Civinnovate

Discover, Learn, and Innovate in Civil Engineering

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INTRODUCTION:

Engineering is a study largely based on practical study and field visits. Among the different fields of engineering, Civil Engineering is the one in which field visits proves most fruitful for both the learning students and teaching teachers as only learning by studying in a classroom is far the insufficient to produce a good and skilled Civil Engineer. Civil Engineering infact is one the most interesting study to learn having wide and interdisciplinary subjects included within the course.

Based on these proven principles, we the 2nd year students were taken to the field visit for subject **Engineering Geology (CE 503)** in Malekhu area of Dhading district of Central Nepal as per the syllabus for B.E Civil given by the Tribhuvan University. This subject provides the basic knowledge of geology to the students. It helps to understand how to identify the rocks, minerals, geological structures, geological processes and their impacts on engineering structures. Engineering gelogy is one of the most important subject for civil engineering as every civil engineering works/construction are done on the land and construction of any kind of civil engineering projects without taking into account the geological features of that place can lead to the failure of such high cost projects.Engineering geology gives the idea of site selection, proper investigation and eligibility of the area for particular type of engineering project.

We would like to acknowledge our subject teachers Mr. Basanta Raj Adhikari and Mr. Prakash Chandra Gautam for assisting us during the two day visit. We would also like to thank the civil department for providing us the transportation facility for the field visit. This field visit has proven very fruitful for all of us and it has also given us a basic experience about working in the field for the first time and this is sure to help us in our near future to work as a civil engineer. Again we would like thank our teachers who also assisted us to prepare this report and helped us to achieve our objectives invariably during this entire semester. We have tried our best to reduce the errors during the report writing as well in the fields but there might still be some errors and lack and hope you will consider them.

OBJECTIVES OF STUDY:

Our field works was based on the following objectives:

1) Study of geological works of river and landform developed by erosional and depositional activities of river.

2) Study and identification of rocks in the field (Marble, Granite, Schist, Quartzite, Phyllite, Slate, Gneiss, Limestone).

3) Handling of geological compass and measurement of attitude of geological planes (Bedding plane, Foliation plane, Joint plane, Fault plane, etc.)

4) Study and identification of geological structures (Joints, Folds, Faults, Unconformity, Thrust, Foliation, Bedding Plane).

LOCATION AND TOPOGRAPHY OF STUDY AREA:

LOCATION:

The study area is connected with Kathmandu valley through the Prithvi Highway, which is also considered as a channel linking Kathmandu with Pokhara, Birgunj, Butwal & other major cities of the country. It has wide range of geological features within a small range of area. The Malekhu V.D.C. of Dhading district lies about 70 Km south west of Kathmandu valley and is located at latitude of 27^{o} 50' 38''E to 27^{o} 45' 50''E and longitude of 24^{o}49'5''N to 24^{o}50' 50''N. Malekhu Bazaar is therefore accessible by motor able and graveled roads.

TOPOGRAPHY:

The topography of Malekhu is very rough. It includes hills, river valleys, spurs, saddles, river plain and terrace etc. The lowest altitude of this area is about 340m at the Trishuli river valley and the highest altitude of this area is about 1525 m at the north of the Dharapani village.

Malekhu lies on lesser Himalayan unit of Nepal. It is situated on the bank of Trishuli and Malekhu river. The Trishuli river is running from the eastern direction to the western direction and the Malekhu river from south to north which mingles into the Trishuli river. Also, the

Malekhu river has a tributary namely the Apakhola which meets the Malekhu river at a distance about 3 kms from the Malekhu bazzar. Climatically Malekhu is a sub-tropical zone. The Trishuli River, a snow fed river of the Central Nepal, is the main drainage of Malekhu and its surrounding areas. It flows through the east to the west, more or less parallel to the structure strike. Because of the variation in altitude, ranging from 350 m from sea-level (at the bank of Trishuli River) to 1000m , the local climate varies throughout the year. There is tropical to sub-tropical climate in valleys and temperate climate at higher areas. Physiographic condition, monsoon winds, altitude & vegetation controls the climate of the area. Temperature ranges from 250c to 380c in summer and 100c to 200c during winter season. Valley area is relatively warmer than higher areas. Rainy season brings difficulties in habitation. Various disasters like floods, landslides etc. cause the damage to the highway bridges, agriculture lands, houses etc.

STUDY AND IDENTIFICATION OF ROCKS

Rock Definition:

ROCK is a relatively hard, naturally occurring mineral material. It consists of a single mineral or of several minerals that are either tightly compacted or held together by a cement like mineral matrix.

Classification of Rocks:

The three main types of rock are Igneous, Sedimentary, and Metamorphic.

A) Igneous Rock

These types of rocks are formed by the solidification of magma either under the surface of earth or over it. These are of three types according to the solidification process.

Plutonic Rock :- The rocks, which are formed underneath the surface of the earth, are called the plutonic rocks.

Volcanic Rock :- The rocks, which are solidified on the surface of earth, are called volcanic rocks.

Hypabyssal Rock :- The rocks, which are solidified on the way of extrusion process, are called hypo basal rocks.

Igneous rocks are commonly identified in the field by the study of their interlocking crystallization of a number of mineral grains. Igneous rocks are generally hard, massive, compact, having no bedding plane and interlocked grains. It usually contains much

feldspar. By the study of these properties we can identify the igneous rocks in the field. e.g.,

Granite - generally equigranular texture, light colour appearance

Gabbro - coarse grain and dark colour

Dolerite - containing dark minerals in good proportion with medium grain sized

B) Sedimentary Rock:

These rocks are derived from pre-existing rocks through the process of erosion, transportation and deposition by various natural agencies such as wind, water, glacier etc. The loose sediments undergo compaction and form resulting products as sedimentary rocks. According to the mode of transportation the sedimentary rocks are divided into three different types.

Clastic Rocks :- The rocks which are formed by deposited mechanically are known as clastic rocks.

Chemical Deposits :-The rocks which are formed by chemical precipitation are known as chemical deposits.

Organic Deposits :-The rocks which are formed by deposited organically are called organic deposits.

Sedimentary rocks are identified in the field by the study of different layers, which are originally bedded or laminated under suitable

conditions. There may be the impression of fossils in sedimentary rocks. The colour and the grain size of the rocks may be different in different layers. By the study of these properties also the rocks may be identified. e.g.,

Conglomerate - grain size greater than 2 mm

Sandstone - grain size is equal to sand (i.e. 1/16 mm –2 mm), quartz is common

Clay stone - formed by deposition of clay, shale is common example

C) Metamorphic Rock

These are formed by alteration of alignment, texture, structure, chemical composition etc. in pre-existing rocks due to the action of temperature, pressure and chemical reaction. Metamorphic rocks are generally hard and having of interlocking grains.

- Contact Metamorphic
- Dynamic Metamorphic
- Dynamo Thermal
- Metasomatic

Metamorphic rocks are distinctly distinguished from other types of rocks by the development of features like cleavage, foliation, schistosity and by the presence of such minerals which are known to be of metamorphic origin. Metamorphic rocks often exhibit an interlocking texture of the constituent minerals grains. Thus these

rocks are basically identified in the field on the basis of colour, texture as well as structure.

Different types of rock cleavages are:

1. Slaty cleavage: Cleavage may be parallel to original bedding or at certain angles to it. It is due to parallel arrangement of highly cleavable minerals in rocks. Eg:slate, phyllites
2. Schistosity: Rocks are made up of parallel layers of platy and flaky minerals. It is due to recrystallization and reorientation of minerals due to thermal and dynamic metamorphism. Eg: Schist
3. Gneissosity: Rocks are made of alternate bands of flaky/platy minerals and equidimensional granular minerals. Alternate black and white bands are seen.

Slate - slaty cleavage

Phyllite - soapy feeling

Schist - rough, irregular and undulated plane, unequal growth of minerals

Gneiss - band of contrast colour, composition and texture (mica band)

Field Identification

Location 3: About 150m from Malekhu Suspension bridge along Dhadhing Basi due north.

Sample 1(Slate)

Physical Properties:

Color:	Grey
Structure:	Foliation-Plane
Texture:	Non-Crystalline
Grain Size:	Fine
Specific Gravity:	Medium
Acid Test:	No Acid Test
Hammer Test:	No Hammer Test
Mineral Composition:	Quartz, Feldspar

Rock Type: Metamorphic Rock

Rock Name: Slate

Engineering Properties:

Strength: Low

Drillialibility: High

Blastabity: Low

Uses: Roofing, Construction material

Geological Unit: Benight slate

Location 4: About 100 m from Malekhu Suspension bridge along Dhading Basi due north.

Sample 2(limestone):

Physical Properties:

Color: White

Structure: Bedding plane

Texture: Non crystalline

Grain Size: Fine

Specific Gravity: Medium

Acid Test:

Hammer Test: hammer scratches rock

Mineral Composition: Calcite

Rock Type: Sedimentary

Rock Name: Limestone

Engineering properties:

Strength: Low

Drillialibility: High

Blastabity: High

Uses: To make Cement

Geological Unit: Malekhu Limestone

Location 6: Situated just after 700m upstream from Broken Bridge and in the right bank of Malekhu river

Sample 3:

Physical Properties:

Color:	Grey
Structure:	Foliation Plane
Texture:	Non-Crystalline
Grain Size:	Fine
Specific Gravity:	Low
Acid Test:	No acid test
Hammer Test:	No hammer test
Mineral Composition:	Quartz, Feldspar, Saricite
Rock Type:	Metamorphic

Rock Name: Phyllite

Engineering properties:

Strength: Low

Drillialibility: High

Blastabity: low

Uses: To make dry wall

Geological Unit: Robang Phyllite

Sample 4:

Physical Properties:

Color: White

Structure: Foliation

Texture: Crystalline

Grain Size: Medium

Specific Gravity: Medium

Acid Test:

Hammer Test: Rock scratches hammer

Mineral Composition: Quartz

Rock Type: Metamorphic

Rock Name: Quartizite

Engineering properties:

Strength: High

Drillialibility: Low

Blastabity: High

Uses: Construction, Riprap material

Geological Unit: Dunga Quartzite

Location 8 :Situated about 850 m upstream from broken bridge and in the right bank of malekhu river

Physical Properties:

Color: Dark grey

Structure: Foliation(Schistocity)

Texture: Non-Crystalline

Grain Size: Fine

Specific Gravity: Low

Acid Test: no acid test

Hammer Test: no hammer test

Mineral Composition: Quartz, Feldspar, Chlorite, Biotite, Muscobite

Rock Type: Metamorphic

Rock Name: Schist

Engineering properties:

Strength: Low

Drillialibility: High

Blastabity: LOW

Uses: Construction material

Geological Unit: Raduwa Formation

Location 11: situated about 875 m upstream from broken Bridge and in the right bank of malekhu river

Sample 6:

Physical Properties:

Color: White

Structure: Random Orientation

Texture: Crystalline

Grain Size: Coarse

Specific Gravity: High

Acid Test: No acid test

Hammer Test: No hammer test

Mineral Composition: Plogioclase(milky white), Quartz(dirty white)

Rock Type: Igneous

Rock Name: Granite

Engineering properties:

Strength: High

Drillialibility: Low

Blastabity: High

Uses: High Construction material

Geological Unit: Agra granite

(Undigested foreign material present in plutonic rock like granite is xenolith rock)

Sample 7:

Location 10

Physical Properties:

Color: White

Structure: Random Orientation

Texture: Crystalline

Grain Size: Coarse

Specific Gravity: medium

Acid Test: No acid test

Hammer Test: No hammer test

Mineral Composition: Plogioclase(milky white), Quartz(dirty white)

Rock Type: sedimentary

Rock Name: conglomerate

Engineering properties:

Strength: Low

Drillialibility: Low

Blastabity: High

Uses: Aggregates

Geological Unit: -

Location 12: situated about 870m upstream from broken Bridge and right bank of Malekhu river

Sample 8:

Physical Properties:

Color: White

Structure: Accroidal

Orientation: Preferred

Texture: Crystalline

Grain Size: Coarse

Specific Gravity: Medium

Acid Test:

Hammer Test: Hammer Scratches sample(hardness 3)

Mineral Composition: 99% calcite

Rock Type: Metamorphic

Rock Name: Marble

Engineering properties:

Strength:	High
Drillialibility:	High
Blastabity:	High
Uses:	Decoration, Flooring
Geological Unit:	Bhaisedobhan Marble

Study and Identification of Geological Structures

Study and identification of geological structures was done in **location no** 5, about 300m upstream from the old bridge Highway on the left bank of Trishuliriver.

Structural Geology:

Structural geology is the branch of geology which deals with the mechanism and types of deformations of the rocks of earth due to influence of stress generated by various geological processes.

Geological structure:-

The feature developed in the rock during the formation and after the formation of rock due to the influence of different stresses is known as geological structure.

Types of geological structures:

a) Primary geological structures:-

Those structures of features developed by on the rock during the formation of rock due to the different deformations appeared is known as primary structures.It is usually found in sedimentary rock.For example,bedding,cross-bedding,lamination ripple,etc.

b) Secondary geological structures:-

Those geological structures or features developed on the rock after the formation of rock due to the different deformations is known as secondary geological structures.For example: fold, fault,thrust, rock cleavage, etc.

Several of these secondary structures were observed during our field visit.

a) **Fold**:-

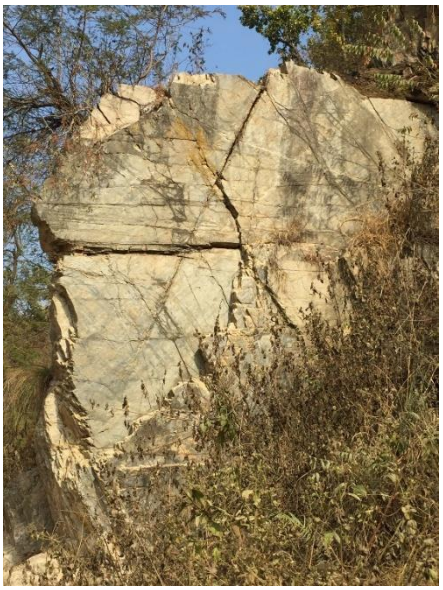
The ductile deformation of rock due to which the rock strata forms bendings or 0curvatures is known fold.The force acting may be shear or compressive.Process of its formation is a very slow geological process.

Limb: It is a side of the fold.

Crest and Trough: These are the convex and concave portions of the fold.

b) **Fault**:-

Rupture of fracture along which there is relative displacement of rock parallel to the fracture plane due to brittle deformation due to the stress i.e. compressive, shear or tensile is known as fault.



c) Joint:-

Rupture or fracture along which there is no relative displacement along fracture plane due to brittle deformation under the influence of shear,compressive or tensile stress.

Classification of fold:-

Based on upward or downward bend:-

a) Anticline fold:-

- strata convex upwards.
- limbs dip away from each other.
- older beds at core.

- older rocks are exposed near the fold axis and younger rocks are exposed away from the axis.

b) Syncline fold:-

- strata concave upwards.
- limbs dip towards each other.
- younger beds at core.
- younger rocks are exposed near the fold axis and older rocks are exposed away from the axis.
- tensile stress acts on the trough.

Axial plane:-The imaginary plane which divides the folds into two equal halves is known as axial plane.

Based on relationship of the axial plane to the limb:-

a) Symmetrical fold:-

- limbs are mirror image of each other.
- axial plane is vertical.
- limbs of both sides dip at equal angles.

b) Asymmetrical fold:-

- limbs of both sides dip at different angles.
- axial plane is inclined.

c) Overturned fold:-

- Axial plane is inclined but both the limbs dip at unequal angle in same direction.

d) Recombent fold:-

- Both the limbs are laid horizontal.
- axial plane is also horizontal.

Classification of fault:-

Genetic classification:-

a) Normal fault:The fault in which hanging wall moves downward with respect to the footwall is known as normal fault.

b) Reverse fault: The fault in which hanging wall moves upward with respect to the footwall is known as reverse fault.

c) Thrust fault:-These fault are reverse fault in which fault planes are generally inclined at 10° to 45° to the vertical.is known as thrust fault.If the angle is less than 10° it is known as overthurst.

d) Strike slip fault: In this fault movement takes place parallel to the strike of the fault.

Terminologies of faulting:-

a) Fault gauge: During faulting,rubbing and shearing of the rock takes place. The rocks are finely pulverized into clay like fine black powder rock material which is caused at the near part of the fault region called fault gauge.

b) Fault breccia:-The angular, fragmentary material produced during faulting is known as fault breccia.

Evidences of faulting:-

a) Presence of slicken slides: The parallel grooves formed due to frictional sliding on flat, polished surface is known as slicken slides.

b) Fault gauge and fault breccia: Presence of fault gauge and fault breccia on the location indicates faulting.

c) Abrupt termination: Abrupt termination of strata or any geological structure indicates presence of fault.

c) Unconformity

Surface of erosional and depositional gap within a sequence of strata is called unconformity.

These are usually the weak contact where the failure starts to generate. It created permeability contrast thus natural springs or discharge can occur in such places.

At Chainage 100m from suspension bridge above Trishuli River along DhadingBesi old road unconformity was seen. Among series

of rock strata soil and stone deposition could be seen which established an unconformity at that place.

d) Thrust

A kind of reversed fault in which hanging wall has actually moved up relative to the footwall is called trust.

e.g.: - Mahabharata thrust separates Nuwakot complex and Kathmandu complex.

e) Foliation

Foliation is usually formed by the preferred orientation of minerals within a rock. Foliation is any penetrative planar fabric present in rocks. Foliation is common to rocks affected by regional metamorphic compression typical of orogenic belts. Rocks exhibiting foliation include the typical metamorphic rock sequence of slate, phyllite, schist and gneiss.

Foliation in areas of shearing, and within the plane of thrust faults, can provide information on the transport direction or sense of movement on the thrust or shear. Generally, the acute intersection angle shows the direction of transport. Foliations typically bend or curve into a shear, which provides the same information, if it is of a scale which can be observed.

f) Bedding Plane

In geology a bed is the smallest division of a geologic formation or stratigraphic rock series marked by well-defined divisional planes (bedding planes) separating it from layers above and below. A bed

is the smallest litho stratigraphic unit, usually ranging in thickness from a centimeter to several meters and distinguishable from beds above and below it. Beds can be differentiated in various ways, including rock or mineral type and particle size. The term is generally applied to sedimentary strata, but may also be used for volcanic flows or ash layers.

In a quarry, 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.

Handling of geological compass and measurements of attitudes of geological planes

Handling of geological compass was done in **location no 4**, situated about 20m downstream from Malekhu suspended Bridge on the right bank of Trishuli river.

Geological Compass

-geological compass is defined as the combination of compass and inclinometer.

Types of Geological Compass

There are mainly three types of geological compass.They are:

1. **Brunton Compass**
2. **Clar Compass**

3. Digital Compass

In the geological field we used brunton compass for measurement of various parameter like dip amount,dip direction etc.

Brunton Compass

Brunton Compass, properly known as the Brunton Pocket Transit, is a type of precision compass made by Brunton.Unlike most modern compasses, the Brunton Pocket Transit utilizes magnetic induction daping rather than fluid to damp needle oscillation.Although Brunton makes many other types of magnetic compass,the Brunton Pocket Transit is a specialized instrument used widely by those needing to make accurate degree and anglemeasurements in the field.

Fig: Brunton Compass

Handling Of Brunton Compass:

Brunton compass have three main parts,box,sighting arm,and lid.The box contains most of components: the needle; bull's eye level(round level to read horizontal angles); clinometer level(barrel shaped) and clinometer scale(for reading vertical angles); damping mechanism; lift pin(to lock the needle);side brass screw and index pin(to set and display the declination);graduated circle or card(to read the bearing).It is used to measure the dip direction and dip amount.While measuring the dip direction, geographic north of compass should be pointed towards the water- flow and take the reading shown by magnetic north of compass.

Measurement of attitudes

S.N.	Strike	Dip Amount	Dip direction
1	165	71	260
2	345˚	62˚	262˚
3	171˚	58˚	77˚
4	166˚	83˚	256˚
5	347˚	62˚	262˚

Dip direction measurement

RIVER CHANNEL MORPHOLOGY

River is a mass of water that flows along a path high to low gradient carrying different materials and responsible for different geological actions, such as erosion, transportation and deposition of sediments. The route along which the river flows is called river channel. In engineering practice, many structures, such as dam, bridge, reservoirs etc. are constructed in river channels. Besides construction of infrastructures, construction materials are also barrowed from the river territory. Types of river channel and the availability of construction materials in the site greatly affects the design and cost of such structures.

TYPES OF RIVER CHANNEL

1. Straight River: This type of river follows a straight path. The topography of the area is characterized by steep relief. The gradient of the river path is also high causing the flow velocity of water high. Since the energy level of such river is high, the erosional rate is intensely higher than the deposition of sediments. Deep scouring along the river path is higher than the side cutting. Straight rivers are dominantly occurred in the higher Himalayan region.

2. Meandering river: This type of river follows a zigzag path. The topography of the area is characterized by moderate relief. The gradient of the river path is so moderate that the river strikes in one end and return to other direction making the path zigzag. The river is widened and flow with lower velocity than that of Straight River. Since energy level of such river is medium, the erosional rate and the deposition rate of sediments is comparatively equal. The side cutting by the river is higher than the deep scouring along the river path. In the striking bank, the side cutting is higher with higher erosional rate and opposite to strike bank in a depositional bank where deposition of sediments takes place. Due this phenomenon, the channel shifting is prominent in such type of river system. Meandering rivers are dominantly occurred in the midlands and lesser Himalayan region.

3. Braided river: In this type of river, a single river path is diverted into several paths and may converge to single later. The topography of the area is characterized by low relief. The gradient of the river path is so low and the river area is widened and flow with lower velocity. Since the energy level of such river is low, the deposition rate of sediments is intensely higher than the erosional rate. Thick successions of sediments

go on depositing along the river path and the river diverts to other sub paths for flow down. Many channel bars occur along the river path. Due to this phenomenon, the channel shifting is prominent in such type of river system. Braided rivers are dominantly occurred in terai regions.

FEATURES DEVELOPED BY RIVER:

1. Erosional landforms

a. Ox bow Lake: An oxbow lake is U-shaped body of water that forms when a wide meander from main stem is cut off, creating a free-standing body of water. This landform is so named for its distinctive curved shape, resembling the bow pin of an oxbow. An example of an entirely artificial waterway with oxbows is the Oxford canal in England.

b. River valley: A valley formed by flowing water, or river valley, is usually V-shaped. The exact shape will depend on the characteristics of the stream flowing through it. Rivers

with steep gradients, as in mountain ranges, produce steep walls and a bottom. Shallower slopes may produce broader and gentler valleys. However, in the lowest stretch of a river, where it approaches its base level, it begins to deposit sediment and the valley bottom becomes a flood plain.

c. Pothole: A pothole is a type of failure in an asphalt pavement, caused by the presence of water in the underlying soil structure and the presence of traffic passing over the affected area. Introduction of water to the underlying soil structure first weakens the supporting soil. Traffic then fatigues and breaks the poorly supported asphalt surface in the affected area. Continued traffic action ejects both asphalt and the underlying soil material to create a hole in the pavement.

d. Gorge: It is a deep ravine between pairs of cliffs and is the most often carved landscape by the erosive activity of a river over geological timescales. Rivers have a natural tendency to cut through underlying surfaces so will eventually wear away rock layers to lessen own pitch slowing their water; given enough time, their bottoms will

gradually reach a baseline elevation-which is the same elevation of the body of water it will eventually drain into.

e. Rock island:

I: Bed rock: It is the part of rock island which is formed by the erosional activity and some part of rock island gets removed and the remaining part of rock is called bed rock.

II: Boulder: It is also the part of rock island which is the removed part from bed rock. It is about 200 mm in size.

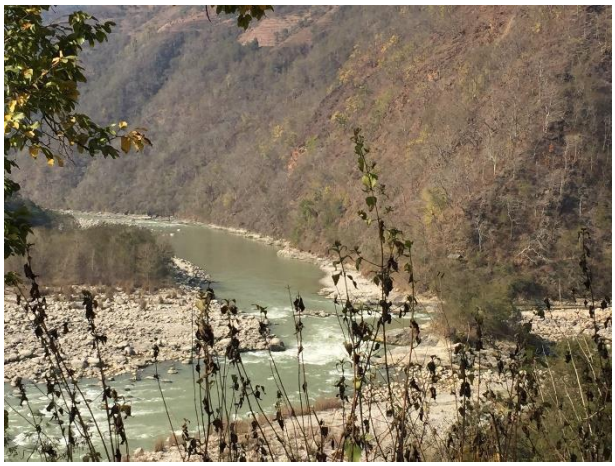
2. Depositional landforms

a. Point bar deposit: It is a type of deposition in which many rivers deposit the sediments at a single point.

b. Side bar deposit: In this type of deposit, the channel moves in a straight path and it carries away the sediments side by side forming side bar deposition landforms.

c. Channel bar deposit: Here two channels move in a parallel format with certain gap between them and deposits the sediments in the middle of them which gives a formation of channel bar.

d. Fan: When sediments flow down from high gradient tributaries on the low relief, the sediments get accumulate forming a fan shaped deposit, which is called fan deposit. Since deposit is due to water, the fan is known as alluvial fan. If the materials are dominantly composed of large angular fragments, then the deposit is called debris fan.



e. Delta: This feature is common on the confluence of river and sea. Rivers take sediment along with it and on the flat land, the sediments spread. The sediment deposits resemble the Greek letter delta, so the deposit is called Delta. Delta is land of fertile soil. Delta of Ganga and Brahmaputra River, delta of Nile River, Delta of Mississippi River are the world's largest Deltas.

Description of location:

In Malekhu, River channel morphology of Trishulikhola was studied.

The location of our study was along the roadway to Dhadingbesi at a distance of about 60m from the suspended bridge to the left with respect to the flow of river.

Following features of river was observed at the site:

1. Meandering river channel
2. Still water present in some parts
3. Rock island formed at the junction of Trishuli and Thopalriver.
4. Point bar deposit in Trishuliriver
5. Large and wide striking bank
6. Oxbow

CONCLUSION:

At last we had concluded the Malekhu and its surrounding is the answer for geological curiosity. Actually the Malekhu is small in area but it has large amount or number of the geological phenomena and features and hence it can provide broad knowledge for the learners like us.

Along the Malekhu river, we found sedimentary rocks and

gradually metamorphised from phyllite to crystalline schist and along the way to Dhading, it gradually metamorphised to limestone to phyllite and to the slate.

We have learnt different methods of geological data collection measures and the way how the rock mapping is done. Handling compass and to measure the attitude of rock outcrop is now very easy to us. We also got chance to know about river channel morphology that how the river flows, what are the factors affecting erosion and deposition and how it occurs.

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