure 02: Group F (GeoExplorers)

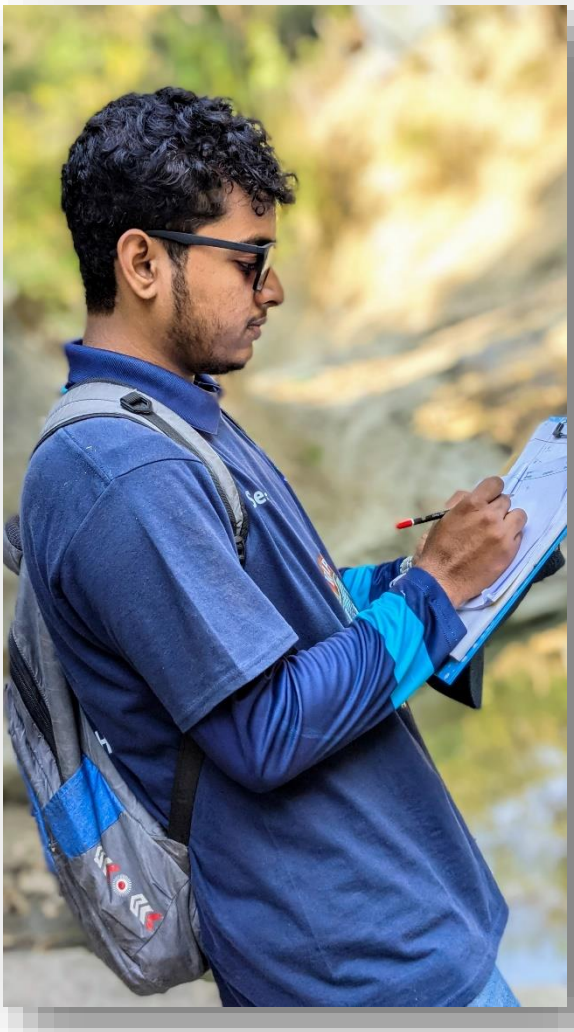


Fig: Myself during the field

Chapter 1: Introduction

1.1 General Statement

Geology is the study of the material and structural makeup of the earth, as well as its past and the events that have shaped it. After all, it's a visual science that studies, among other things, natural phenomena like mountains, rock formations, and the earth's interior. Thus, in addition to academic understanding, field research and real-world experience ought to be prerequisites. Rocks, topographic structures, and other geological fieldwork operations are routinely investigated and interpreted.

Geologic Field Work is a compulsory course of the Geology & Mining Department, which adds to one's practical knowledge. The primary goal of the fieldwork is to become familiar with various geologic field problems and correctly interpret them.

As a result, the Department of Geology and Mining, University of Barishal organizes an annual field trip for students.

They arranged schedule field work in Sitapahar Anticline in the Rangamati-Kaptai hilly region. The students of the 3rd year B.S. (Hon's) Session 2018-2019 made a field study for a week. The field study started 8th February 2024 and came to an end on the 13rd February 2024. The study area is delineated by the latitude 22°28'16.43" N to 22°30'10.70" N latitude and 92°07'45.0222" E to 92°12'36.00" E longitude. It is situated about 230 km south-east of Dhaka city. The area is connected to the Chittagong city by a metalloid road. It is also connected with Banderban hill tract by a jeepable road.

The geologic field work deals with the study and explanation of the rocks, topographic forms, drainage patterns and structural features such as fold, fault, joint, unconformity and plotting this geologic data on the base map. It is an ideal place for exploring many geologic features.

We discovered a proper image or view of the Sitapahar anticline by analyses of sedimentary structures, geological structures, geomorphic features, and the tectonics processes that are accountable for this, which is provided in this study.

1.2 Objectives

† Fieldwork enables us to estimate distances, see landforms, and locate/identify geographic and geologic features using maps (topographic and geologic).

† To formulate or evaluate a hypothesis, combine data from field activities, laboratory measurements, library research, and/or course work

† In igneous, metamorphic, and sedimentary layers, detecting common structures and bed characteristics is simple.

† To understand how to acquire data from field observations, as well as how to handle, evaluate, and display that data.

† Learn how to use visual clues to identify common minerals in hand samples and field exposures of rock.

† To learn how to write a field report and to comprehend the importance of completing field work.

† Using observations of mineral formation and composition, distinguish between the common forms of igneous, metamorphic, and sedimentary rock in hand samples and field exposures.

† Students will create and present oral reports based on posters or digital media (such as Power Point) that clearly and properly discuss and demonstrate the background, techniques, data, and interpretation pertinent to a specific project.

† Description and quantification of mineral / paleontological composition, grain distribution, textural qualities, bed formations, and structures of earth materials and strata using a variety of instruments and instrumentation.

† After all, it aids in the development of critical thinking abilities and the enhancement of geological knowledge.

1.3 Study Area

The research region, Kaptai- Rangamati Road Cut Section, is situated in the southeast of Bangladesh, approximately 450 kilometers from Barishal District along the Dhaka-Chattagram Highway. The district of Rangamati has the Sitapahar Anticline (Fig. 1). The anticline (Fig. 1.2) is roughly 12 km (E-W) in width and 70 km (N-S) in length. Its area is roughly 550 square kilometers. Situated in the southern region of the Chittagong-Tripura folded belt, the location is roughly 50 km northeast of Chittagong metropolis (Fig. 1.1). The area under investigation spans 92°07'45.0222" E to 92°12'36.00" E longitude and 22°28'16.43" N to 22°30'10.70" N latitude. It is almost 230 kilometers southeast of the city of Dhaka. A metalloid road connects the region to the metropolis of Chittagong. The area is connected to the Chittagong city by a metalloid road. It is also connected with Banderban hill district by a jeepable road.

Figure 03: Rangamati district on Bangladesh Map

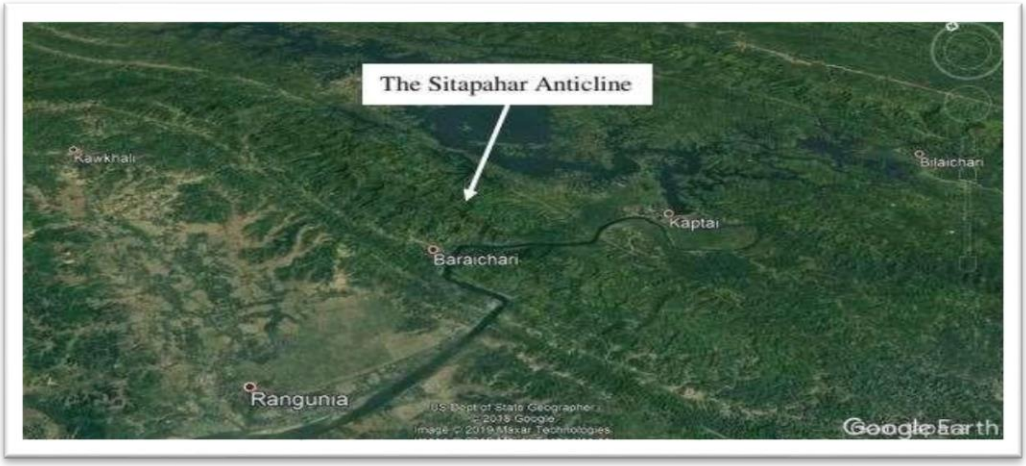


Figure 04: Satellite View of study Area

1.4 Previous Work

Many geologists surveyed on the Sitapahar anticline. Shell Oil attempted to know about the subsurface structural configuration with seismic surveys. So, they attempted to drill a deep exploration well on the Sitapahar Anticline which was about 1560 m in depth in 1988

There are not many publications that presented facies analysis on these clastic rocks exposed in southern part of Chittagong-Tripura Folded Belt (Alam, 1995; Alam and Ferdous, 1995, 1996; Alam and Karim, 1997; Gani and Alam, 1999). The significance of dital influence in shallow marine Surma Group was first discussed by Alam (1995). Gani and Alam (1999) an overall basinward progradation from deep marine to coastal marine within the active margin setting of the Indo-Burmese plate convergence. suggested that the entire Surma Group succession represents Gani and Alam, latter in another publication (2000), have shown a detailed lithofacies analysis and gave an interpretation about the origin of, and genetic relationships between individual units in response to sea-level changes.

Chapter 2: Physiography

2.1 Topography

2.2 Drainage Pattern

2.3 Climatology

2.4 Population and Culture

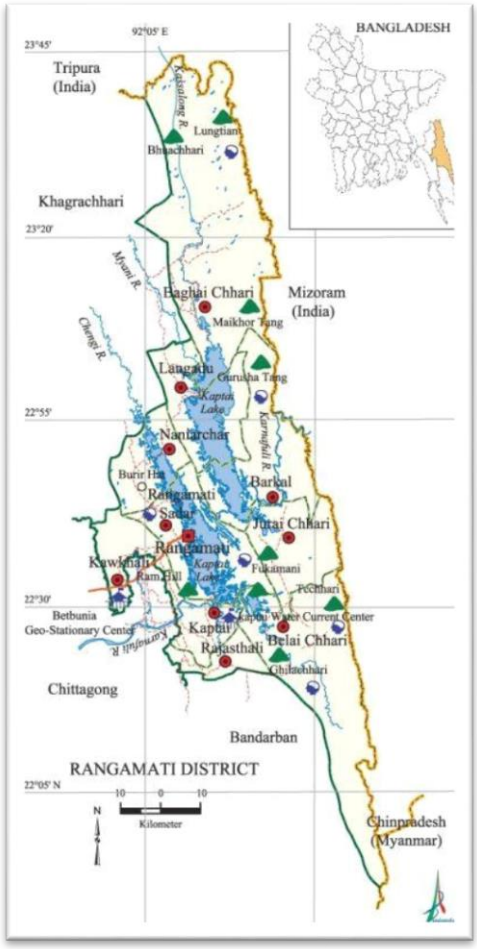


Figure 05: Physiographic map of Rangamati

2.1 Topography

Topography is a detailed map of the surface features of land. It includes the mountains, hills, creeks, and other bumps and lumps on a particular hunk of earth.

Topographically, the investigated area is a rugged terrain with elevation ranging from 16m to 493m and characterized by numerous hillocks, valleys, spurs and ridges.

Topography refers to mountains, valleys, rivers, or craters on the surface. Reimann 1993, has subdivided Bangladesh into nine subdivisions. According this subdivision the study area situated in Chittagong Hill Tract.

Sitapahar and its adjoining area may vary physiographically on the basis of structures, topography and rock types. The investigated area is hilly region with irregular topography. These are characterized by a number of hillocks, spurs, ridges and valleys. This region is highly designated by valley with parallel ridges. The ridges are parallel to the regional structure of Chittagong hill range trending NNW-SSE.

The average elevation of the Sitapahar Anticline is 167 meters where it ranges from 16 meters to 335meters. Most of the elevated area are eroded and become reduced elevation. But resistant rock resists this erosion. The slopes of Sitapahar Anticline are very rugged and difficult to climb.

The structure reflects the lithologic and structural control over the topography. It is assumed that the higher hills are of more resistant rock than the lower hills.

Figure 06: Topography of Kaptai Rangamati Hill Range

2.2 Drainage Pattern

Drainage pattern is the general arrengement of channels in a drainage basin. There are numerous valleys and stream along and across the Anticline .The steams are locally known as “Chara”.There are numerous streams in the investigated area those are more or less dendrite in pattern.

The Karnaphuli River is the major river drained through the area which is running these streams locally named as “Chara” or “Chari” is of subsequent type.

The Karnaphuli River is the major river drained the area, which is running along East-

West

trend. This is the most important and largest river of the Chittagong Hill Tracts. It rises from the western slope of Lushai Hill in Indian Territory. There are numerous streams and streamlets, more or less dendritic pattern.

The most important tributaries and chara or creeps that drain the area are Shumba Chara, Shundari chara, Manikchari chara, Ghagra chara, hatimara chara, Tippara chara etc.

During the rains, they are deep and the currents strong and do great erosion of the area. But they are mostly dry during winter season The Kaptai reservoir feeds the investigated area throughout the season, particularly in dry season.

A large water body known as Kaptai Lake was made for hydro-electric project in the eastern flank. Even though the investigated area is hilly terrain, groundwater prospect of the area is fairly good.

The streams are in youthful stage demonstrated by their characteristics feature like waterfall, pot holes, gorges, v-shaped valleys etc.

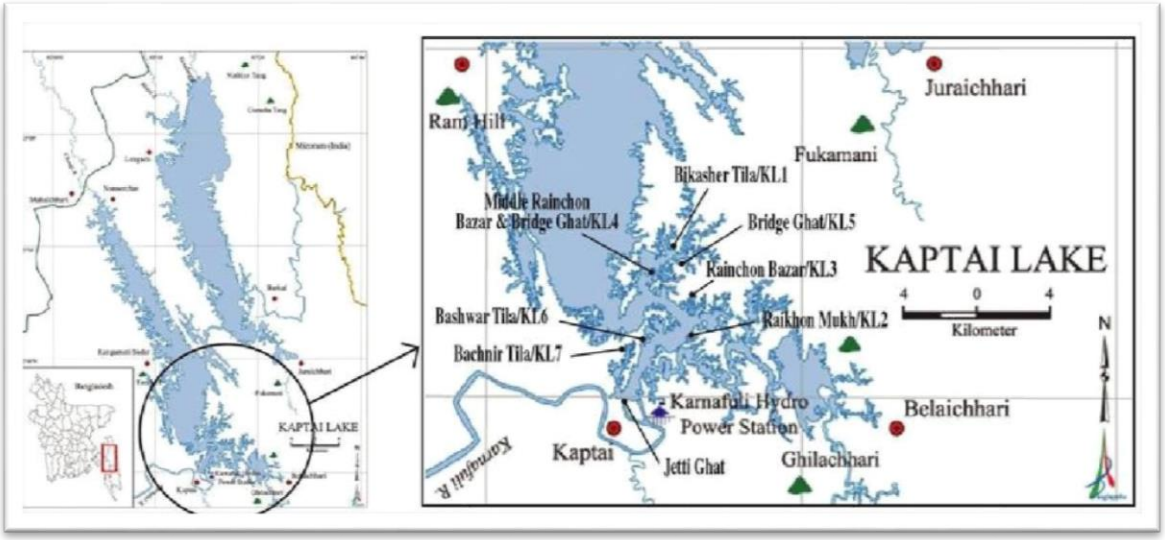


Figure 07 : Drainage pattern of Kaptai Lake

2.3 Climatology

The area can be characterized by tropical to sub-tropical climate condition.The temperature of the area ranges from 90F to 65F. Three distinct seasons are felt in Rangamati and adjoining areas. Such as

i. The summer

ii. The monsoon

iii. The winter.

i. The Summer which starts from March and with high temperature and moderate precipitation;

ii. The Monsoon which begins in June and continue up to October, is characterized by dark clouds in sky with heavy rainfall and dusty wind and often cyclonic storm;

iii. The Winter characterized by pleasant cool and dry weather, begins from November and ends in February.

We started our field in the month of february at the then that was the time of winter in the region. Where the temperature range between 14-26 degree celsius.

2.4 Population & Culture

Population:

Kaptai Upazila (Rangamati District) area 259 sq km, located in between 22°21' and 22°35' north latitudes and in between 92°05' and 92°18' east longitudes. It is bounded by Rangamati Sadar and Kawkhali upazilas on the north, Rajasthali upazila on the south, Belaichari on the east, Rangunia and Kawkhali upazilas on the west.

Population Total 66135; male 36677, female 29458; Muslim 38759, Hindu 4049, Buddhist 579, Christian 22696 and others 52. Indigenous communities such as Chakma, Marma, Tripura belong to this upazila.

Culture:

Rangamati District has a long history and heritage of very rich culture of tribal & Bengali

people. There are Chakma, Murong, Pankho, Marma, Chak, Tripura, Lucai, Kheang, Tanchanga, Khumi known as tribal people besides Bengali. The people live on the top of the hills and also on foot of the hills. Here, life is very hard. Major part of the population lives mostly along the foot hills and most of the tribal people live on the hilly region.

Chapter 3: Geological Characteristics

3.1 Tectonic Framework

A tectonic plate is a massive, irregularly shaped slab of solid rock, generally composed of both continental and oceanic lithosphere. Plate tectonics also called lithospheric plate.

Tectonically, Bangladesh lies in the northeastern Indian plate near the edge of the Indian carton and at the junction of three tectonic plates – the Indian plate, the Eurasian plate and the Burmese micro plate. These form two boundaries where plates converge the India- Eurasia plate boundary to the north forming the Himalaya Arc and the India-Burma plate boundary to the east forming the Burma Arc.

The Kaptai region is situated and a part of burmese plate. The area is also known as the India-Burma plate boundary. The Indian plate is moving 6cm/yr in a northeast direction and sub ducting under the Eurasian (45 mm/yr) and the Burmese (35 mm/yr) plates in the north and east, respectively. This continuous motion is taken up by active faults. Active faults of regional scale capable of generating moderate to great earthquakes are present in and around Bangladesh. Because of indo-burmese plate sitakund area shows numerous folds.

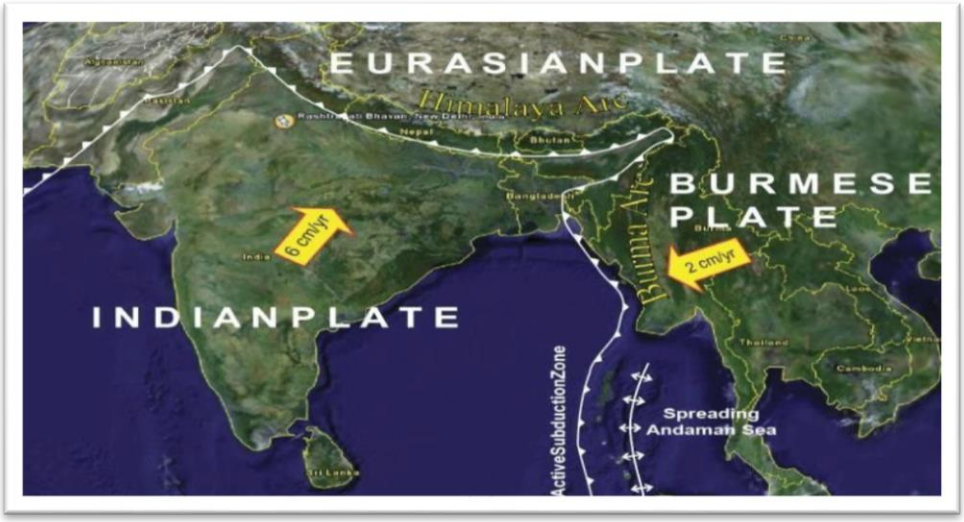


Figure 08 : Teconic map of Bangladesh along (Rangamati-Kaptai)

3.2 Geomorphology

Geomorphology is the branch of Geology that deals with the physical features of the surface of the Earth and the geological processes by which they are produced.

In a simple way geomorphology deals with the shape of the Earth's surface.

During our field trip we recognized numerous geomorphic features. Some of these are:

- Waterfall
- Channel
- Pot holes
- Valleys
- Ripple mark
- Meanders etc.

3.3 Structural Geology

Structural Geology is the branch of geology that deals with the form, arrangement, and internal structure of rocks, and especially with the description, representation, and analysis of structures, chiefly on a moderate to small scale. The subject is similar to tectonics, but the latter is generally used for broader regional or historical phases. The features are-

- Fold
- Fault
- Joint

3.4 Petrology

Petrology is a science that deals with the origin, history, occurrence, structure, chemical composition, and classification of rocks.

Petrologic Features:

- Sandstone Silt
- Shale
- Mudstone
- Girujan clay
- Silty Shale
- Concretion.

Chapter 4: Methodology

4.1 Method of Study

We investigate, studied and surveyed the area along the roads and streams where the bed rocks were exposed and outcrops were found.The following methods were used during the field work –

Measuring attitude of bed:

The field study included of the determination of the strike, dip and amount of dip. These were measured with the help of clinometers, the location of the stations were find out in the base map and marked with corresponding lithology.

Writing information on Notebook

During our investigation we found some data about the attitude of beds and also about the lithology. We wrote down the data on notebook got from Barabkund to Choto Darogar Hat on each and every station.

Data plotting on the supplied Map:

We found some data of the attitude of beds and we tried to understand te lithology of the beds during our investigation.

Collecting Samples

Rock sample we get in any station we collected it. Sometimes we got some small structure. We collected them for further investigation.

Taking Photographs

We take Photographs of well exposed geomorphic features, structures and topography in each section.

Taking locations and bearing:

The base map helped to determine the location of the suitable sections. Arial distance was measured by taking pacing. Our instant positions were plotted on the map by the help of the clinometer and a remarkable point on the base map. Bearing of the section was measured by clinometer.

4.2 Laboratory Investigation

The rock specimens and samples collected during the field investigation at Kaptai-Rangamati Road cut section were studied in the laboratory due to the unavailability of lab facilities. So that we made the precise investigations on our collected samples. But we tried to collect samples that have good apparent view to be recognized by hand and eyes.

4.3 Equipments

The instruments and accessories that used in the field are as follows:

01. **Base Map:** Base map of the area locate different investigated area.
02. **Pocket Knife:** To cut anything when needed.
03. **Global Positioning System (GPS):** To know the locations (Longitude & Latitude) of the stations, points and exposure.
04. **Field Note Book:** To note the description of field studies.
05. **Compass Clinometers**: Used in measuring the attitude of beds.
06. **Haversack**
07. **Geological Hammer:** To find out fresh exposures bedding plane and to break rocks for sample collection.
08. **Sample Bag:** To conserve the sample.
09. **Pocket Lens:** For identification of mineral grains and to determine their shape and size.
10. **Camera**: For taking photograph.
11. **10 % dil. HCl Acid with dropper:** Identifying the rocks whether it is calcareous in nature or not.
12. **Lithological Chart:** To know lithologic description of rock.

We also have taken pen, pencil, eraser, clip board, set square, t scale, diagonal scale, water flask, lunch box etc.

Figure 09: Clinometer

Figure 10: Hand Lens

Figure 11: Hammer

Figure 12 : Grain Size Comparator

Figure 13: Measuring Tape

Figure 14: A Student measuring Attitude of Bed

Chapter 5: Section Study

5.1.1 Section 1 (Lichubagan Roadcut Section)

Day - 01

Date: 09-02-2024, Friday

Start time: 9:35 A.M.

Weather: Sunny

Temperature: 24ºC

Start point:

Latitude: 22º28'16" N

Longitude: 92º07'45" E

Ending point:

Latitude: 22º30'22" N

Longitude: 92º09'49" E

5.1.2 Short Description

This section is located between the longitude of E 92°7´45.022´´W to E 92°7´40.15´´W and latitude of N 22°28´16.43´´S to N22°29´20.82´´S. This section is cross cutting the anticlinal structure from west to east.

In this section the exposure was investigated along the both side the road. This area was well accessible by metal led road and buses are to reach the section. The investigated area is hilly region with irregular topography.

These are characterized by a number of hillocks, ridges and valleys. This region is a highly region designated by valley with parallel ridges. The ridges are parallel to the regional structure of Chittagong hill range trending NNW -SSE.

5.1.3 Geomorphic Features

Stream: A body of running water or any other moving liquid under the influence of gravity to lower levels in a narrow, clearly defined natural channel is called stream. It has three important roles in the formation of a landscape: It erodes the channels in which it flows, it transports materials provided by weathering and slope processes, and it produces a wide variety of erosional and depositional landforms.

Figure 15: Stream

Valley: Relatively low lying area where the sediments are deposited .Any hollow or low lying land bounded by higher ground usually traversed by a stream or river which receivesthe drainage of the surrounded heights.

Ridge: A ridge or mountain ridge are geological features consisting of a chain of mountains or hills that form a continuous elevated crest for some distance. The sides of theridges slope away from narrow top on either side. The line along the crest formed by the highest points with the terrain dropping down on either side is called the ridgeline. Ridges are usually termed hills or mountains as well, depending on size. The contours formed by aridge are long, narrow and elliptical in shape.

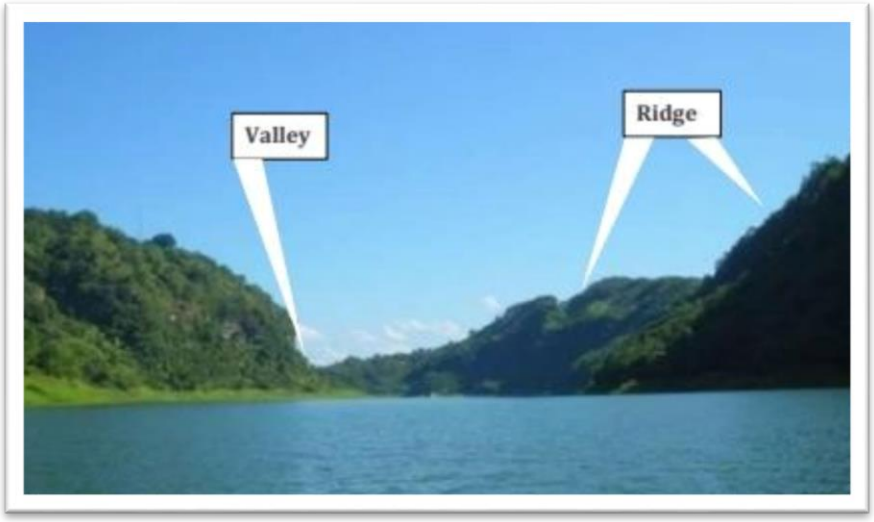


Figure 16: Valley & Ridge

5.1.4 Sedimentary structures

Sedimentary structures are visible features within sedimentary rocks that formed at the time of deposition and represent manifestations of the physical and biological processes. The sedimentary structures that have been observed are-

Bedding: A bedding is a term used for a structure occurring in granite and similar massive rocks that allows them to split in well-defined planes horizontally or parallel to the land surface, thickness more than 1cm.

Lamination: The lamination of fine grained rocks may result from the alteration of granular clayey layer or from the parallelism of that grains and flaky minerals. The thickness of the lamination is less than 1cm.

Figure 17: Lamination in Lichubagan Sandstone with shale alteration

Mud cracks: A fracture, part of a desiccation pattern, caused by the drying out and shrinking of silt or clay.

Burrows: Reworked Upper Oligocene fossils have also been reported Barrows. It is a one kind of fossil of animal.

5.1.5 Description of Individual Section

Lichubagan Sandstone

Lithology

Yellowish brown in color, medium to coarse grain, cementing material ferruginous, highly permeable are found within this section.

Figure 18: Lichubagan Sandstone

Depositional Environment

The depositional sedimentary environment is a geometric unit which deposition takes place. In this section the presence of clay gall in yellowish brown sandstone indicates the continental fluviatile environment. The presence of pebble, cobble in this section indicate the nearer source area. Younger age of this section can be interpreted by the presence of mica. Yellowish brown color and iron incrustation of this sediments is indicator of intense weathering. The coarse-grained sandstone was deposited at marine regressive phase at high energy fluviatile condition**.**

Bergunia Clay

Location & Physiography

This section is located the longitude of E92°7´40.93´´W and latitude of N22°29´21.8´´S. The investigated area is a hilly region with irregular topography.

Lithology

Blueish gray in color, loosely compacted, thinly laminated shale**.**

Figure 19: Bergunia Clay

Chandraghona Sandstone

Location & Physiography

This section is located between the longitude E92°7´40.93´´W to E92°08´3.30´´W and latitude of N22°29´23´´S to N22°29´42.83´´S.

In this section the exposure was investigated along the both sides the road. This area was well accessible by metaled road and buses are used to reach the section. The investigated area is a hilly region with irregular topography. These are characterized by a number of hillocks, ridges and valleys.

Lithology

Brownish in color, medium to coarse grain, cementing material ferruginous, large amount of carbonaceous material present.

Figure 20: Chandraghona Sandstone

Depositional Environment

In this section moderately compacted brownish sandstone contains clay gall which indicate the fluvial environment. The occurrence of cross bedding, current ripple sedimentary structure indicates the continental fluviatile environment

Dupitila Formation

Location & Physiography

The physiography of the Dupitila Formation is heavily influenced by the tectonic activity and geological processes that have shaped the region over millions of years. The formation consists of sedimentary rocks, primarily sandstone and shale, which were deposited during the Cretaceous period.

The Dupitila Formation is known for its distinctive stratigraphic features, including layers of sandstone interbedded with shale and occasional conglomerate deposits. These sedimentary layers were formed through the deposition of sediments in ancient river systems, deltas, and shallow marine environments.

Lithology

Sandstone is a predominant lithology within the Dupitila Formation. It often occurs in thick beds or layers, indicating deposition in ancient river systems, deltas, or shallow marine environments. The sandstone beds may vary in color, texture, and grain size, ranging from fine to coarse-grained.

Shale is another significant component of the Dupitila Formation. It typically occurs interbedded with sandstone layers, forming alternating sequences of sandstone and shale. Shale is a fine-grained sedimentary rock composed primarily of clay minerals, silt, and organic matter. It often appears as thinly laminated layers and can exhibit various colors, including gray, black, and

greenish hues. In addition to sandstone and shale, the Dupitila Formation may contain layers of siltstone and mudstone. Siltstone is a sedimentary rock composed of fine-grained particles larger than clay but smaller than sand, while mudstone is similar but typically contains a higher proportion of clay minerals. These fine-grained lithologies often occur interbedded with sandstone and shale layers, contributing to the overall stratigraphy of the formation.

Figure 21: Dupitila Formation

5.2.1 Section 2 (Baraichari Section)

Day – 02

Date: 10-02-2024, Saturday

Start time: 08:50 A.M.

Weather: Sunny

Temperature: 24ºC

Start point:

Latitude: 22º30'23" N

Longitude: 92º08'16" E

Ending point:

Latitude: 22º30'21" N

Longitude: 92º09'27" E

End time: 04:30 P.M

5.2.2 Geomorphic features

Basin: A basin is a large-scale structural formation of rock strata formed by tectonic warping of previously flat lying strata.It was seen in Barabkund Section. Basins are geological depressions, and are the inverse of domes. Some elongated structural basins are also known as synclines.

Pothole: pothole, in geology, cylindrical pit formed in the rocky channel of a turbulent stream. It is formed and enlarged by the abrading action of pebbles and cobbles that are carried by eddies, or circular water currents that move against the main current of a stream.

Figure 22: Pothole

Mender: A meander is produced by a stream or river as it erodes the sedimentscomprising an outer, concave bank (cut bank) and deposits this and other sediment downstream on an inner, convex bank which is typically a point bar.

Figure 23: Meander

Channel: In physical geography, a channel is a type of landform consisting of the outline of a path of relatively shallow and narrow body of fluid, most commonly the confine of a river, river delta or strait. The word is cognate to canal, and sometimes takes this form.

Cliff: A very steep, vertical or overhanging face of rock.

Figure 24: Cliff Height Measurement

∠C=48° (Using Clinometer)

∠B=90°

BC= Numberr of Steps x Average Pacing

=80*.72=57.6m

AB=cliff height=tanC*57.6= 69.12m

5.2.3 Sedimentary Structures

Sedimentary structures are visible features within sedimentary rocks that formed at the time of deposition and represent manifestations of the physical and biological processes. The sedimentary structures that have been observed are-

Bedding: A bedding is a term used for a structure occurring in granite and similar massive rocks that allows them to split in well-defined planes horizontally or parallel to the land surface, thickness more than 1cm.

Lamination: The lamination of fine grained rocks may result fromthe alteration of granular clayey layer or from the parallelism of that grains and flaky minerals. The thickness of the lamination is less than 1cm.

Mud cracks: A fracture, part of a desiccation pattern, caused by the drying out and shrinking of silt or clay.

Nodular structure: Nodule, rounded mineral concretion that is distinct from, and may be separated from, the formation in which it occurs. Nodules commonly are elongate with a knobby irregular surface; they usually are oriented parallel to the bedding.

5.2.4 Description of Individual Section

Baraichari Sandstone & Shale

Location & Physiography

This section is located between the longitude of E92°8´2.97´´W to E92°8´46.88´´W and latitude of N22°29´45.7´´S to N22°30´31.64´´S. The investigated area is a hilly region with irregular topography.

Lithology

Alteration of sandstone and shale, maybe sandier than shale. Sandstone is yellowish brown in color, medium to fine grain size, thinly bedded with carbonaceous cementing materials. Shale is light gray in color, thinly laminated, moderately compacted, fissile in nature, and argillaceous cementing material is present.

Figure 25: Baraichari Sandstone & Shale

Depositional Environment

In this section we found alteration of sandstone and shale which indicates that deposition has happened in a condition of changing depth of sea.

5.3.1 Section 3 (Shilchari – Base Camp Section)

Day – 03

Date: 11-02-2024, Sunday

Start time: 08:30 A.M.

Weather: Sunny

Temperature: 24ºC

Start point:

Latitude: 22º30'17" N

Longitude: 92º09'35" E

Ending point:

Latitude: 22º30'07" N

Longitude: 91º12'32" E

End time: 04:30 P.M

5.3.2 Geomorphic features

Pool and riffle: Pool and riffle, deep and shallow portions of an undulating stream bed. Pools are most easily seen in a meandering stream where the outer edge of each meander loop is deep and undercut; riffles from in the shallow water of the short, straight, wide reaches between adjacent loops.

River: A river is a natural flowing watercourse, usually freshwater, flowing towards an ocean, sea, lake or another river.

5.3.3 Sedimentary Structures

Nodular structure: Nodule, rounded mineral concretion that is distinct from, and may be separated from, the formation in which it occurs. Nodules commonly are elongate with a knobby irregular surface.

Trough cross bedding: Trough cross bedding consists of cross-bedded units in which one or both bounding surfaces are curved.

Lenticular Bedding: Lenticular bedding is a form of heterolytic sediment characterized by the presence of isolated sand ripples and lenses, set in a mud matrix.

Wavy bedding: Wavy bedding occurs when mud is deposited over the whole area of a bed of rippled and/or cross stratified sand. It usually loosely follows the alternating concave-convex nature of the ripples creating a wavy appearance. In wavy bedding the ripples are laterally discontinuous.

Clay galls: A dry, curled clay shaving derived from dried, cracked mud and embedded and flattened in a sand stratum.

Figure 26: Clay Galls

5.3.4 Description of Individual Section

Shilchari Shale

Location & Physiography

This section is located between the longitude of E 92°8´48.8´´W to E92°12´8.25´´W and latitude of N22°30´34.44´´ to 22°30´5.8.

The investigated area is a hilly region with irregular topography. These are characterized by number of hillocks, ridges, valleys, unconformity, stream, rapids**.**

Lithology

Shale is bluish gray color, thinly to thickly laminated, calcareous band present, argillaceous cementing material, lamination and nodule are found in this rock type. Nodular fissile shale found. Axis passes through this section.

Figure 27: Shilchari Shale

Calcareous Shale:

Calcareous shale is a type of sedimentary rock that is composed primarily of clay minerals, with a significant amount of calcium carbonate (often in the form of fossil fragment or shells) mixed in. Calcareous shale form in a variety of depositional environments, such as marine or lacustrine (lake) environments, where the accumulation of organic material and sediment creates an oxygen depleted environment that slows down the decomposition process, leading to the preservation of organic mattered fossils. The presence of calcium carbonate in calcareous shale can have a significant impact on the rock's properties, including its hardness and ability to weather. Calcareous shale can also serve as an important source of oil and gas, as well as a potential reservoir for groundwater

Figure 28 : Calcareous shale

Depositional Environment

In this region shale, silty shale has been found, which indicates that deposition has happened in a condition of changing depth of sea. Silty shale indicates the sedimentation had taken place by strong current.

Chapter 6: Structures

6.1 Tectonic Structures

Tectonic structures are regularly repeating form of occurrence of rocks in the Earth's crust. In the broad sense, the term Tectonic Structure is applied to various parts of the Earth's crust that are formed by the combination of a number of different smaller structural forms.

The structures that have been observed in the exposed rock of the investigated area are

described below.

Fold: Folds are the waves undulation found in the rock unit of the earth surface that forms in response to directional forces (Billings M.P., 1986). The most and the major structure of the study area is that it is an asymmetric anticline, named as "Sitapahar Anticline".

The Sitapahar anticline is the most prominent structure of the investigated area which axis is trending NNW-SSE direction along the main structure of the Chittagong –Tripura Folded Belt (CTFB). This doubly plunging anticlinal structure is about 400km long and 12-15 km wide and major part of the western flank is steeper than the eastern flank. The western flank dips in an angle ranging from 18 to80◦ and the eastern flank shows dip ranging from 4-78◦ which indicate that the anticline is an asymmetric anticline. From the attitude of the beds the anticline is suspected as a plunging anticline.

Characteristics of this Anticline:

• Shale is the oldest rock unit in axial region, so it forms the core of the anticline.

• The western flank of the anticline is steeper than the eastern flank and the attitude of beds of the western flank is not uniform.

Fault: Faults are rapture along which the opposite walls have move past each other. Same faults are only a few inches long and the others have a length of hundreds of miles. Most faults produce repeated displacements over geologic time. During an earthquake, the rock on one side of the fault suddenly slips with respect to the other. The fault surface can be horizontal or vertical or some arbitrary angle in between. From the irregularity in topography and structure we can say that sitakund hill range fault running NNW-SSE which is roughly parallel to the axis of the anticline. Total sitakund hill range acted as hanging wall and the western flank acted footwall. This footwall is covered by alluvial plane. But well exposed reverse fault is found in at Shahasradhara section.

Figure 29: Fault

Joint: Joint is a fracture in rocks along which no appreciable movement has occurred. Some joints in sedimentary rocks may have formed as the result of contraction during compaction and drying of the sediment. Joints are the very common structural features in the investigated area. These are widely distributed in the area. Joints are well developed in relatively resistant rocks. Vertical joints are the prominent structural features.

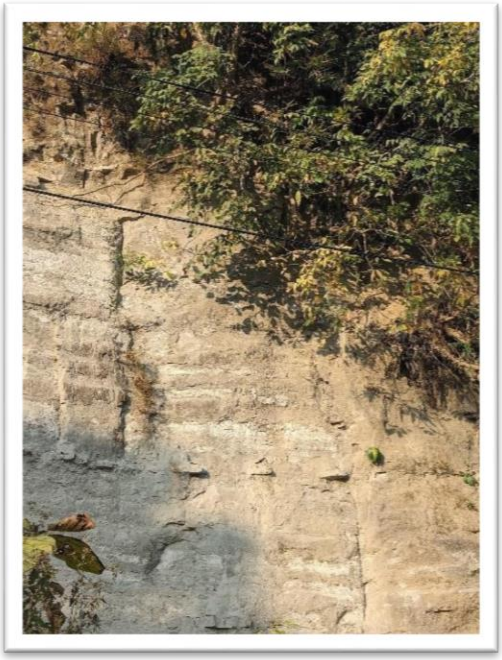


Figure 30: Joint

Oblique joint: Those striking in a direction that lies between the strike and direction of dip of the associated rocks.

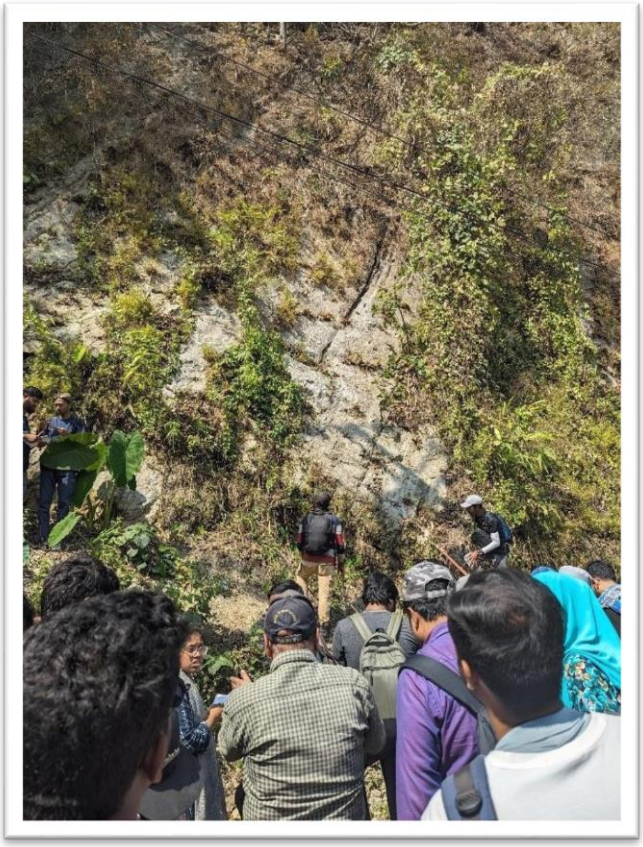


Figure 31: Oblique Joint

Local Unconformity: It is a disconformity of small extent representing a short interval of time. In the deposition of continental sediments, such as, gravels, sands and clays, the streams may wander back and forth across the basin of deposition. At time of flood these streams may scour out channels scores often wide and many feet deep. As the flood subsides or some days or even some years later, the channel may be filled up again.

Figure 32: Local Unconformity

Gas Seepage:

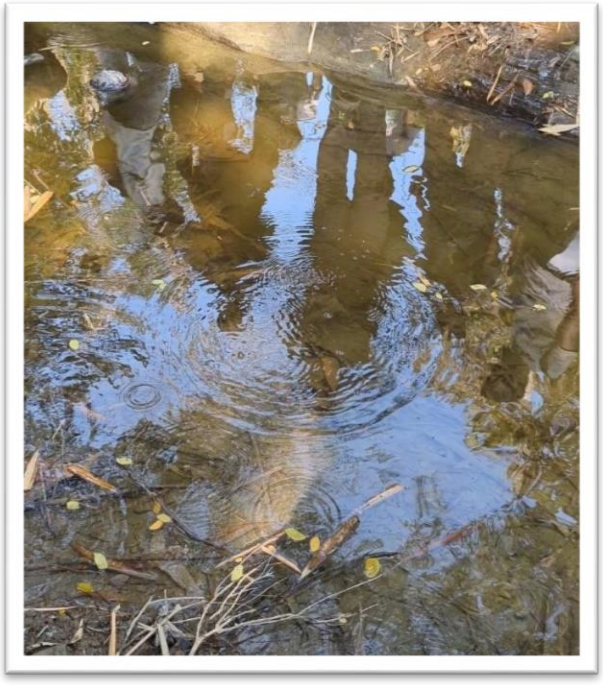


Figure 33: Gas Seepage

6.2 Sedimentary Structures

Sedimentary structures are large-scale features of sedimentary rocks such as parallel bedding cross bedding, ripples, mud cracks etc. They are generated by a variety of sedimentary processes including fluid flow, sediment gravity flow, soft sediment\ deformation, and biogenic activity (Boggs, 2001). A good number of sedimentary structures have been observed in the exposed rocks of the investigated area of the RangamatiChittagong Road cut section. They are described below-

Lamination: When the thickness of the strata is less than 1cm then the rock is said to be laminated (Boggs, 2001). These mainly found in shale.

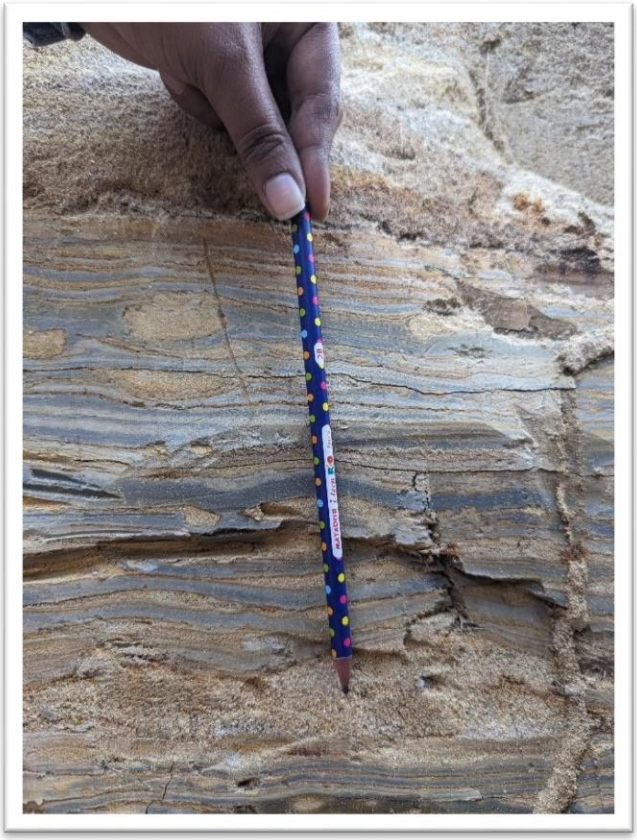


Figure 34: Lamination

Bedding: When thickness of the stratification is over 1 cm then it is called bedding. (Boggs,2001). Bedding is found in all the units of the both flank of investigated area.

Figure 35: Bedding

Trough Cross Bedding: Trough cross bedding consists of cross-bedded units in which one or both bounding surfaces are curved. The units are trough shaped sets consisting of an elongate scour filled with curved foreset laminae that commonly have a tangential relationship to the base of the set. (Boggs, 2001)

Figure 36: Trough Cross Bedding

Tabular Cross Bedding: Tabular cross-bedding consists of cross-bedded units that are broadin lateral dimensions with respect to set thickness and that have essentially planar bounding surfaces

The foreset laminae of tabular cross-beds are also commonly planar, but curved laminae that have a tangential relationship to the basal surface. (Boggs, 2001)

Wavy Bedding: When mud and sand proportion is being equal then the structures are called wavy bedding, which indicate the fluctuations of energy condition. This are formed in the intertidal zone. (Lindholm, 1991)

Figure 37: Wavy Bedding

Flaser bedding: Flaser bedding is a type of ripple bedding in which thin streaks of mud occur between sets of cross-laminated or ripple laminated sandy or silty sediment. Flaser suggests deposition under fluctuating hydraulic conditions.

Figure 38: Flaser Bedding

Iron Incrustation: It is a ring enclosed shape structure of iron generally formed in sandstone. Iron encrustation was a common feature in Lichubagan Sandstone.

Figure 39: Iron Incrustation

6.3 Engineering Structures

Artesian Well: If altitude that the pressurized aquifer pushes water up a well tapping it is the"piezometric level". If this level is below the land surface altitude (right side artesian well in the diagram) the water will not shoot out of the well at the land surface...the well is called an artesian well.

Figure 40: Artesian Well

Nut Bolting :

Figure 41: Nut Bolting

Ditch/Drain:

Figure 42: Ditch/Drain

Chapter 7: Stratigraphy & Correlation

7.1 Lithological Description

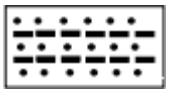
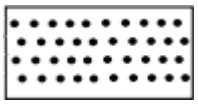
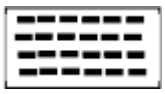
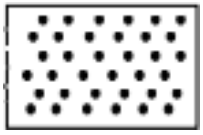
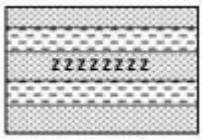
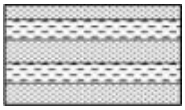
Stratigraphy is a branch of geologic sciences concerned with the study of stratified rocks in terms of time and space. It deals with the correlation of rocks from different localities. Correlation methods may be involving the use of rock units (lithostratigraphy), fossils (biostratigraphy), or geologic-time units or intervals (chrono stratigraphy). Stratigraphy is simply the relative spatial and temporal arrangement of rock strata.

The Rangamati-Chittagong road-cut section is characterized by various types of rock which are exposed along both side of road and also along stream-cut sections.

On the basis of lithology, the rocks are divided into six units. They are (from youngest to oldest)-

- ♣ Alluvium
- ♣ Lichubagan Sandstone
- ♣ Bergunia Claystone
- ♣ Chandraghona Sandstone
- ♣ Baraichari Sandstone and Shale
- ♣ Shilchari Shale and Sandstone

Table 01: Rock Units of Rangamati kaptai Road Cut Section

Formation	Local Rock Unit	Lithology	Symbol
	Alluvium	Unconsolidated Sand,Silt and Clay	
Dupitila	Lichubagan Sandstone	Yellowish brown, medium to coarse grained, massive sandstone, presence of quartz pebble and wood fragments	
Girujan Clay	Bergunia Clay	Bluish gray claystone with subordinate shale and a few silty sand	
Tipam Sandstone	Chandraghona Sandstone	Light yellow, medium to fine grained, moderately compacted sandstone interbedded with shale.	
Bokabil	Baraichari Sandstone and Shale	Alternation of yellowish brown, medium to fine grained Sandstone and bluish gray Shale with calcareous band and minor siltstone.	
Bhuban	Shilchari Sandstone and Shale	Alternation of light gray, moderately laminated, highly compacted, fissile shale with a few siltstone	

7.2 Lithologic Succession

Lithologic Succession at Baraichari Sandstone and Shale Unit:

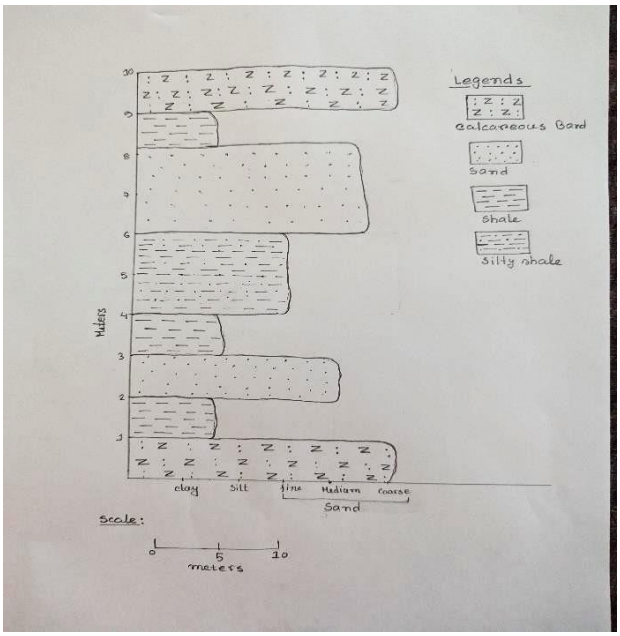


Figure 43: Lithologic Succession at Baraichari Sandstone and Shale Unit

Lithologic Succession at Shilchari Shale unit:

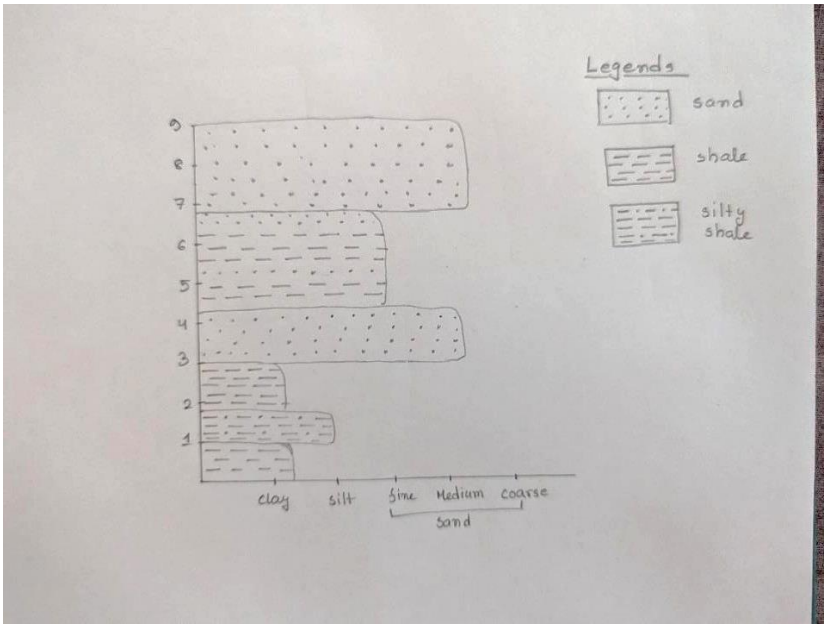
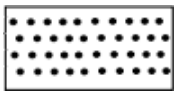
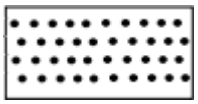
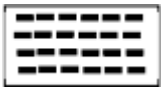
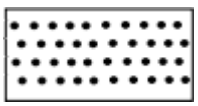
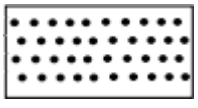
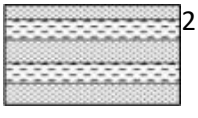


Figure 44: Lithologic Succession at Shilchari Shale unit

7.3 Correlation & Regional Stratigraphy

Lithology and stratigraphy are the possible means to the correlation of the studied area comparing the rock types of the surveyed area with that of Assam by vertical and horizontal cross section. Our investigated area lies on the eastern folded belt of Bengal Basin that was developed as the South extension of Assam Himalaya, in the Mio-Pliocene age. The stratigraphy of Assam has already been well established.

Table 02: Correlation between on field observer lithology, with regionally established lithology (Reimann, 1993)

Era	Period	Epoch	Group	Lithology	Formation	On-field observed Lithology	Symbol
CENOZOIC	Quarternary	Holocene			Alluvial		
		Pleistocene			Madhupur Clay		
		Pliocene					
		Late Miocene	Tipam	Medium to coarse-grained, Gray to yellow sandstone with clay balls and quartz pebbles	Dupi Tipa Sandstone	Yellowish Brown sandstone (fine to medium in size), sand-shale alteration, clay chips, and ferruginous materials	
		Middle Miocene		Claystone, silty shale, and subordinate sandstone	Girujan Clay	Brown colored fine-grained unconsolidated clay size mudstone with the presence of a massive structure	
		Early Miocene	Surma	Massive sandstone with subordinate shale	Tipam Sandstone	Bluish gray, sand shale alteration, moderately compacted calcareous shale	
				Alternation of well-bedded siltstone and shale with subordinate sandstone	Bokabil	Bluish Gray sand shale alteration, moderately compacted calcareous shale	
				Siltstone with subordinate shale and sandstone	Bhuban	Bluish colored and hard compacted shale also present minor silt	

- **Individual latitudes and longitudes of each sections**

Day-1

Section	Latitudes	Longitudes
1	92°7’49”	22°28’12”
2	92°7’44”	22°28’31”
3	92°7’36”	22°28’37”
4	92°7’35”	22°29’22”
5	92°7’40”	22°29’22”
6	92°7’43”	22°29’23”
7	92°7’46”	22°29’25”
8	92°7’49”	22°29’25”

Day-2

Section	Latitudes	Longitudes
1	92°8’6”	22°29’32”
2	92°8’9”	22°29’34”
3	92°8’4”	22°29’35”
4	92°8’3”	22°29’42”
5	92°8’2”	22°29’45”
6	92°8’3”	22°30’4”
7	92°8’19”	22°30’11”
8	92°8’28”	22°30’11”
9	92°8’33”	22°30’32”
10	92°8’40”	22°30’27”
11	92°8’46”	22°30’32”
12	92°9’15”	22°30’32”
13	92°9’16”	22°30’31”
14	92°9’19”	22°30’36”
15	92°9’21”	22°30’38”
16	92°9’23”	22°30’41”
17	92°9’22”	22°30’45”

Day-3

Section	Latitudes	Longitudes
1	92°9’49”	22°30’13”
2	92°9’51”	22°30’9”
3	92°9’59”	22°30’10”
4	91°10’1”	22°30’11”
5	92°10’2”	22°30’12”
6	92°10’7”	22°30’10”
7	92°10’9”	22°30’11”
8	92°10’17”	22°30’8”
9	92°10’29”	22°30’2”
10	92°10’30”	22°28’59”
11	92°10’33”	22°29’58”
12	92°10’37”	22°29’55”
13	92°10’50”	22°29’51”
14	92°11’19”	22°29’44”
15	92°11’31”	22°29’50”
16	92°11’38”	22°29’54”
17	92°11’39”	22°29’57”
18	92°11’42”	22°30’1”
19	92°11’48”	22°30’3”
20	92°12’8”	22°30’6”
21	92°12’21”	22°30’9”

Chapter 8: Discussion & Conclusion

8.1 Discussion

Field work is inevitable program for a geology student. Geologically the Sitapahar anticline is an elongated, asymmetrical, box type double plunging anticline; which is the most prominent structures of Bengal Basin. It is situated in the Bengal Fore deep portion of the Bengal Basin, located in the northwest part of Chittagong district. The Sitapahar anticline has the position in the western sub zone of the Folded Flank, which is considered to be the most continuation of the Chittagong –Tripura folded belt. It is originated from the deformation by the relative movement of the Indian plate and Burmese sub plate, the Sitapahar anticline is trending in NNW-SSE direction.

The Sitapahar Structure is situated within the middle asymmetric thrust faulted zone of the Chittagong-Tripura Fold Belt (CTFB) and immediate east of the Indo-Burmese deformation front. This fold belt of the Bengal Basin along with more easterly Indo-Burman Range (IBR) developed as a consequence of the oblique collision between Indian and Burmese Plates. The tectonic activity is still continuing and shaping the geomorphology of this area. The present research focused to explore the geology and active tectonics of the Sitapahar Structure and its surroundings based on geomorphic observations, geometrical analysis of the bedding attitude data, and 2D structural modelling.

Based on surface geology, four major rock units and two sets of faults have been identified. Faults are mainly thrust (master and back thrust), and reverse-dextral slip faults. Among the four faults along the Ghagra-Rangamati road cut section, the western thrusts and the easternmost thrust are the direct result of the collision of the Indian and Burmese Plates, and the other eastern thrust is the back thrust of the western fault. The reverse-dextral slip faults along the Chandraghona-Kaptai road cut section are probably results from the oblique collision. The sterographic analysis reveals that the Sitaphar Anticline is an assymetrical open fold.

8.2 Conclusion

The investigated area is an asymmetrical anticline where the eastern flank is gently dipped and the western flank is steeper. The studied area mainly carried out in the both western and eastern flank of Sitapahar Anticline along the road cut section. This field report deals with the overall geology of the investigated area Sitapahar Anticline that is physical and geomorphic features, structure, stratigraphy, tectonics, depositional environment and economic importance.

The Rangamati-Chittagong Road cut section is a region of irregular topography marked by the sense of hillocks trending NNW-SSE direction. Geologically the region is interesting as it is a tectonically disturbed zone indicated by the presence of fold, fault and joints caused by major folding and faulting in the affected area after deposition of Tertiary sediments. The faults are thrust in nature. In each flank two prominent faults are identified. Tectonically the area Rangamati-Chittagong hilly region generated due to the collision of Indian Plate moving along South-East to North-East and Burmese Plate moving along east to west. By correlating the stratigraphy of the study area with the stratigraphy of Bangladesh on the basis of lithology, sedimentary sequences, the investigated area divided into five formations.

These are Bhuban, Boka Bil, Tipam, Girujan Clay and Dupi Tila from older to younger and Miocene to Plio-Pleistocene aged. The major rock types that are found in this region are only sedimentary origin, such as shale, silty shale, sandy shale, sandstone, mudstone. Various types of sedimentary structures are also observed here such as bedding, cross bedding, lenticular bedding, lamination, cross lamination, wavy bedding, clay galls, nodular structures etc. Because of weathering here also developed a thick alluvium cover.

However, from a geological point of view, it may be a perfect place for economic resources. Proper investigation is necessary to detect the presence of oil and gas in this area. Sitapahar anticline is an excellent area for detailed investigation which requires more time, more equipment, more scope and higher knowledge.

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Geological Map

Field Map