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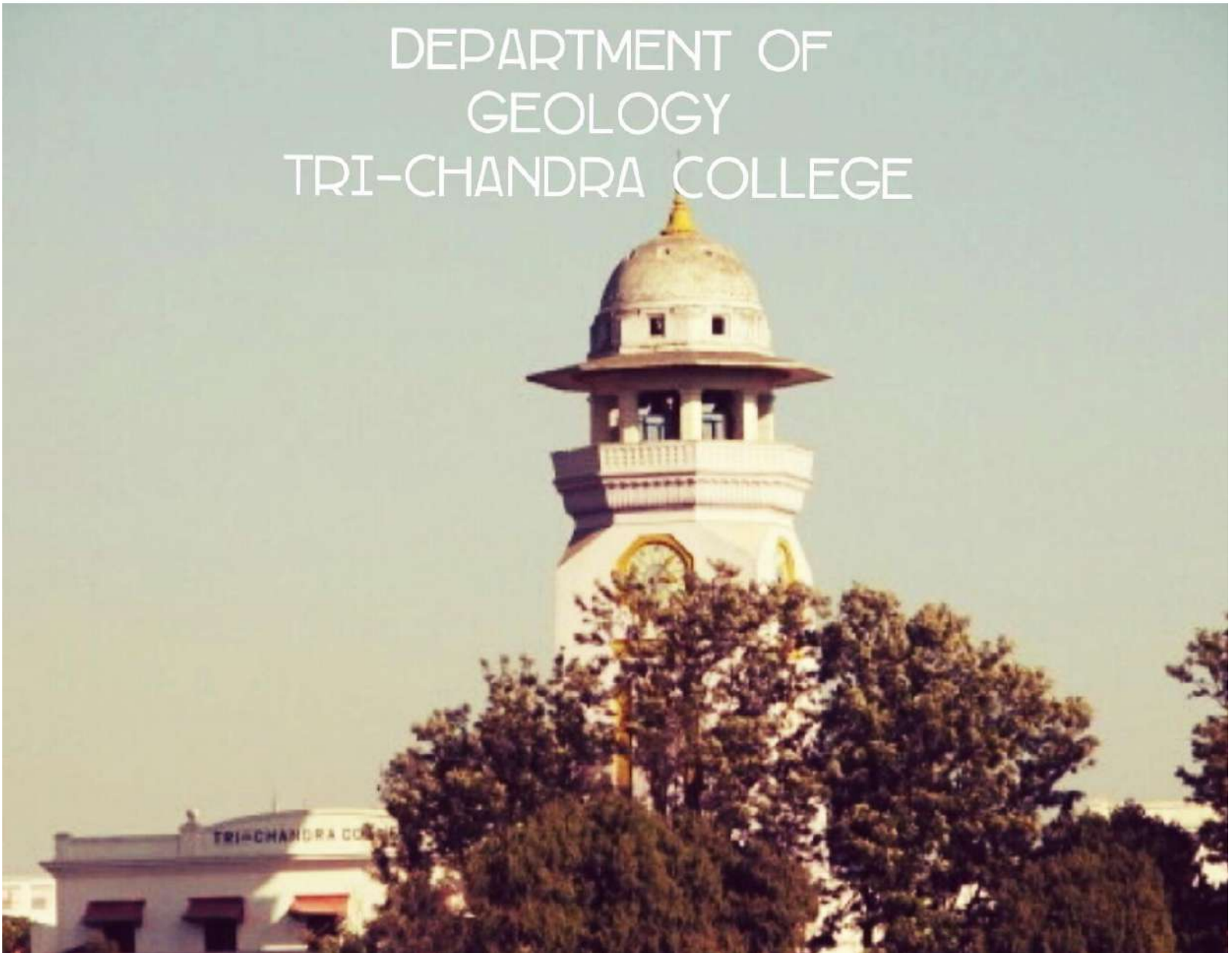
GEOWORLD

STUDENTS' MAGAZINE

2014

STUDENTS' GEOLOGICAL SOCIETY
GEO-CLUB

DEPARTMENT OF
GEOLOGY
TRI-CHANDRA COLLEGE



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Advisors:
Prof. Dr. Hari Prasad Thapaliya
Dr. Tara Nidhi Bhattarai
Mr. Binaya Ram Bhatta

Special thanks:
Anoj Khanal

Editorial board:
Basant Bhandari
Durga Khatiwada
Govind Joshi
Madhavi Regmi
Navin Thapa
Ronash Adhikari
Sameer Poudel

Computer work:
Amit Shrestha
Bikram Shrestha
Ishwor Gyawali
Kiran Pandey

Production Management
Rahul Poudel

Editorial

The Editorial Board is immensely delighted to bring out this student magazine (GEOWORLD) of the Students' Geological Society. This is also a developed document for the record of our batch (2067-2070) in Department of Geology. It also contains brief academic details and personal experience of B.Sc 3rd year student who studied geology in the department and also contributed articles.

Our sincere thanks to all the student of geology who has contributed their valuable articles to this magazine. Similarly, we would like to thank all the members of the GEO-CLUB for their cooperation. We received enormous encouragement and supports from Campus Administration, Department of Geology, Free Students' Union and students of Geology for which we express our sincere gratitude. We would like to express our gratitude to Dr. Tara Nidhi Bhattarai, Head of the Department of Geology for his real encouragement and continuous support to publish this magazine.

We hope that the readers will find this student magazine useful and informative. Comments and suggestions for the further improvement of the GEOWORLD are highly welcomed.
Thank you!

The Editorial Board
GEOWORLD, Vol.5, 2014

Ph. No. 4-244047

Tribhuvan University
Tri-Chandra Multiple Campus
(Estd. 1918 A.D.)

Office of the Campus Chief
Saraswati Sadan,
Kathmandu, Nepal.

Ref. No.:-

Date: 2070/12/30

Message from Campus Chief

Education is vision of political, social and economical development of the countries. For the development of any country there should be educational promotion and enhancement of academic sector is remarkable.

On this regards, I would like to introduce you that our student from Geo-club published the magazine (book) GEOWORLD, Vol. 5, 2014 which is mainly focused on promoting the quality education of concerned subject. This GEOWORLD book definitely support for inspiring the knowledge of every readers those who are really interested about Geology.

My sincere thanks to all members of editors for publishing this book with the hard working and also for the readers who are really benefitted from the books.

Thank you.

.....

Prof. Dr. Hari Pd Thapaliya
Campus Chief
Tri-chandra Multiple Campus

Tribhuvan University
Tri-Chandra Multiple Campus
(Estd. 1918 A.D.)
DEPARTMENT OF GEOLOGY
Durbar Marg, Ghantaghar, Kathmandu, Nepal, Tel: +977-1-4268034 / 4220476
Fax: +977-1-4220467, E-mail: info@geology.edu.np, Website: www.geology.edu.np

April 04, 2014

Congratulation

I am very pleased to know about the publication of the GEOWORLD; a Bulletin published by the Students' Geological Society established within the Department of Geology, Tri-Chandra Campus. The Bulletin has been one of the popular references among geology students as it provides a space for academic write-up. Besides, it also helps to disseminate the geological information required for constructing physical infrastructures like road, tunnel, railway, irrigation canal, drinking water supply, and high rise buildings. Similarly, many of the articles included in the Bulletin are helpful to minimize the impact of natural hazards like landslides, floods, earthquakes, and human activities like extracting sands and gravels from river beds. In fact, the Bulletin serves as a bridge among outgoing and incoming geology students willing to work in a team in the days to come.

The Bulletin is a result of hard working and dedication of our students particularly to those who contributed as the member of the Editorial Board. I congratulate all the 3rd year students of Geology for their devotion and interest in bringing out the Bulletin. I also take this opportunity to thank Campus Administration and Free Students' Union for their generous support and constant encouragement to engage our students for their academic enhancement.

I once again congratulate all the 3rd year students of geology for bringing the Bulletin in time and wish them a success in their future endeavor.

(Tara Nidhi Bhattarai, Ph. D.)

Head, Department of Geology, Tri-Chandra Campus

Tribhuvan University, Kathmandu, Nepal

"Man is conducted by brain, but not by bread"
- B. P. Koirala

TRIBHUVAN UNIVERSITY
Phone No.: 4-221253
4-244047
Free Student's Union
Tri-Chandra Multiple Campus
Ghantaghar, Kathmandu

Ref. No.

Date:.....2070/12/30

MESSAGE FROM PRESIDENT

It is my great pleasure to express few words to congratulate the Students' Geological Society for the successful publication of their annual souvenir "GEOWORLD". This publication has been one of the major activities of the Society which is very commendable. I believe this publication will be very useful for all the students interested in Earth Science.

I would like to wish for the continuation of this publication in more advanced shape in the very future.

Binay Ram Bhatta
F.S.U President

Students' Geological Society
Tri-chandra Campus
Geo-Club

Date: **2070/12/30**

From the Desk of President

It is a pleasure and honor of Student Geological Society to present the latest issue of GEOWORLD 2014; a remarkable collection of geological articles and personal write-ups of the students of Department of Geology.

Student's Geological Society is a student organization designed to initiate, cultivate and conserve a casual interest in geology and GEOWORLD is among one of its various commendable work. I am truly delighted to present this magazine as a symbol of legitimacy handed by the seniors to us. I hope the contents of this magazine will be useful in various manners for all the students interested in geology.

I would like to acknowledge Campus Administration, Department of Geology, Student's Union and editorial team for their help and support to publish this magazine.

I expect the regularity and quality of the publication in the upcoming days as well.

Rahul Poudel
President

Contact: geoclub.tc@gmail.com

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Sand and Gravel Mining: and Their Impacts

Amit Shrestha
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
E-mail: shrestha.amit99@gmail.com

Introduction

Rivers are very important community assets which generate a wide range of benefits including values for ecological habitat, fisheries, agriculture and recreation. They provide amenities with urban, industrial and social significance. Rivers are also important sources of sand and gravel. Sand and gravel have long been used as aggregate for construction of roads and building and many other structures. Today, the demand for these materials continues to rise. Due to such high demand, sand and gravel are extracted haphazardly that river and other sources cannot replenish.

Sand is often used in manufacturing as an abrasive, and it is to make concrete. Due to urbanization construction continues to grow leading to the high demand of sand and gravel. Another reason of sand mining is for the extraction of minerals such as rutile, ilmenite and zircon, which contain the industrially useful elements titanium and zirconium. These minerals typically occur combined with ordinary sand, which is dug up, the valuable minerals being separated in water by the virtue of their densities.

Objective

The main objectives of this article are:

- To give general idea about sand and gravel mining.
- To aware people about the impacts of over extraction.
- To suggest some preventive measures.

Methodology

Information were collected through secondary sources such as books, articles, project reports, website etc and finally presenting as an article.

Sand and Gravel Mining

Sand mining is a practice that is used to extract sand, mainly through an open pit. However, sand is also mined from beaches, island dunes and dredged from ocean beds and river beds. In case of our country Nepal, extraction of those construction materials from riverbed and bank are most common. Talking about Kathmandu valley, due to rapid urbanization for last two decades has increased excessive demands of sand for construction purpose. During the past, sands were mostly supplied from riverbeds located in the northern regions of the valley. After the prohibition of riverbed mining from Nepal Government in 1991 (Kharel et al. 1992), terrace mining in the same northern regions began. However, the illegal mining has still been operated in river areas. Most of the sand supplied to the market has come from riverbeds. Mainly the rivers originated from the Shivapuri Range in the north of the Kathmandu Valley: the Mahadev, Sanla, Bishnumati, Dhobi, Bagmati and the Manahara Rivers are the sources of sand. Gneiss and granite (Stöcklin and Bhattrai 1982) of the Shivapuri Range weathered to produce large amount of sand transported remarkably during monsoon season. Other sources of sand are the fluviodeltaic deposits of the Tokha, Gokarna and Thimi Formations (Yoshida and Igarashi 1986;

DMG 2001) which are incised by the rivers exposing the scarps.

Figure: Excavation of sand from the base of the terrace in the Sanla Khola

Excavation of riverbed sand has invited various environmental problems in river. Unsystematic mining has caused erosion and instability of the riverbanks, and pollution of rivers (Tamrakar 2004; Adhikari and Tamrakar 2005; Bajracharya 2006).

Impacts of Sand and Gravel Extraction

With time our environment is degrading. One of the major causes is haphazard mining without considering environment. Riverbed excavation of sand has affected bridge, roads, cultural heritages (temples and crematories), quality of water and many houses. Exposure of foundation of bridge has been caused by excessive riverbed sand excavation. In 1991, the Bagmati Bridge that links Kathmandu with Lalitpur collapsed due to haphazard exploitation of sand from the riverbeds. Similarly, the destruction of bridge at Sankhamul Ghat and exposure of foundation of different bridges in the valley were also caused by river bed mining.

- **Riverbed and Bank Erosion:** When bed load (sand and gravel) removal from a section of river exceeds the amount being transported into in from upstream, there is net sediment loss to the system (Erskine et al, 1985). In simple terms, the river responds by eroding its bed or banks or both, which of these actually depends on the composition of the bed and banks along with their susceptibility to erosion.

- **Groundwater Quality and Quantity:** Extractionsand and gravel from river channels has potential to affect the quality and quantity of water taken into floodplain aquifers. This is especially the case if extraction is below the water table. If the extraction is below the riverbed level, groundwater recharges from rivers to floodplain aquifers may be severely reduced. This will impact adversely on the bores and wells in the area.

- **Water Quality and Aquatic lives:** Because of sediment flux caused by sand and gravel mining from river water quality of the river has been deteriorated. Several species of fishes and aquatic fauna have lost their habitats because of high turbidity of water and pollution of surface water. Increased turbidity will also depress the amount of light available for photosynthesis. Consequently the productive base of a river's ecosystem will be reduced.

- **Vegetation:** Extraction of river sand and gravel often involves direct clearing of vegetation. Indirectly, destabilization of the bank by any means of the above mentioned erosion, may cause trees to fall into stream. Construction of access tracks and processing sites associated with the extraction process can also involve clearing of vegetation.

- **Riparian Habitat:** Increased riverbed and bank erosion, destruction of vegetation and siltation will all affect riparian and aquatic habitats adversely.

- **Other Environmental Impacts:** Increased noise, dust and visual pollution may result from extractive industries. Collapsing and exposing of the bridge foundation has been reported. Excessive hours of operation can be nuisance to people living in surrounding areas.

Conclusion

Sand and Gravel mining is a practice that is used to extract sand and gravel from riverbed, bank or any other sources. Due to high urbanization, the demand of sand and gravel are increasing day by day. Due to haphazard extraction our environment is deteriorating at severe level. For the preservation of these resources, Concerned Authority should play a vital role as well as people should be made aware about the impacts of over extraction of sand and gravel. Policies regarding illegal mining should be implemented. Legal and Advance mining practices should be brought against the illegal and traditional mining. The concept of sustainable development should be kept in mind as sand and gravel are finite resources. Geologists should also help assist to increase awareness.

Acknowledgement

I would like to express my gratitude to Dr. Tara Nidhi Bhattarai, Head of Department of Geology for his encouragement to write articles. Also want to thank Kiran Pandey for his great support in collecting subject maters and good sources of data. I am very grateful to the editorial board for their effort for the publication of this magazine.

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Managing Flash Flood Risk in the Himalayas

Anuma Shrestha
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Introduction

A flash flood is a rapid flooding of geomorphic low-lying areas. They consist of a sudden and very strong and sudden strong sure of water, usually along a river bed or dry gully, that can carry rocks, soil and other debris. It may be caused by heavy rain associated with a severe thunderstorm, hurricane, tropical storm or melt water from ice or snow flowing over ice sheets or snowfields. Flash floods may occur after the collapse of natural ice or debris dam or a human structure such as man-made dam. Flash floods are sudden, usually unexpected and allow little time to react. Individual flash floods may last from several minutes to several days and may happen anywhere, but are more common in mountain catchments. Although flash floods are by their natural difficult to predict and control, it is possible to reduce the risk to lives and property through different measures.

Causes of flash flood

Flash floods can be caused by a variety of fractures. The main direct cause in the Himalayan region are intense rainfall events, landslide dam outbursts, glacial lake outbursts, glacial lake outbursts, rapid melting of snow and ice, sudden release of water stored in glaciers, and failure of artificial structures such as dams and levees.

Intense rainfall

Intense rainfall in the region is generally caused by cloudbursts, stationary monsoon troughs or monsoon depressions. When the rain falls in an area with limited surface and subsurface drainage, it can cause a local flash flood; when it is channeled down a steep slope through a narrow opening, it can cause massive destruction.

Landslide dam outburst flood

Landslides and debris flows are common in the Himalayan region as a result of the weak geological formations, tectonic activities, rugged topography, and intense monsoon rainfall. Sometimes large amount of material from a landslide or debris flow can temporarily block a river, preventing outflow of the water and leading to development of a temporary reservoir or lake above the landslide dam. Eventually, the unstable dam may break, either as a result of pressure from the volume of water or when the water raises high enough to flow over the top of dam and destabilize it. Occasionally secondary landslides falling into the reservoir will lead to a combination of pressure and overtopping with a sudden catastrophic failure of the dam. The resultant outburst of water can have effects far downstream. Such outburst events are generally random and cannot be predicted with precision, although when a landslide blocks a river the likelihood of an outburst at sometimes clears. The Yigong flood in Tibet, China on 10 June 2000 is a typical example of a large landslide dam outburst flood with a transboundary impact.

Glacial lake outburst flood (GLOF)

Glacial lakes form when a glacier retreats leaving the debris mass at form when a glacier the end moraine exposed. The moraine wall can act as a natural dam,

trapping the melt water from the glacier and leading to the formation of a lake. The moraine dams are composed of unconsolidated boulders, gravel, sand and silt. As with landslide dams, they can eventually break catastrophically, leading to a glacial lake outburst flood. The glaciers in the Himalayan region are in a general state of retreat and the number of glacial lakes and the threat of an outburst, are likely to increase. Thirty- five GLOFs have been recorded in the region since 1935.

Assessing the risk

The risk of flash flood must be assessed before a risk management strategy can be developed. Risk assessment consists of characterizing the area, determining the likelihood and likely intensity of a flood, assessing the extent of damage that could result and using this information to assess the overall risk. The assessment can be used to priorities, plan, and implement management measures (especially if a full economic assessment is made) and also indicates the kind of management needed.

Managing the risk

Most flash flood events take place in remote, isolated catchments where the central government's reach is limited or non-existent. When flash floods strike, external help may take several days to reach affected communities, during which time they are left to cope o their own. Technological advances and institutional arrangements for disaster risk management are gradually improving in the Himalayan region, but this process takes time in areas where flash floods can be expected, it is essential to build the capacity of communities to manage the risk from disaster by them. Individual households usually have strategies in place, but the effectiveness of these individual efforts can be enhanced many fold if they are co-ordinate.

Community risk management committee

A forum like a community flash flood risk management committee (CFFRMC)) is a good mechanism for uniting the efforts of community members and local authorities. The use of local and indigenous knowledge can be an important part of community based flash flood risk management. It is essential that gender aspects are taken into account of the effects on all members of a community considered during planning.

Structural and non- structural measures

It is difficult to predict that exact location, magnitude, and extent of most flash floods, thus it is rarely useful to carry out large scale structural measures like building of embankments, dams, and levees. But there are many non- structural measures that can help to reduce the impact of floods, rangingfrom land use planning, construction codes, and soil management, through insurance, awareness raising, public information and emergency system, to post-catastrophe recovery plan. Such nonstructural measures are generally sustainable and less expensive. Small-scale structural measures like check dams, small scale levees using local materials and sand bag embankments can also be useful. The best solution is usually a combination of small- scale structural and non- structural measures.

Conclusion

Flash floods are one of the most common forms of natural disaster in Himalayan region. The Himalayan region is partially vulnerable to this type of flood as a result of the steep slopes, high rate of surface erosion and intense seasonal precipitation, particularly during the summer monsoon in the central and eastern Himalaya and in winter in the western Himalaya, changing watershed and environmental conditions are

increasing this vulnerability. Although flash floods generally affect smaller areas and population than reverie floods, their unexpected and intense nature means that they pose a significant risk to people and infrastructure, leading to death and destruction.

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Geology Study and Its Scope

Arjun Bhandari
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: vandari.arzun@gmail.com

Abstract

We should know if Geology is good to study or not and how can we get admission in geology. This article tries to answer the above questions. The article basically aims to provide knowledge about the subject geology and its scope within the country and outside the country, the work of geologist, the quality to be a geologist, how to get admission in geology. After reading this article students might be clear about the geology subject, its study and scope.

Background

Geology is the scientific study of the Earth. The field of geology encompasses the study of the composition, structure, physical properties, dynamics, and history of Earth and the processes by which they are formed, moved, and changed. The field is a major academic discipline and is also important
for mineral and hydrocarbon exploration and extraction, knowledge about and mitigation of natural hazards, some engineering fields, and understanding past climates and environments. The application of geology is seen in everyday life. All around of us we see hills and valleys, rivers, seas and coastlines, rocks and soils. Geology tells why these things are there and how they are formed. Geologists have an important role in preserving and keeping the environment clean as they assess natural disasters and its effects. Their activities include - monitoring waste disposal sites, preserving water supplies and minimizing the threat to Communities at risk from geologic hazards like earthquakes, landslides, volcanoes and tsunamis. Geological maps are important inputs for the generation of hazard maps. It helps the mitigation team to engage in disaster management in an efficient manner.

Now there is a scarcity for geologists.Mainly in developing countries like Nepal. The job prospects for geologists in the private sector are going to increase .There are good scope for geologists in the country as well as in other countries.

Objective

The main objective of this report is

- How to get involved in geology
- What we get know in the geology class?
- Branches of geology
- What does a geologist does?
- Opportunities in field of geology

Methodology

All the data are collected from website and edited. Some data are taken from guide book of central department of geology

Geology study:

Entering the field: To start career as a geologist one must have completed an MSc in Geology. Tribhuvan University offers

BSc and MSc geology course in Nepal. You must have completed 10+2 in Science to enroll for a BSc in Geology.

B.Sc.

A B.Sc. focuses on the basic concepts of Petroleum Geology, structural Geology etc.

M.Sc.

It comprises both pure and applied geology, which focuses on the advanced learning of the fields. It builds upon the foundation laid during a BSc, by building a strong theoretical and practical framework. Writing a dissertation is one of the general requirements.

Further specialization

After M.Sc., one can also opt for M.Sc. (Tech)/MTech for specialization in Geotechnical Geo-environmental engineering and Engineering geology etc., which are parts of Civil Engineering field.

Geology class

A geology class all starts with rocks and minerals, which are not just stones but stories. For instance, the knowledge on the age of the rock would help a student of geology to identify the type of mineral. The study of rocks, minerals, mountains, earthquakes, volcanoes, rivers, glaciers, landslides and floods fall into this broad fieldHow do mountains rise? How are rocks created and destroyed? These questions can be answered if we study Geology, a field-oriented, scientific discipline, which investigates the properties of the earth, its substances, shapes, processes and history. Geology is a multi-disciplinary subject, which includes study of minerals (mineralogy), rocks (petrology), the structure of the Earth (structural geology), volcanic phenomena (volcanology), landforms and the processes that produce them (geomorphology and glaciology), study of fossils (paleontology), the development of sedimentary strata (stratigraphy) and the evolution of planetary bodies and their satellites (astrogeology). By studying the history, composition, changes that occur on the earth, geologists foresee how events, processes of the past influence the future.

Some of the branches of Geology are:

- Physical Geology (Study of Physical forms, physical processes of earth)
- Mineralogy (Study of Minerals)
- Petrology (Study of Rocks)
- Structural Geology (Study of structure of the earth)
- Paleontology (Study of fossils)
- Stratigraphy (Study of geological strata and establishing order of superposition)
- Geochronology (Measurement of geological time)
- Mining Geology
- Petroleum Geology
- Geochemistry
- Geophysics
- Hydrogeology (Study of ground water)
- Seismology (Study of earthquakes)
- Volcanology (Study of Volcanoes)
- Marine Geology
- Specialization can be done in any of the above fields.

A geologist's work significantly includes

Field activity, office-based data processing, report writing and project planning. The scope of the job depends on the work area of the company or organization, you work

for.Working in the field may mean spending long hours outdoors, doing exploration, surveying and production.

Field trips

Since geology is related to environment, a large portion is taught outdoors. So, field work becomes an integral part of all degree programs. It may include collection of geologic data, constructing a measured section, interpreting geologic structures and geologic mapping.

Geology and the environment:

What a geologist does?

A geologist's job involves two main functions: Exploration and Research.

Exploration: Involves detailed identification of structures (mountains, rivers, rocks), investigation of the resources of a region (drilling into the ground to locate water, mineral, energy resources), predict future geologic hazards like earthquakes, floods, landslide.

Research: Compiles the data into a geological map, which shows the distribution and relationship of the properties. It is supplemented by laboratory investigation, where a geologist uses microscopic, electronic equipment and computing techniques to analyse samples collected from the field. After the analysis (which includes calculations) a geologist prepares a report.

Qualities required for the geologist

- Ability to visualize
- Good scientific/technical skills
- Audacious as an explorer
- Physical fitness
- Ability to interpret statistical and graphical information
- Attention to detail
- Report-writing skills

Job offered for Geologist in government sector in Nepal

- Department of mines and geology
- Nepal Electricity authority
- Department of survey
- Department of road
- Ground water and irrigation
- University and college
- National seismological center
- National academy for science and technology(NAST)
- DWIDP and soil conservation
- Water and energy commision

Public Sector Undertakings

- Construction mining and trades
- Private hydropower companies
- Private construction companies
- Cement factories
- Private engineering college

Opportunities abroad

Besides the USA, Australia, Canada, the need for geologists is rising in developing countries. Indonesia, Malaysia, Saudi Arabia, UAE, Kuwait, India, Vietnam, Thailand, Afghanistan, Bangladesh and Pakistan require geologists for civil works such as the construction of highways, airports, dams, pipelines etc.

Acknowledgments

I am very thankful to Geology Department and DR. T. N. Bhattrai; (Head of the

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Refrence

http://careers360.com/news/4705-Geology-where-to-study-Careers-options

:-guide book of department of geology

Geology of Mars

Arya Kumari Thakur
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: arya_thakur62@yahoo.com

Background:

Mars is the fourth planet from the sun and the second smallest planet in the solar system named after the Roman god of war. It is often described as the "Red Planet" because the iron oxide prevalent on its surface gives it a reddish appearance. The atmosphere is very much thin, less than one hundredth that of the earth and composed primarily of carbon dioxide.

Objectives:

- To understand the tectonic activity
- To understand the volcanic activity
- To understand the topography
- To understand the mineral, magnetic field and structure
- To compare with the Earths geology

Tectonic activity:

About nearly 40 years of research, scientists have finally proven that plate tectonics exist on Mars. A paper published by An Yin in the journal lithosphere reveals that the origin of Valleys Marineris on Mars- the longest trough system in the solar system was formed by rifting, strike-slip faulting and subsurface mass removal. The trough is like a gaping wound on the Red Planet. Some researchers had suggested that it was a " big crack" that had just opened up but Yin's work shows that Valles Marineris is in fact part of a plate boundary, one that subject to slow but persistent is in horizontal motion; the two plates have moved about 93 miles relative to each other. The analysis also suggests that Mar's tectonic activities are slow with major tectonic shifts occurring about every million years.

Fig: volcanic Features in Mars [www.google.com]

Topography:

The surface of mars is flat but no topography is visible on mars from earth. The bright areas and dark markings seen through a telescope are albed features. The bright red-ochre areas are locations where fine dust covers the surface.

Volcanic activity:

Volcanic structures and landslides cover large portions of the Martian surface. Geologists think one of the reasons that volcanoes on Mars are able to grow large because Mars has sparsely few tectonic boundaries compared to Earth.

Minerals, magnetic field and structures:

Mars consists of minerals containing silicon, oxygen, metals and other elements that make up rocks. The surface of Mars is primarily composed of tholeitic basalt, although other parts are more silica rich than typical basalt and may be similar to

andesitic rocks on earth or silica glass. Much of the surface is deeply covered by finely grained iron oxide dust.

Although mars has no evidence of a current structured global magnetic field. Observations show that parts of the planets crust have been magnetized and that alternating polarity reversals of its dipole field have occurred in the past. This paleomagnetism of magnetically susceptible minerals has properties that are very similar to the alternating bands found on the ocean floor of the earth.

Comparison with earth:

Mars is only about one half the diameter of the earth but both planets have roughly the same amount of dry land surface area. This is because over two third of the earth's surface is covered by oceans, whereas the present surface of Mars has no liquid water. Mars is very different planet to earth when it comes to temperature, size and atmosphere but geologic processes on the two planets are almost similar. In case of physical land features similarity exist on both planet.

Conclusion

Even mars and earth are totally different planets by the scientific study it has been confirmed that there are similar land features in the Mars. The existence of processes of plate tectonics and minerals found there has made it really a mystery as well as an interest to people.

Aknowledgement

I am lucky to be a student of Geology. I would like to extend my heartfelt gratitude and sincere appreciationto Dr Tara Nidhi Bhattarai, Head of Department. I am very thankful to editorial board especially Madhavi Regmi for giving me her precious suggestions, comments as well as being supportive for the preparation of the article. Lastly I would like to thank my colleagues and my all friend of bachelor level who directly and indirectly supported me till now.

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My Amazing Childhood and Geology

Basant Bhandari
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: basanta_j4u@hotmail.com

I am from a remote village of Lamjung district, I born, grew up and spent my childhood in Segle village of Simpani V.D.C. I was sensitive towards the strange things from my childhood. I used to think every single thing differently. I used to imagine my own little world with assumptions and considerations of things around me. There are many such events, which makes me to smile while I remember those days. Now I am a student of geology. I learned a lot of things from these three years of bachelor in geology. Many of my prospective and views have been changed. Now I use to observe most of the things geologically. Now I know what geology is. But my childhood geological concepts were totally different. I didn't have geological knowledge during those days but I was very close with geology; oh! That was funny geology. I am going to share some of that funny geology of my childhood.

I couldn't remember my first birthday. I don't know when I started to stand up, walk and speak, but I have still very clear image of that first childhood mineral; yes, mica. Mica was my first childhood mineral with which I introduced. During those days they were not mica grains which used to glitter on the wall of my house; they were stars of my micro world. Our house is made up of soil, rock and wood. The soil which has been used on the wall of our house has a lot of mica grains on composition. There was a bed near the wall of my house where I used to sleep with my mother. There wasn't electricity on our village during those days. We used to light up kerosene lamp for light at evening. Every evening, lamp used to be lit up and I used to sleep on the bed near the wall coated by mica rich soil. Those mica grains used to glitter like stars on the dim light of kerosene lamp and I used to sleep, staring at those shining mica grains. I used to imagine my little world of stars till the entrance for the dreamland.

My days were passed happily with my friends and family. I started to attend school at the age of four. I used to go school with my sister on those days. Near our primary school there was a barren land where we used to play. On that ground there were many small pieces of rock, which were well faced with smooth surface as if someone had cut off and polished it. They were brown in color. We used to collect and play with them. Those rock fragments were precious stones for us. And I used to think, how those small pieces of rock became such pretty.

One day I escaped from my home with few senior brothers for swimming. We went to Khudi Khola for swimming. I didn't inform at home, because they won't let me go for swimming on such a big river. All of us started to swim expect me, because I was too small and the River was too big and I didn't know how to swim at that time. After few hours we were about to return back, one of us proposed to collect firing stone. "Firing stone" I asked with surprise. "Yes, firing stone, pick up these shiny white stones, they can produce fire at night", he replied. I picked up two shiny white stones and they did the same. Finally we reached home around 6 pm. My parents scolded me that were had I been for the whole day

without any information. I didn't say the truth; instead I tried to convince that I was at my uncle's home. They warned me not to go anywhere without information again. On that evening I pretended as an obedient son and remain calm. After evening meal I went to the bed with those pieces stones in pocket, which I had collected on the bank of the river that day. On the darkness under blanket I robbed those stones together as that brother taught, amazingly a small spark of fire had been produced there. I spent few minutes robbing those stones and slept, keeping those stones below the pillow. That night I thought deeply about the production of fire from that stone.

I was flying in the sky. An enormous monster was following me. He was almost catching me; I escaped from his hand and landed at the roof of my house. Suddenly the house started to shake. Immediately I woke up from dream and shouted. Our house was shaking in real at the midnight. I got afraid. My father suggested me to keep calm. As my father told that was an earthquake. I felt earthquake for the first time. I asked fearfully with mother, "how this happens mom?" As told by my mother, there is a large fish at the core of the earth; which is carrying the whole load of the earth on his arm. Because of fatigue on his arm, sometimes he changes load on his another arm; at that time we feel earthquake. On that night I slept with the imagination of that large fish which had made me to be afraid at the middle of the night.

I still remember his wrinkled face, long nose and dim eyes with power glasses. My grandfather used to love me a lot he used to carry me on his back and wander here and there. He generally used to tell ancient tales and many stories from 'Ramayana' and 'Mahabharata'. One day he told me an interesting story about those big hills, which were rising proudly around our village. He said that, there were not any hills before king Janaka. There wasn't any sign of precipitation on his kingdom. So he had been suggested that, if ploughed the land, precipitation will take place. So he started to plough the land on flat surface. Later due to ploughing land had been deformed and present morphologies like hills, saddles, spur, valley etc. are formed. I believed him though, how big was the king Janaka is to make those large hills by ploughing.

These are few my childhood memories related with geology. Now I am a student of geology at Tri-Chandra Multiple Campus. I have gained Geological knowledge from here. I have solved many my questions and confusions of childhood. Now those glittering grains are no longer stars for me. They were shiny under the light because of vitreous luster. Those small and pretty stones of playground were garnet crystals formed during the metamorphism of rock. Those firing stones were quartz; they had produced fire because of their hardness against applied force. The earth had been shaking due to tectonic movement; not by the big fish as my mother told. The hills around my village were formed by the collision of Indian and Tibetan plate. I have scientific solutions and answers for those questions and confusions. I learned what the geology is. But my childhood geology itself was amazing.

Myth and Geology

Bijaya Thapa
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Introduction

Geomythology is the study of alleged references to geological events in mythology. The term was coined in 1968 by Dorothy Vitaliano, a geologist at Indiana University. "Geomythology indicates every case in which the origin of myths and legends can be shown to contain references to geological phenomena and aspects, in a broad sense including astronomical ones (comets, eclipses, meteor impacts, etc.). As indicated by Vitaliano (1973) 'primarily, there are two kinds of geologic folklore, that in which some geologic feature or the occurrence of some geologic phenomenon has inspired a folklore explanation and that which is the garbled explanation of some actual geologic event, usually a natural catastrophe'."

Objective

To give information on relationship between myth and geology.

Main body

The claim is that oral traditions about nature are often expressed in mythological language and may contain genuine and perceptive natural knowledge based on careful observation of physical evidence. Geomythology alleges to provide valuable information about past earthquakes, tsunamis, floods, impact events, fossil discoveries, and other events, which are otherwise scientifically unknown or difficult to trace.

To be distinguished from this are plainly aitiological tales that account for geological features without any connection to their formation; an example is the Native American legend of a giant bear chasing a couple who were saved when the land rose

beneath their feet; the bear's claws left gouge marks on the sides of the uplift known today as Devils Tower, Wyoming.

In August 2004, the 32nd International Geological Congress held a session on "Myth and Geology", which resulted in the first peer-reviewed collection of papers on the subject (2007).

Some points are taken from “Myths and Geology” book.

Myth and geology are related in several ways. First, man has always sought to explain his natural environment. A good example of this is Devil's Tower in the state of Wyoming . Originally interpreted as a volcanic neck or plug,closer study revealed that it is the eroded remnant of a more extensive body, a laccolith. Two Indian tribes living in the vicinity have slightly different stories accounting for its unique shape (Mattison 1967), but both involve a group of people being pursued by a giant bear, appealing to their deity for help, and having the ground on which they stood uplifted beyond the reach of the animal (Fig. 2). The fluting of the columns, a classic example of columnar jointing, is explained as the claw marks made by the bear as it tried to reach them.

Another example of a myth inspired by unusual topography is the island of Mangaia, one of the Cook Islands in the South Pacific (Fig. 3). The central core of the island is an eroded volcano, which is surrounded by a moat-like depression, and this in turn is surrounded by a raised platform of eroded coral rock called the Makatea, 110-210 feet above sea level. A terrace at the base of this cliff slopes gently toward the sea, ending in a low cliff, and surrounded by a fringing reef of coral.

According to the myth, the island was once smooth and regular, with gentle slopes (Marshall 1927). One day the god of the sea and the god of rain had a contest to see which was more powerful. The sea god, aided by the wind god, attacked the island and eroded it to the height of the Makatea. Then the rain god caused it to rain for five days and nights, washing clay and stones into the ocean and carving deep valleys into the slopes, until only the flat top of the original surface remained. The inhabitants of the island took refuge on this peak, and as their situation became more and more precarious, their chief appealed to their supreme god, who ordered the others to stop the contest. This myth explaining the island's unique shape reflects an appreciation of the role of running water and storm waves in shaping the landscape. In geological terms, the island was a volcano built up on the sea floor. After its activity had ceased, it was eroded down to sea level. Then it was elevated above sea level and subjected to weathering and erosion, while a fringing reef of coral grew around it. Gradual subsidence then allowed the coral to grow upward to become a barrier reef, separated from the land by a lagoon. Re-elevation of the land left the barrier reef high and dry, forming the Makatea, and the lagoon became the moat-like depression.

The Pacific islands have inspired many other landform myths, including a number of 'fishing-up' myths which explain the presence of certain islands (Nunn 2001, 2003). 'Fishing-up' myths generally tell of a god who, while fishing, hooks his line on the sea bottom and hauls up rocks and other features that assume the specific configurations of the islands in question. Nothing is too small to inspire geomyths. In vol- canic eruptions, small droplets of molten lava can be blown by winds from the surface of a lava flow, or from a lava fountain, usually trailing a thread of spun glass. These can pile up into what the Hawaiians call Pele's hair (the threads) — Pele being the Hawaiian volcano goddess — and Pele's tears (the droplets). These terms have been adopted into the scientific nomen-clature, and that fact constitutes yet another example of the relationship between myth and geology. For that matter, we are indebted to mythology for the very word volcano, from Vulcan, the Roman god of fire, whose forge was thought to be in Mt Etna.

The Hawaiians believed that Pele came to the islands because she was fleeing the anger of her older sister, whom she had somehow offended. First she came to the Northwesternmost Island, where she dug a pit in search of fire, but her sister chased her to the next island, and the next, and so on down the chain until she took up residence in Halemaumau, the fire pit on Kilauea volcano. Then the sister gave up the chase, and there Pele and her relatives are said to live today. This myth indicates that the Hawaiians were keen observers of their environment, for the volcanism becomes younger as one progresses down the chain, all activity in historic times being confined to the big island, Hawaii, except for the last eruption on its neighbouring island, Maui. That is because the island chain is passing

over a hot spot in the earth's mantle. Submarine eruptions SE of the big island indicate that a new island is in the process of being created.

Myths have also been invoked to explain geo- logical processes, particularly those manifested violently, such as earthquakes, volcanic eruptions and floods. In Japan it was believed that a giant catfish in the earth was responsible for earthquakes (Ouwe-hand 1964). This catfish was usually pinned down by the Kashima deity but when this god had to pay attention to other matters, the catfish was left free to wriggle and a quake resulted. The association of catfish with earthquakes may not be entirely fanciful. Unusual activity in catfish was long believed to portend a quake. Elsewhere in the world, unusual behaviour in various creatures has also been taken to be a sign of an impending shock, and it has been suggested that they might be sensitive to small changes in one of the Earth's force fields, such as the geoelectrical field. At Tohoku University in Japan, experiments were actually carried out to test this idea. A small stream was diverted to flow through a tank of catfish, and their response to a tap on the glass was recorded. It did seem as though the fish were more agitated by the tapping shortly before a shock, but the results were not definitely conclusive.

Some geomyths actually constitute a record of major geological events. Beautiful Crater Lake in the state of Oregon in the United States is a volcanic caldera. It was created by an eruption of Mt Mazama in the Cascades Range According to the myth of the Klamath Indians, Llao, the chief of the Below World, standing on Mt Mazama, was battling Skell, the chief of the Above World, who stood on Mt Shasta in Califor-nia, about a hundred miles away (Clark 1953). They hurled rocks and flames at each other, and darkness covered the land. The fight ended when Mt Mazama collapsed under Llao and hurled him back into his underworld domain. The large hole that was created then filled up to form Crater Lake. This sounds like an eye-witness account of such an eruption, and it undoubtedly is, for Indian artifacts have been found buried in the Mazama ash. The eruption has been radiocarbon-dated to about 6500 years ago on the basis of Indian sandals found in the ash, but had no datable materials been found, this myth alone would have served to date the eruption as post-Pleistocene, because this part of the world was first inhabited by people who crossed the Bering Land Bridge and migrated down through Alaska and Canada into the northwestern United States.

A myth also helped to solve a geological problem for the German volcanologist Jorg Keller. He was able to date the last eruption in the Lipari Islands, off the coast of Italy, on the basis of a local legend (Keller 1970). Ash from that eruption over- lies Roman ruins on Vulcano that date from the fourth and fifth centuries AD (Fig. 9). According to a local tradition, a hermit named Calogero, who lived on Lipari and was later made a saint, was cred-ited with having driven the devil and his fires from Lipari (Fig. 10) to Vulcanello, and as that was still too close for comfort, on to Vulcano. As St Calogero is known to have lived from ad 524- ad 562, Dr Keller inferred that the eruption must have occurred sometime between ad 500 and 550. Flood legends appear in the mythology of so many cultures that a universal flood has often been invoked to explain their prevalence. Many of them, however, appear to be purely of local origin. The myth of the Makah Indians on the Pacific coast of the state of Washington is such a one (Andree 1891). The sea is said to have risen and fallen several times in the course of a few

days. The people took to their canoes and rode it out safely, though some of them were carried far to the north and stayed there. Such a rise and fall of the sea is typical of tsunamis, and the west coast of Canada and the United States is very susceptible to tsunamis resulting from Alaskan earthquakes, such as the one recorded at Crescent City in northern California in 1964.

Another one is the Atlantis story, which has probably given rise to even more speculation as to its origin than the Flood. There are very few parts of the world that have not been proposed as the location of Atlantis, but not until I960, when the Bronze Age eruption of Santorini in the Aegean Sea was suggested as the cause of the demise of Minoan Crete (Galanopoulos 1960), did there seem to be a truly plausible geological basis for the idea. True, it was not a whole continent that disappeared, only most of a small island, but a great empire appeared to have declined quite suddenly.

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I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friend as well as the chief editor Navin Thapa for his valuable comments and inspiration to write this article. Also I would like to thank the whole editorial board for their support. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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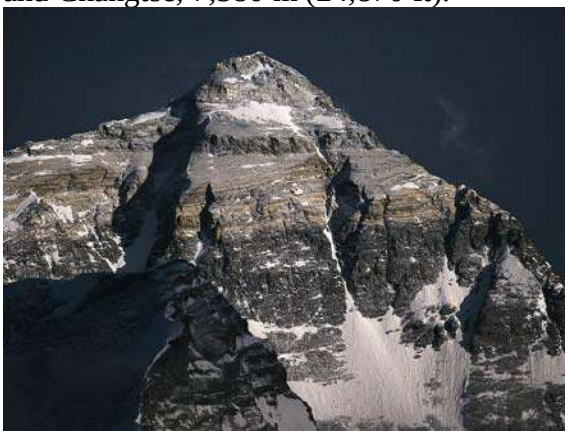
Geology of Mount Everest

Drona Adhikari
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: dronaadhikari92@gmail.com

Introduction

Mount Everest (also known in Nepal as सगरमाथा - Sagarmatha) is the Earth's Highest Mountain, located in the Mahalangur section of theHimalayas at Solukhumbu District, Sagarmatha Zone, Nepal. Its peak is 8,848 metres (29,029 ft) above sea level and the 5th furthest point from the centre of the Earth.The international border between China and Nepal runs across the precise summit point. Its massif includes neighboring peaks Lhotse, 8,516 m (27,940 ft); Nuptse, 7,855 m (25,771 ft) and Changtse, 7,580 m (24,870 ft).



Mount Everest
Mount Everest, the highest mountain in the world, with a height of 8,850 m (29,035 ft), rises in the Himalayas on the frontier of Nepal and Tibet. Numerous groups tried to reach the summit before the successful attempt by two members of a British expedition on May 29, 1953.

Objective

- Geological history of Mount Everest before the formation of Himalaya.
- Interpretation of the process of Himalaya formation.
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- Gives basic ideas about Pre-Historic life that preserved as fossils in the sediments of Mount Everest.
- Helpful to assume the future condition of Himalaya including Mount Everest.
- Helpful for the mount climbers and environmentologists.

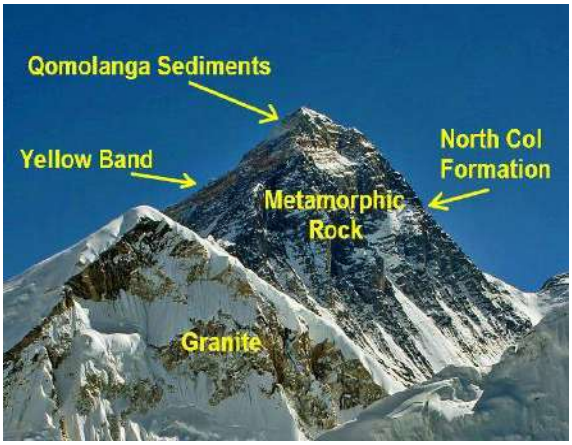
Geological formation

Mount Everest is covered with huge glaciers that descend from the main peak and its nearby satellite peaks. The barren Southeast, Northeast, and West ridges culminate in the Everest summit; a short distance away is the South Summit, a minor bump on the Southeast Ridge with an elevation of 28,700 feet (8,748 m). The mountain can be seen directly from its northeastern side, where it rises about 12,000 feet (3,600 metres) above the Plateau of Tibet. The peak of Changtse (24,803 feet [7,560 m]) rises to the north. Khumbutse (21,867 feet [6,665 m]), Nuptse (25,791 feet [7,861 m]), and Lhotse (27,923 feet [8,511 m]) surround Everest's base to the west and south.

Everest is shaped like a three-sided pyramid. The three generally flat planes constituting the sides are called faces, and the line by which two faces join is known as a ridge.

The North Face rises above Tibet and is bounded by the North Ridge (which meets the Northeast Ridge) and the West Ridge; key features of this side of the mountain include the Great and Hornbein couloirs (steep gullies) and the North Col at the start of the North Ridge. The Southwest Face rises above Nepal and is bounded by the West Ridge and the Southeast Ridge; notable features on this side include the South Col (at the start of the Southeast Ridge) and the Khumbu Icefall, the latter a jumble of large blocks of ice that has long been a daunting challenge for climbers. The East Face—or Kangshung (Kangxung) Face—also rises above Tibet and is bounded by the Southeast Ridge and the Northeast Ridge. From the south side of the mountain, in a clockwise direction, the main glaciers are the Khumbu glacier, which flows northeast before turning southwest; the West Rongbuk glacier in the northwest; the Rongbuk glacier in the north; the East Rongbuk glacier in the northeast; and the Kangshung glacier in the east.

The summit of Everest itself is covered by rock-hard snow surmounted by a layer of softer snow that fluctuates annually by some 5–20 feet (1.5–6 m); the snow level is highest in September, after the monsoon, and lowest in May after having been depleted by the strong northwesterly winter winds. The summit and upper slopes sit so high in the Earth's atmosphere that the amount of breathable oxygen there is one-third what it is at sea level. Lack of oxygen, powerful winds, and extremely cold temperatures preclude the development of any plant or animal life there.



Geologists have subdivided the rocks comprising Mount Everest into three units called "formations". Each formation is separated from the other by low-angle faults, called "detachments", along which they have been thrust over each other. From the summit of Mount Everest to its base these rock units are the Qomolangma Formation, the North Col Formation, and the Rongbuk Formation.

From its summit to the top of the Yellow Band, about 8,600 m (28,000 ft) above sea level, the top of Mount Everest consists of the Qomolangma Formation, which has also been designated as either the Everest Formation or Jolmo Lungama Formation. It consists of grayish to dark gray or white, parallel laminated and bedded, Ordovician limestone inter layered with subordinate beds of recrystallized dolomite with argillaceous laminae and siltstone. **Gansser** first reported finding microscopic fragments of crinoids in this limestone. Later petrographic analysis of samples of the limestone from near the summit revealed them to be composed of carbonate pellets and finely fragmented remains of trilobites, crinoids, and ostracods. Other samples were so badly sheared and recrystallized that their original constituents

could not be determined. A thick, white-weathering thrombolite bed that is 60 m (200 ft.) thick comprises the foot of the "Third Step", and base of the summit pyramid of Everest. This bed, which crops out starting about 70 m (300 ft) below the summit of Mount Everest, consists of sediments trapped, bound, and cemented by the biofilms of micro-organisms, especially cyanobacteria, in shallow marine waters. The Qomolangma Formation is broken up by several high-angle faults that terminate at the low angle thrust fault, the Qomolangma Detachment. This detachment separates it from the underlying Yellow Band. The lower five meters of the Qomolangma Formation overlying this detachment are very highly deformed.

The bulk of Mount Everest, between 7,000 and 8,600 m (23,000 and 28,200 ft), consists of the North Col Formation, of which the Yellow Band forms its upper part between 8,200 to 8,600 m (26,900 to 28,200 ft). The Yellow Band consists of intercalated beds of Middle Cambrian diopside-epidote-bearing marble, which weathers a distinctive yellowish brown, and muscovite-biotite phyllite and semischist. Petrographic analysis of marble collected from about 8,300 m (27,200 ft) found it to consist as much as five percent of the ghosts of recrystallized crinoid ossicles. The upper five meters of the Yellow Band lying adjacent to the Qomolangma Detachment is badly deformed. A 5–40 cm (2–16 in) thick fault breccia separates it from the overlying Qomolangma Formation.

The remainder of the North Col Formation, exposed between 7,000 to 8,200 m (23,000 to 26,900 ft) on Mount Everest, consists of interlayered and deformed schist, phyllite, and minor marble. Between 7,600 and 8,200 m (24,900 and 26,900 ft), the North Col Formation consists chiefly of biotite-quartz phyllite and chlorite-biotite phyllite intercalated with minor amounts of biotite-sericite-quartz schist. Between 7,000 and 7,600 m (23,000 and 24,900 ft), the lower part of the North Col Formation consists of biotite-quartz schist intercalated with epidote-quartz schist, biotite-calcite-quartz schist, and thin layers of quartzose marble. These metamorphic rocks appear to be the result of the metamorphism of Middle to Early Cambrian deep sea flysch composed of interbedded, mudstone, shale, clayey sandstone, calcareous sandstone, graywacke, and sandy limestone. The base of the North Col Formation is a regional thrust fault called the "Lhotse detachment".

Below 7,000 m (23,000 ft), the Rongbuk Formation underlies the North Col Formation and forms the base of Mount Everest. It consists of sillimanite-K-feldspar grade schist and gneiss intruded by numerous sills and dikes of leucogranite ran ging in thickness from 1 cm to 1,500 m (0.4 in to 4,900 ft). These leucogranites are part of a belt of Late Oligocene–Miocene intrusive rocks known as the Higher Himalayan leucogranite. They formed as the result of partial melting of Paleoproterozoic to Ordovician high-grade metasedimentary rocks of the Higher Himalayan Sequence about 20 to 24 million years ago during the subduction of the Indian Plate.

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I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friend as well as Navin Thapa and Govind Joshi for their valuable comments and inspiration to write this article. I would like to thank my

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Impacts of Urbanization on Groundwater Recharge and Discharge

Durga Khatiwada
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: mailatdurga@gmail.com

Abstract

It is well known that; everything has its merit as well as demerits but it also depends on the way of how we use it and maintain it. So while using any sort of renewable resources it is the duty of every citizen to use it in a sustainable manner. Therefore, urbanization with well - planned investigation and proper implementation is a prosperous way of living a standard and well facilitated life. But unplanned and mismanaged urbanization have maximum demerits to the surrounding environment and on the various natural components along with on the basic needs of the people. So, this article mainly aims to provide the way how urbanization hampers the mechanism of groundwater recharge phenomenon. It provides information why there is no balance between the recharge and discharge of groundwater and how urbanization is acting as a main obstacle for this? I hope reading this article; the readers might also get an idea why the capital city of Nepal, Kathmandu is facing the problem of shortage of water day by day? I hope this article will alert us to focus on the proper utilization and extraction of groundwater maintaining recharge of groundwater along with its discharge phenomenon. It's all is necessary in need to be known by everyone because if there is no water, no life is possible.

Background

Urbanization refers to the process of growth in the proportion of population living in urban areas. Mankind is the major geomorphic agent that affects the Earth's land surfaces (Sherlock, 1922; Underwood, 2001) and, perhaps second only to agriculture, urbanization is the major process now affecting the land. Over 50% of the Earth's population now lives in cities and it is estimated that by 2025 this will increase to over 67% (Ramsey, 2003). "Impervious" cover is a major index or urbanization areas and is considered the most pervasive, relevant characteristic leading to hydrologic impacts (e.g., Arnold and Gibbons 1996). Cities and urban populations are growing at a high pace and so are the anthropic impacts on the hydrologic cycle on the local scale.

Urbanization is a major geomorphic process affecting both surface and groundwater systems. General hydrogeological effects of urbanization include altered topography and vegetation, increasing shallow groundwater temperatures, changes to water table elevations, and a multitude of changes associated with construction and pumping, and pollution of ground-waters and surface waters. Groundwater systems in urban areas are also impacted significantly, and these impacts can have important consequences for human activities and the environment. Because usually groundwater is out of sight, it is sometimes out of mind, but the impacts of urbanization on groundwater systems must be considered in land-use planning, construction, or in regards to water resources to make future urban areas sustainable.

Groundwater systems at all scales, from a local unconfined aquifer in a Quaternary unconsolidated deposit to an entire

groundwater basin, are characterized by the factors that determine recharge, storage, discharge, and flow to discharge areas. The amount of water in storage in the zone of saturation does not remain constant but fluctuates with the precipitation. Water is recharged through precipitation and from streams and ponds while water is continually being discharged from the underground reservoir by seepage, wells, and springs. The water table lowers in times of drought and rises during times of precipitation. So, there seems no proper balance between water recharge and discharge phenomenon as amount of water discharged is greater than its recharge. And it's probably sure that urbanization increases the demand of water as a result it has its effect on the groundwater extraction phenomenon.

Objective

1. To determine the impact of the urbanization on the ground water recharge and discharge. 2. To know about the future effects in the ground water due to urbanization.

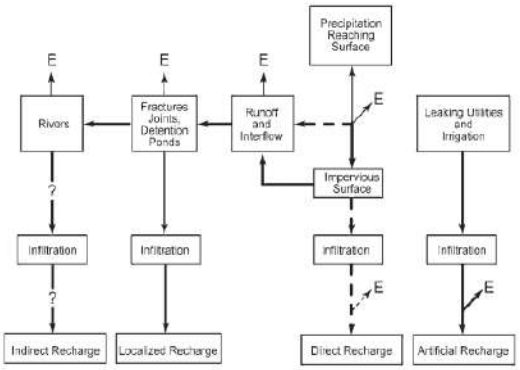

Fig. 4: *Sources of recharge in an urban area. Modified from Wiles and Sharp, (2008).*

Methodology

Study area

The Kathmandu Valley is facing potentially insurmountable challenges due to overpopulation by immigration and natural growth. Traffic jams, a polluted environment, and rapid changes in the socio-cultural diversity are common features of this valley. Unplanned urban development fostered by weak institutional arrangements has encouraged rapid and uncontrolled urban sprawls which have contributed to dramatic changes in the urbanized landscape.

Geologically, the Kathmandu Valley is as vulnerable as Haiti, which experienced a devastating 7.0 earthquake on January 13, 2010 that resulted in the loss of over 200,000 lives, and left half a million people (a third of the nation) homeless.

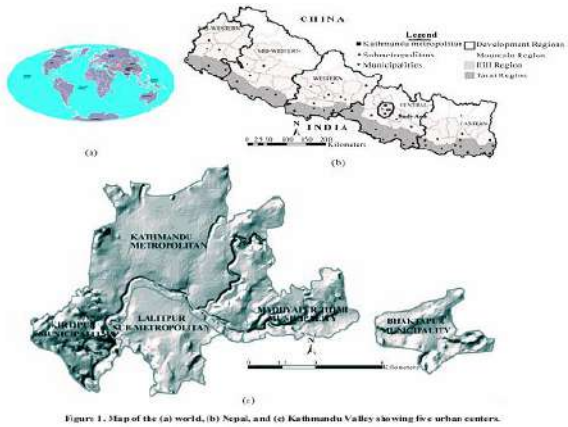

Figure 1. Map of the (a) world, (b) Nepal, and (c) Kathmandu Valley showing five urban centers.

Field investigation and data collection

Different journals and articles were analyzed and the following comments were made. The results were based on the remote sensing, spatial metrics techniques, field visit and questionnaire. This result and conclusion are made from the comparative analysis of the different researches based on Kathmandu focused on the urbanization and different aspects of water supply systems within the Kathmandu valley.

Result and discussion

From the study, it was identified that the groundwater re-charge commonly increases because of: 1) leakage from water distributions systems, sewer lines, detention

ponds, and storm drains; 2) over irrigation of lawns, gardens, and parks; 3) artificial recharge; 4) reduced evapotranspiration and 5) infiltration through "impervious" cover. This coupled with pumping of shallow groundwater, controls water table fluctuations. The impacts of urbanization on groundwater systems are predictable and should be considered in urban planning from geotechnical, environmental, and water resources perspectives.

The spatiotemporal pattern of urbanization in Kathmandu Valley using remote sensing and spatial metrics techniques based on 33-years of time series data compiled from satellite images revels us the different interesting and awfulness fact. A highly dynamic spatial pattern of urbanization is observed in the valley. Urban built-up areas had a slow trend of growth in the 1960s and 1970s but have grown rapidly since the 1980s. The urbanization process has developed fragmented and heterogeneous land use combinations in the valley. However, the refill type of development process in the city core and immediate fringe areas has shown a decreasing trend in the neighborhood distances between land use patches, and an increasing trend towards physical connectedness, which indicates a higher probability of homogenous landscape development in the upcoming decades.

Kathmandu Valley aquifer in central Nepal is continuously under stress since the commencement of mechanized extraction of groundwater resources in early 1970s. Many wells have been drilled in shallow and deep aquifers of the valley; and numerous studies have been made in last four decades to understand the aquifers. However, up-to-date information on well inventory, water extraction, water quality and overall situation of groundwater environment are not yet known in the absence of institutional responsibility in groundwater management.

Due to increasing population density (3,150–4,680 persons/km2), urbanization (increase in urban population from 0.61 to 1.29 million) and increasing number of hotels due to tourism (23–62 hotels) during a decade are acting as driving forces to exceed groundwater extraction over recharge (extraction = 21.56 and recharge = 9.6 million-cubic meter-a-year), decrease in groundwater levels (13–33 m during 1980–2000 and 1.38–7.5 m during 2000–2008), decline in well yield (4.97–36.17 l/s during mid-1980s to 1998) and deterioration in water quality.

The valley requires around 220 million liters of water every day; but the supply is less than half of that – approximately 100 million liters a day. And an estimated 40% of the water supply is lost through leakage from old, rusty and broken pipes. The shortfall is met by people pumping out groundwater themselves. Experts are warning that, if the present groundwater extraction trend continues, then the soil of the valley itself may subside within a few decades.

According to Nir Shakya, senior hydro-geologist on Nepal's Groundwater Resources Development Board, study has revealed that the groundwater table has been dwindling by 0.7 to 1.7 meters a year at alarming trend. The valley is becoming more prone to subsidence. Also the habitable banks of rivers have turned uninhabitable, which has reduced the water flora and fauna population by at least 90% in the last two decades.

In the absence of immediate management intervention with institutional responsibility for groundwater development, regulation and knowledgebase management (i.e. to facilitate collection, integration and dissemination of knowledge); situation of groundwater environment are expected to

deteriorate further therefore groundwater modeling approach may help to suggest appropriate management intervention under current and expected future conditions.

Conclusion

This study shows that currently Kathmandu valley is in great water scarcity as enough drinking water is not available due to this bungled haphazard urbanization and the situation seems to be the same in every urbanized areas and cities. Hence, the condition of groundwater is deteriorating day by day in Kathmandu. As we can see, there is maximum discharge of water but no any suitable methods and system of water recharge. Almost there is maximum wastage of water due to lack of proper management and has been near to the worst condition. So, proper practical scientific methods is to be implemented by each individual for the balance between the water recharge and discharge so that we could think for the upcoming urban habitats and save our god gift natural resources for the future generation. Geologists should also play role to conserve this life saving resource.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friend for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Glacial Lake Outburst Flood: GOLF

Govind Joshi
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: mailatdurga@gmail.com

Introduction

A glacier is a large body of ice, in which ice from a higher elevation is transported to a lower elevation. The body of ice must be at least 30 metres thick for this to take place. The movement of the ice is always from the upper part of the glacier towards the lower end (the snout), regardless of whether the glacier is advancing or retreating.

Periodic or occasional release of large amounts of stored water in a catastrophic outburst flood is widely

referred to as a **jokulhlaup** (Iceland), a **debacle** (French), an **aluvión** (South America), or a **Glacial**
Lake Outburst Flood (GLOF) (Himalaya). A **jokulhlaup** is an outburst which may be associated withvolcanic activity, a **debacle** is an outburst but from a proglacial lake, an **aluvión** is a catastrophic flood ofliquid mud, irrespective of its cause, generally transporting large boulders, and a GLOF is a catastrophicdischarge of water under pressure from a glacier. GLOF events are severe geomorphological hazards andtheir floodwaters can wreak havoc on all human structures located on their path. Much of the damagecreated during GLOF events is associated with the large amounts of debris that accompany the floodwaters. Damage to settlements and farmland can take place at very great distances from the outburst source, for example in Pakistan; damage occurred 1,300 km from the outburst source (WECS 1987b).

A glacial lake outburst flood (GLOF) is a type of outburst flood that occurs when the dam containing a glacial lake fails. The dam can consist of glacier ice or a terminal

moraine. Failure can happen due to erosion, a buildup of water pressure, an avalanche of rock or heavy snow, an earthquake or cryoseism, volcanic eruptions under the ice, or if a large enough portion of a glacier breaks off and massively displaces the waters in a glacial lake at its base.

The Hindu Kush-Himalayan region contains the world's largest volume of glacier ice and perennial snow outside the polarRegions. The Himalayan range extends for approximately 2,400 km within the 3,500 km length of the Hindu Kush-Himalayan ranges,and has about 33,000 sq.km of the estimated 110,000 sq.km of glaciated area. The Nepal Himalayas occupy 800 km of the central section of the Himalayan range and thera are about 3,252 glaciers in Nepal

alone. So, Nepal is very much prone to glacial lake outburst flood.

Glacial Lake Outburst Flood Events in Nepal

In Nepal, several GLOF events have occurred over the past few decades incurring extensive damage toroads, bridges, trekking trials, villages, as well as incurring loss of human life and other infrastructures(Fushimi et al. 1985; Galey 1985; Vuichard and Zimmerman 1986, 1987; Ives 1986; Water and EnergyCommission Secretariat [WECS] 1996).In Nepal at least 12 GLOF events have been reported to date. The GLOFs have caused extensivedamage to major infrastructures. The government has undertaken some mitigation steps to minimise therisk by establishing a telemetric early warning system in Tsho Rolpa and the lower areas that couldprobably be affected. The open canal constructed to lower the lake level of Tsho Rolpa Glacial Lake hasbeen operating since June 2000.

Causes of glacial lake outburst flood

GLOF occurs when the dam containing a

glacial lake fails. The dam can consist of glacier ice or terminal moraine. Failure can happens due to erosion, a buildup of water pressure, an avalanche of rock or heavy snow, an earthquake or cryoseism, volcanic eruptions under the ice, or if a large enough portion of a glacier breaks off and massively displaces the water in a glacial lake at its base. Other causes are as follows:

• Rapid change in climatic conditions that increase solar radiation causing rapid melting of glacier iceand snow with or without the retreat of the glacier.

• Intensive precipitation events

• Decrease in sufficient seepage across the moraine to balance the inflow because of sedimentation ofsilt from the glacier runoff, enhanced by the dust flow into the lake.

• Blocking of ice conduits by sedimentation or by enhanced plastic ice flow in the case of a glacialadvance.

• Thick layer of glacial ice (dead ice) weighed down by sediment below the lake bottom which stopssubsurface infiltration or seepage from the lake bottom.

• Shrinking of the glacier tongue higher up, causing melt water that previously left the glacier
somewhere outside the moraine, where it may have continued underground through talus, not tofollow the path of the glacier.

• Blocking of an outlet by an advancing tributary glacier.

• Landslide at the inner part of the moraine wall, or from slopes above the lake level

• Melting of ice from an ice-core moraine wall.

• Melting of ice due to subterranean thermal activities (volcanogenic, tectonic).

• Inter-basin sub-surface flow of water from one lake to another due to height difference and
availability of flow path.

Glacial Lake Outburst Flood Mitigation Measures

There are several possible methods for mitigating the impact of Glacial Lake Outburst Flood (GLOF)surges, for monitoring, and for early warning systems. The most important mitigation measure forreducing GLOF risk is to reduce the volume of water in the lake in order to reduce the peak surgedischarge.Downstream in the GLOF prone area, measures should be taken to protect infrastructure against thedestructive forces of the GLOF surge. There should be monitoring systems prior to, during, and afterconstruction of infrastructures and settlements in the downstream area.Careful evaluation by detailed studies of the lake, mother glaciers, damming materials, and thesurrounding conditions are essential in choosing an appropriate method and in starting any mitigationmeasure. Any measure taken must be such that it should not create or increase the risk of a GLOFduring and after the mitigation measures are in place. Physical monitoring systems of the dam, Lake Mother glacier, and surroundings are necessary at different stages during and after the mitigation process.

1. **Reducing The Volume Of Lake Water**

Possible peak surge discharge from a GLOF could be reduced by reducing the volume of water in thelake. In general any one or combination of the following methods may be applied for reducing thevolume of water in the lake:

• controlled breaching,

• construction of an outlet control structure,

• pumping or siphoning out the water from the lake, and

• making a tunnel through the moraine barrier or under an ice dam.

2. **Preventative Measures Around The Lake Area**

Any existing and potential source of a larger snow and ice avalanche, slide, or rock fall around the lakearea which has a direct impact on the lake and dam has to be studied in detail. Preventative measureshave to be taken such as removing masses of loose rocks to ensure there will be no avalanches into the lake.

3. **Protecting Infrastructure Against The Destructive Forces Of The Surge**

The sudden hydrostatic and dynamic forces generated by a rapid moving shock wave can be difficult toaccommodate by conventionally designed river structures such as diversion weirs, intakes, bridges,settlements on the river banks, and so on. It will be necessary to build bridges with appropriate flowcapacities and spans at elevations higher than those expected under GLOF events. The Nepal–Chinahighway, after reconstruction, has arched bridges well above the 1981 GLOF levels. Also, the road hasbeen moved to higher levels and has gabion protection at the base of the embankments. Settlementsshould not be built at or near low river terraces but at heights well above the riverbed in an area withGLOF potential. Slopes with potential or old landslides and scree slopes on the banks of the river nearsettlements should be stabilised. It is essential that appropriate warning devices for GLOF events be developed in such areas.

4. Monitoring And Early Warning Systems

A programme of monitoring GLOFs throughout the country should be implemented using a multi-stageapproach, multi-temporal data sets, and multi-disciplinary professionals. Focus should first be on theKnown potentially dangerous lakes and the river systems on which infrastructure is developed.Monitoring, mitigation, and early warning system programmes could involve several phases as follow.

• Detailed inventory and development of a spatial and attribute digital database of the glaciers andglacial lakes using reliable medium- to large-scale (1:63,360 to 1:10,000) topographic maps

• Updating of the inventory of glaciers and glacial lakes and identification of potentially dangerouslakes using remote-sensing data such as the Land Observation Satellite (LANDSAT) Thematic Mapper(TM), Indian Remote Sensing Satellite (IRS)1C/D Linear Imaging and Self Scanning Sensor (LISS)3,Stéréo Système Probatoire d'Observation de la Terre (SPOT) multi-spectral (XS), SPOTpanchromatic (PAN) (stereo), and IRS1C/D PAN (stereo) images.

• Semi-detailed to detailed study of the glacial lakes, identification of potentially dangerous lakes andthe possible mechanism of a GLOF using aerial photos.

• Annual examination of medium- to high-resolution satellite images, e.g. LANDSAT TM, IRS1D, SPOT, ans so on to assess changes in the different parameters of potentially dangerous lakes and thesurrounding terrain

• Brief over-flight reconnaissance with small format cameras to view the lakes of concern more closelyand to assess their potential for bursting in the near future

• Field reconnaissance to establish clearly the potential for bursting and to evaluate the need forpreventative action

• Detailed studies of the potentially dangerous lakes by multi-disciplinary professionals

• Implementation of appropriate mitigation measure(s) in the highly potentially dangerous lakes

• Regular monitoring of the site during and after the appropriate mitigation measure(s) have beencarried out

• Development of a telecommunication and radio broadcasting system integrated with on-site installedhydrometeorological, geophysical, and other necessary instruments at lakes of concern anddownstream as early warning mechanisms for minimising the impact of a GLOF

•Interaction/cooperation among all of the related government departments/institutions/agencies /broadcasting media, and others for detailed studies, mitigation activities, and preparedness forpossible disasters arising from GLOF events.

Conclusion

Glacial lake outburst flood (GLOF) is major natural hazard that may cause devastating disaster. So, Every should get focused for consequence and major step should be taken for the mitigation. Many NGO's and INGO's are working in the area but still it is not sufficient, so other program should also be launched.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friends for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Labradorite: An Economic Mineral

Gunanidhi Pokhrel
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

The plagioclase feldspar with an iridescent play of color that is often used as a gemstone.

What is Labradorite?

Labradorite is a feldspar mineral of the plagioclase series that is most often found in mafic igneous rocks such as basalt, gabbro and norite. It is also found in anorthosite, an igneous rock in which labradorite can be the most abundant mineral. Specimens of labradorite exhibit a schiller effect, which is a strong play of iridescent blue, green, red, orange, and yellow colors as shown in the photographs above and at right. Labradorite is so well known for these spectacular displays of color that the phenomenon is known as "labradorescence." Specimens with the highest quality labradorescence are often selected for use as gemstones.

What Causes Labradorescence?

Labradorescence is not a display of colors reflected from the surface of a specimen. Instead, light enters the stone, strikes a twinning surface within the stone, and reflects from it. The color seen by the observer is the color of light reflected from that twinning surface. Different twinning surfaces within the stone reflect different colors of light. Light reflecting from different twinning surfaces in various parts of the stone can give the stone a multi-colored appearance.

Properties of Labradorite

Labradorite is a mineral in the plagioclase series, and it shares many of the properties of plagioclase minerals. It has a Mohs hardness of about 6 to 6 1/2 and two distinct directions of cleavage that intersect at an angle of about 86 degrees or 94 degrees. Plagioclase minerals frequently exhibit twinning and striations on cleavage faces.

Labradorite is the only mineral in the plagioclase series that exhibits strong labradorescence; however, many specimens of labradorite do not exhibit the phenomenon. Without seeing labradorescence, distinguishing labradorite from other members of the plagioclase series can be difficult. The methods used for distinguishing them are x-ray diffraction, chemical analysis, optical tests, and specific gravity determinations on pure specimens.

Fig: A specimen of labradorite feldspar rough about four inches across exhibiting a beautiful play of color. Collected near Nain, Labrador, Canada

Close-up photo of a beautiful cabochon showing flashes of aventurescence caused by light reflecting from the copper platelet inclusions within the stone. Some of this material is labradorite and known as "Oregon Sunstone."

Much of the gem-quality feldspar mined in Oregon and sold as "Oregon Sunstone" is actually labradorite feldspar

Fig: cabochon

Physical Properties of Labradorite	
Color	usually clear, white or gray in reflected light labradorescent colors can include: blue, green, yellow, orange and red
Streak	white
Luster	vitreous, pearly on cleavage faces
Diaphaneity	transparent to translucent
Cleavage	two directions of perfect cleavage intersecting at about 86 degrees
Mohs Hardness	6 to 6 1/2
Specific Gravity	2.68 to 2.72
Distinguishing Characteristics	hardness, cleavage (twinning and labradorescence - only shown by some specimens)
Chemical Composition	$(Na,Ca)(Al,Si)_4O_8$ with Na (30-50%) and Ca (70-50%)
Crystal System	Triclinic

Labradorite as a Gemstone

Labradorite has become a popular gemstone because of the unique iridescent play of color that many specimens exhibit. The quality, hue and brilliance of the labradorescence varies from one specimen to another and within a single specimen. Stones with exceptional color are often given the name "spectrolite."

Labradorite is rarely seen in mass-merchant jewelry. Instead it is most often used by designers and jewelers who do unique and custom work.

Many specimens of labradorite do not exhibit labradorescence. These materials can still produce beautiful gemstones because of their desirable color or other optical effects such as aventurescence. A beautiful orange piece of labradorite cut as a faceted stone is shown in the right column of this page. Some specimens of sunstone are labradorite. Sunstone is a plagioclase gemstone in which tiny platelets of copper or another mineral are arranged in a common orientation. These platelets produce a reflective flash when incident light enters the stone at a proper angle relative to the angle of observation. Some cautions are required when using labradorite as a gemstone. It breaks in two directions with perfect cleavage. This makes it subject to breaking with impact and not a good candidate for jewelry or other objects that could be subject to impact. It also has a hardness of 6 on the Mohs scale. It will therefore scratch much more easily than diamonds, rubies, sapphires and emeralds, and slightly more easily than jasper and agate.

Cutting Labradorite

Labradorescent material is most often cut into cabochons. The labradorescence phenomenon is best exhibited when the base of the cabochon is parallel to the layers in the material that produce the labradorescent flash. Careful study of the material is required so that the finished stone will be oriented to produce a full "face up color." If the stone is cut at any other angle, the layers that produce the labradorescence will be inclined when the stone is viewed from directly above. This will yield a labradorsecent flash that will appear to be off-center.

Geologic Occurrence of Labradorite

Labradorite is found in igneous, metamorphic and sedimentary rocks. It most often occurs as a primary mineral in mafic igneous rocks such as basalt, gabbro and norite. It is also found in anorthosite, an igneous rock in which labradorite can be the most abundant mineral. Labradorite occurs in gneiss that has been produced through the metamorphism of labradorite-bearing igneous rocks. It is also found in sediments and sedimentary rocks that are derived from the weathering of other rocks that contain labradorite.

Notable Labradorite Localities

Labradorite is named after its location of discovery on the Isle of Paul, near Nain, Labrador, Canada. It was discovered there in 1770 by a Moravian missionary. Labradorite with superb labradorescence is produced from a few deposits in Finland. The best of this material was given the name "spectrolite" by the director of the Geological Survey of Finland. Today, specimens of labradorite with exceptional labradorescence from other locations are frequently called "spectrolite." A significant amount of gray to black labradorite with good labradorescence is produced from locations in Madagascar and Russia. Small amounts of transparent labradorite with internal color flash are produced in India. Several mines in Oregon produce transparent orange, yellow, red, blue, green,

and clear labradorite without labradorescence. These can be cut into very nice faceted stones. Some of this material has platy inclusions of copper in a common alignment that can produce an aventurescent flash when played in the light. These materials are marketed under the name "Oregon Sunstone" and have attracted a strong following from local designers and the tourist trade.

A "Gemmy" Architectural Stone

Some deposits of anorthosite are quarried and cut into slabs that are used to manufacture small sculptures, countertops, window sills, tiles, facing stone and other architectural products. A photograph of a polished surface of an architectural stone known as "blue labradorite granite" is shown in the right column of this page.

Fig: A tumbled stone of labradorite with very strong twinning (the parallel lines of color within the stone). The material used to make this stone was produced in Madagascar.

Anorthosite, a rock rich in labradorite, is often cut, polished and used as an architectural stone. It is sold under a variety of names such as "blue granite" or "labradorite granite." It is used as countertops, tiles, window sills and facing stone. A building faced with labradorite-rich rock can be a spectacular sight when the sun hits it at the right angle. Millions of labradorite crystals reflect brilliant color flashes in various directions. This makes the building glitter colorfully in the sun as you drive or walk by.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friends and also all other friends of editorial board for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Image © iStock/Theanthrope.

Geological application in landfill site construction

Jharendra K.C.
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: jharendra_kc@hotmail.com

Introduction

The topic 'Geological application in landfill site construction' is based on the influencing factor of geology in the matter of landfill site designing. Afterall, the processes of construction and designing the dumping sites are done subsurfacely underground works and that touches the integral role of geoengineering and hydrogeological analysis. Haphazard designing of landfill may harm human lives, pollute soil, water and environment and that hampers the foundation of rock and soil types.

Because of such genuine problems concerning the work, relevant solution should be generated. I tried to some extend elaborating and general understanding about the interrelationship between geology and landfill site selection. Further this article is about the subject which enlighten the basic knowledge about landfill system and its impact towards the environment and its component. Thus, this article deals with improved and managed way of constructing landfill site geologically.

Objectives

- Provides the basic knowledge about landfillsite
- Geological interpretation on designing the sites
- To show significant links between geology and hydrology (Keller A. Edward)
- Identifying probable impacts on geological aspects and areas
- To show geoengineering and hydrogeological roles in landfill construction
- To emphasize the considering factors on its design
- To know harmful effects due to hap hazardous designing of landfill site on the environment
- Providing some basic solutions and measures of controlling the probable effects of the landfill site

Landfill site

Landfill site is a site for the disposal of waste material by burying it. It is the oldest form of waste management. A sanitary landfill (also called municipal solid waste landfill) is a method of solid waste disposal that functions without crating nuisance or hazard to public health or safety (American Society of Civil Engineering).

Historically, landfill has been the most common methods of organized waste disposal and remains. So in many countries, some landfills are also used for waste management, purposes such as the temporary storage, consolidation and transfer or processing of waste materials. There are four critical elements in securing a landfill. They are:

- A bottom layer
- A cover

- A leachate collection
- The nature of hydrological setting

Design of Sanitary landfill

- In the past many problems associated with landfills occurred as a result of non-geological approach and poor management. There are many potential environmental problems associated with the landfilling of waste. These problems are often long term and include possible contamination of the groundwater and subsurface water regimes, landfill gas migration, generation of foul smell.
- The potential sites must be large areas that are suitable for landfill development (Patric Walch and Philipo Leary).
- Design of modern landfills for municipal solid waste (MSW) is complex and employs the multiple barrier approach (Keller. A Edward). Barriers include a compacted clay linear, leachable collection system and a compacted clay cap.

Objectives and Considerations on the Designing Landfill Sites

The primary objectives of landfill site designing are to provide effective control measures to prevent or reduce the negative impacts on environment and risk to human health. The design concept for a landfill depends on the ground conditions, the geology and hydrology of the site. Considerations given to the design of landfill sites:

1. Water control:
   To reduce leachate generation, control measures that minimize the quality of precipitation, surface water and groundwater entering the landfill waste contaminated water will need to be collected and treated prior to discharge.
2. Leachate management :
   An efficient leachate collection system may have to be provided to ensure that leachate accumulation at the base of the landfill is to kept to a minimum.
3. Gas control:
   The accumulation and migration of landfill gas must be controlled. Landfill gas may need to be collected will subsequently treatment and utilization or disposal in a safe manner through flaring or venting.
4. Stability:
   Considerations must be given to the stability of the subgrade basal linear and system of landfill design. The subgrade or basal linear should be sufficiently stable to prevent excessive settlements or slippages. The hydraulic uplift pressure on the linking system due to groundwater must b considered.
   The waste emplacement method should ensure stability of the waste mass against sliding and rotational failure. The caping system should be stable against sliding.
5. Visual appearance and landscape:
   It should be considered the visual appearance of the landfill during operation and at the termination of

landfilling and its impact on the surrounding landform.

Site Selection

Factors controlling the feasibility of sanitary landfills induced are given below:

- Topographic relief
- Location of the groundwater table
- Amount of precipitation
- Types of soil and rocks
- Location of the disposal zone in the surface water and groundwater flow system.

The best sites are those where there is little pollution of groundwater or subsurface water and that conditions are safe because of climate, hydrology. Another best sites for landfills are in arid regions because in dry environment disposals are relatively safe for leachate production.

4: Geological aspects related to landfill site designing:

4.1: Lithology

The base lithology of landfill sites should be stable compose of impermeable layers such as mud and clay. It cannot be sited in certain areas including flood plains, wetland and earthquake fault zones. The litholoy composed of sand and gravel pits is not suitable for landfilling.

4.2: Soil and rock types

Soil and rock profile characters are important for landfill development. The fractured bed rocks and low grade/ weathered rocks should discarded. Soil is important for 3- reasons, they are:

I. Cover: Materials used to cover the solid waste daily and when the area of landfill is completed. The permeability of final cover is greatly influenced the quantity of leachate generated.

II. Gas migration control: The materials below and adjacent to the landfill must be suitable for construction. It must provide a film foundation for linear, roads and for other construction activities.
Ideally, sites should be located in silt and clay soils which restrict the leachate and gas movement. Example: Rocks like limestone, phyllites and fractured rocks are poor sites.

Hydrogeologocal condition

There are sufficient chances of affecting groundwater, surface water and in proper run off. So whie preparing for the sanitary landfill sites one has to know about the hydrological networks present in certain regions. Origination, connections and distribution of the networks should be thoroughly analyzed. Natural hydrologic setting can be maintained.

Example: swampy areas, wetland, flood plains are poor sites.

Effects of landfill site

- Many adverse impacts may occur from landfill operation. Damage can include infrastructure destruction (example: damage to access roads by heavy vehicles).

- Pollution of the local environment (such as contamination of groundwater or aquifer by leakage or sink holes and residual soil contaminations during landfill usage as well as well as after landfill closure). Haphazardous landfill sites may harm people lives and may spread epidermic diesease as well.
- Offgassing of methane generated by decaying organic wastes.
- In some cases, hazardous disposal sites are responsible for reduction of infiltration of surface water by a polyethylene plastic cover.
- Leachate percolation may imbalances the original state of groundwater and pollute the soil.

Measures of controlling effects

The haphazardous sanitary dumping sites may have several adverse effects. So for reducing such affects, certain measures have to be taken. Some are discussed below:

I. Landuse planning deals with the selection for the appropriate sites that helps in well monitoring and proper management in the landfill sites.
II. The basic idea of a secure landfill is ro confine waste to a particular location, control the leachate that drains from the waste collect and treat the leachate and detect the possible leaks.
III. There has to be taken some alternatives ways. The alternatives to landfill are waste reduction and recycling strategies.
IV. Banning the disposals of untreated waste in landfill.
V. Prevention of waste generation and reduce at the source.
VI. Waste recovery through reuse, recycle and energy recovery.
VII. Safe disposals of any remaining non-recoverable waste.
VIII. Identifying the site with good natural barriers such as thick clay – silt deposits (impermeable layers), an arid – climate or a deep water table that minimize migration of leachate.

Conclusion

Solid waste management is one of the challenging urban problems. Government spent a lot of money and manpower for the well management of solid waste. Landfill or sanitary dumping sites are the possible way of monitoring and fight back of such problems. But there are many consequences of such site if they are made without any expertise in the field and prepare haphazardously.

There is huge relationship between landfill site construction and the geology. Technology site selection should be done under the proper study of geology of the particular region. The study of bedrock, soil type, covers of leachate management, gas migration control and control in groundwater pollution. This kind of study and observation provides necessary ideas about effects of landfill sites and measures of controlling effects.

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for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Bagmati River and Its Attributes

Kiran Pandey
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: pandeykiran80@gmail.com

Introduction:

The Bagmati is the principal river of the Bagmati basin in Nepal. The river originates in the Kathmandu valley, which comprises about 15% of the area of the Bagmati basin in Nepal (DHM, 2006). The Bagmati basin is characterized as medium or dry basin fed by springs and monsoon rainfall (WECS, 2008).Based on the morphology and land use, the Bagmati basin is divided into various sub-basins, viz. Upper Bagmati, Upper Middle Bagmati, Lower Middle (Terai) Bagmati and the Lower Bagmati (Terai) sub-basins (BAP, 2009).

Fig. Upper Bagmati Basin, BAP, (2009-2014)

Bagmati attaches spiritual and emotional significance to the Nepali people; most of the important temples, shrines, ghats, etc. are located along the river bank and are used for different cultural and ritual purposes.

Urbanization of Kathmandu valley has strongly influenced Bagmati river. The direct impacts of present urbanization are especially visible in the Bagmati river and its tributaries where they have been used as dumping sites for all types of wastes. The rich cultural heritage along the river and its tributaries are gradually eroding. The river has been widely used for different purposes ranging from sand extraction to land encroachment.

Objective:

The main objectives of this article are:

- to enhance about the general morphology of the holy river Bagmati
- to give general idea about its origin and tributaries
- to alarm people about its deteriorating condition
- to give information about the religious sites

Methodology:

Field study was done and then available secondary sources such as books, articles, documents, etc were collected. Finally, all the collected materials were presented systematically in the form of an article.

Bagmati and its Tributaries:

Bagmati:

The Bagmati river originates in Baghdwar of shivapuri hills in the north of the Kathmandu valley. The river is fed by numerous tributaries originating from the Mahabharat and Siwalik range before it

reached the Terai at Karmaiya and to the Gangatic plain. The total catchment area of the Bagmati River is about 157 sq km with the length of 44 km from its origin at an elevation of 2732 m to katuwal daha, which lies at an elevation of 1140 m (Pradhan, 1996).

Fig. Foaming substances floating on the river, (Photo: Kiran Pandey)

In the northernmost origin of Bagmati River, there are many small and large wetlands that exist inside the Shivapuri National park and the surrounding hills such as dhap, Taudaha and Basantigaun ponds. Such wetland contributes to recharging of the rivers. A large volume of water is diverted for the city water supply by the KUKL at Sundarijal. Besides, water is also diverted into different locations for irrigation, industrial and household use.

Direct disposal of untreated sweage has been prevalent in Jorpati, Tilganga, Minbhawan, Sankhamul, Kupondol, Teku, Balkhu, Sundarighat and Chobhar. Toilets in squatter settlements are being directly discharged into the river. Heavily polluted tributaries such as Dhobikhola, Bishnumati and Tukucha join the Bagmati as it flows towards the chobhar gorge. River banks downstream is used as solid waste dumping sites. Many important cultural and heritage sites such as Sundarimai at Sundarijal, Utter Bahiniang Gokarneshwor at Gokarna, Guheshwari and Pashupatinath temples at Pashupati, Sankhamul heritage sitea along Thapathali-Teku, and Chobhar Ganesh at Chobhar are situated along the river. Most of these sites are in detoriating condition simply because of inadequate management.

Bishnumati:

Bishnumati river is a major tributary of the Bagmati river originating at Bishnudwar at shivapuri and flowing southward (DHM, 2006). The length of Bishnumati is 27.3 km with the total catchment area of 109.3 sq km (Pradhan, 1996). The Bishnumati river merges with the Bagmati river at Teku Dovan.

Use of the river bank is almost similar to the Bagmati river. The river banks along the Gongabu Bus Park are being extensively used for commercial purposes. Most of the river banks are used for dumping solid wastes generate from the city.

Important religious and cultural sites such as Shobha Bhagwati, indryani, Kankeshwori, Shivadev Basaha and Budhanilkantha are located along the Bishnumati river. Most of these sites are in deteriorating condition.

Tukucha:

Tukucha, also known as Ichhumati, originates at Maharajgunj inside the valley. It is about 6.4 km long channel without any tributary and have total catchment area about 8.94 sq km (Pradhan, 1996). It joins the Bagmati at Kalmochan, Thapathali. At present, Tukucha has become an open sewage drain.

The river sides have been extensively occupied by squatters. In some parts such as Durbar Marg and Kamaladi, the river flows underneath the buildings. The entire part of

the river has been used for dumping solid waste and waste water into the river. Bhatbhateni temple, Nil Saraswati and Tudal Devi are important religious sites located along the river.

Dhobikhola:

Dhobikhola, also known as Rudramati river, originates from the Shivapuri hills and flows south joining the Bagmati river at Buddhanagar (Bijuli Bazar). Its length is 18.2 km and the total catchment area is 31.2 km (Pradhan, 1996). Khahare Khola and Chakhuncha khola are its tributaries.

The upstream section that passes through agricultural land has clear water. The discharge of solid waste and raw sewages increases as it flows downstream from Kapan, Mandikatar, Maitidevi, Anamnagar and at the junction of Dhobikhola and Bagmati.

Squatters have extensively occupied the river banks. Sukumbashi tole is at greater risk of flood hazards as it is a flood plain (Neupane, 2007). The river has been severely channelized by a newly constructed road.

Manahara:

Manahara river meets the Bagmati river at Chysal. It originates from Manichaur danda in the north east and flows towards the south-west. It is the longest tributary of the Bagmati, having a length of 23.4 km and total catchment area of about 285.35 sq km (Pradhan, 1996).

The ecological status and water quality of Manahara gradually deteriorates from upstream to downstream. The river is used as the dumping sites. New sewer lines have been connected to discharge waste water directly into the rivers in newly urbanizing locations. A small collection chamber has been constructed near Sano Thimi bridge to collect waste water from the Pepsicola Planning Area. Existing outlets of swear along the river banks are in poor conditions.

Culturally and historically important sites such as Bajrayogini, Salinadi Tirtha and Changunarayan are situated along the banks of this river and they are still in good condition.

Balkhu:

Balkhu, also known as Indramati originates in the Chandragiri in the west and meets the Bagmati outside the Ring Road at Balkhu. Thado Khola is the major tributary. The total Catchment area of the Balkhu river is 46.32 sq km (Pradhan, 1996). The river is extensively used for washing vehicles and bathing animals.

Wastes from many places are discharged directly into the river. Foaming substances floating on the river indicates the possibility of chemical pollution in the river. Large dumps of solid waste are found accumulated near industrial areas. Some squatter settlements are seen along the river.

Important religious sites are Ikkchha Brisheshwor Mahadev, Bishnu devi and Bir Binayak temples.

Nakkhu:

Nakkhu khola flows from the south and meets Bagmati near the chobhar gorge. It originates from the ridge of Bhardeu and the total catchment area is 51.44 sq km (Pradhan, 1996).

Nallu and Lele khola meets at Tikabhairab to form Nakkhu khola. A water treatment and distribution plant has been constructed near the influence of Nakkhu khola and Bagmati.

Sewage pipes are directly discharged into the river in many places. Although solid

waste dumping is absent in upstream areas, it has been observed from Kusunti onwards.

Culturally important temple is Tika Bhairabwhich is located at the confluence of Nakkhu.The Nakkhu khola is also important for Rato Machhindranath festival celebrated every twelve years.

Conclusion:

The Bagmati River is one of the important river systems of Nepal with high cultural values. There are several culturally rich sites along the Bagmati river and its tributaries. However, lagging behind in formulating plans and policies by high level authorities and due to carelessness of common people Bagmati is deteriorated culturally and ecologically. It is us, who are responsible for the condition of the holy river Bagmati and it is again we people that have to take care about it. This is not only our heritage but of our future generation too, so we have to preserve it for them. If not now than never.

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Recent Geological Hazards in Pokhara

Madhavi Regmi
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: regmi_madhavi@yahoo.com

Background:

Pokhara, geophysically is a very unique and beautiful place of Nepal with various geomorphic features, like mountains, lakes, caves, caverns etc. Apart from this scenic beauty some geological hazards are also relevant. Pokhara recently has suffered from two such hazards, the glacial outburst and the sinkholes, a very recent and burning issue of Pokhara. In short it would not be wrong to conclude, along with the unique scenic beauty it is also a source of vulnerability to various natural disasters.

Objectives:

- To understand about the occurred geological hazards.
- To be aware of the areas of impact.
- To know about the occurrences of such hazards.
- To understand about the causes and consequences.

Glacial outburst resulting the flood in Seti River:

The clear views of Himalayas in Pokhara at relatively close range especially Annapurna, Macchapuchre is because of the abrupt rise of mountain in the north and absence of mountain in between the valley and the Himalayan range. This abrupt rise of mountains has also been studied as a cause of various slope failures leading to landslides and their consequences. As a result the impact of the disturbances in the Himalayas or the high mountains in the north is carried out to Pokhara through the Seti and Mardi rivers. Not only that the local people and the development planners have concern only about the economic development through tourism so they don't pay attention towards such vulnerabilities. The recent flash flood of the Seti river nearly about a year ago is the result of the same.

Glacial lake outburst floods are considered the basic reason for the present physical or geomorphic feature of Pokhara valley. Also the Seti and Mardi rivers are important links between the Annapurna Himalayas and Pokhara. The moraine brought by such floods from time to time has helped in filling the valley, blocking the rivers and in the formation of lakes in depressed areas where water has been collected. Not only by the glacial outburst also by the means of other landslides debris has been collected in Pokhara valley. In short soil profile of Pokhara valley is very soft, as a result of deposition of moraine and debris in different locations of the valley. Since the soil profile of the valley is soft during rainy season depressions are formed. It is very important to understand the geomorphology of the area before the construction of infrastructures. But in case of Pokhara, neglecting the seriousness of the matter different buildings and infrastructures have been constructed haphazardly which may result eventually other serious geological hazards.

Sinkholes:

Recent burning issue in Pokhara at recent is the sinkholes. About 40 sinkholes have

already appeared spreading panic and sparking safety concerns. Actually a sinkhole is a natural depression or hole in the ground caused by some form of collapse of the surface layer. Everything around the cavity drains into the formed cavity. Sinkhole may occur gradually or suddenly. But the possibility of such holes or cavity is maximum in the lands where the rock below the land of surface is a limestone or carbonate rocks.

The formation of sinkhole is a natural process. It is formed when groundwater circulates through the soil (silty clay) in the lower part of the land, it dissolves the soil. This causes the formation of caverns and spaces which leads to the collapse of the upper layer of land. Sinkholes may vary in size from 1 to 600m (3.3 to 200ft) both in diameter and depth, and vary in form from soil-lined bowls to bed rock edged chasms. In Nepal they range from 2-3m to 10-15 meters.

Fig: Sinkholes at Armala V.D.C

In case of Pokhara, the recent formation of sinkhole was studied as: when the bridge was constructed in the river, its course was disturbed and blocked. As a result of blockage the river water began to find its way and was diverted to the soil that was weak and loose. The north-south flowing rivers course was almost diverted the north-west direction. As the course of river was changed, the river water flow underground dissolving the soil in the lower layer which created void inside the area of influence. Thus as a result in absence of support of lower layer the outermost layer got depressed and collapsed forming a hole.

Conclusion:

At present the expanding economy and population are forcing new development and construction in more undesirable locations. People are neglecting the importance of nature and geomorphology. By their negligence the nature and environment is compelled to change its course. As a result different geological hazards are knocking our door. It is true that each and every hazards faced, cannot be blamed on peoples activity as some of them may be natural too. But at present context it would not be false to blame that most of the hazards are due to people's unfriendly behavior towards the environment. The haphazard construction works, without understanding the geology of the area has created many problems. Thus it is very much necessary to understand the necessity of nature. Everything in its originality is the best. So we should pay due attention that the nature remain in its originality and it should not be compelled to change its course by our unnecessary wants and desires.

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Selenology: The Moon Science

Manish Shrestha
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Background

According to Oxford Advanced learner's dictionary Geology is the study of the earth including the history and origin of rocks and soil of which the earth is made. Further it can also be defined as science which comprises the study of solid earth, the rock of which it is composed of and process by which they change, it also refers to the study of solid features of any celestial body like moon, Mars etc. While there is no word Selenology in Oxford Advanced learner's Dictionary. Collins English Dictionary (2009) and Oxford English Dictionary

defines Selenology as the study of moon branched from astronomy concerned with its characteristics, nature, origin etc. So the study of moon can be termed as Selenology or Lunar science. Selenology began when man looked up at the moon and wondered what it was? Galileo's first use of telescope to study of the moon in 1609 gave boost to this study. Moon is easiest celestial object to find in night sky. It is satellite of earth and we see them due to reflected sunlight. Moon lack a significant atmosphere, eliminating erosion due to weather and do not posses any form of plate tectonics. Study of moon is difficult from earth. Geological study of earth can be easier as we live on earth but study of moon are based on combination of Earth based telescope, observation, measurement from orbiting spacecraft, lunar samples and geophysical data. Moon is only extraterrestrial body for which scientist have got the sample with known geologic content. Apollo mission in 1960's and late 1970's which brought down 385 kilograms of lunar rocks and soil is only samples that scientist got from moon.

Formation of moon:

It has been centuries for scientist to find out the creation story for earth's moon. Before the Giant Impact model gained the attraction nearly four decades ago other three models were popular.

Binary model stated that moon condensed from the same whirling cloud of dust that created earth. But it could not explain that why even being the twins of earth, moon is less dense than our planet.

Second model stated that young molten Earth spun so rapidly that it split apart, forming a giant blob of magma into the space but earth spinning orbit and moon orbit don't fit the pattern predicted by Fission model.

Third model stated Earth's gravity drag the moon as it wandered through from some distant part of solar system. This model was

appealing until the Apollo astronauts brought their moon's rock back to earth and found that they to be similar to the minerals in Earth's mantle, not a characteristic of another place or part of the world

Giant Impact model came along the 1970's solved all these drawbacks. Model fits an emerging view of how the solar system formed. On that prospective, gaseous and rocky proto planets grew within a disc around the young sun, competing for space for tens of millions of years. As earth bigger it absorbed several Mercury to Mars sized objects. The final major blow was an impact which was so fierce that it left permanent reminder in orbit around us. According to impact model the moon is formed grouping up of shattered debris of impact, a rocky proto planet similar to earth as impact iron ore sank into Earth's core and left the moon as all rock.

Geological History of Moon:

Geological history of moon has divided into six major epochs called geological timescale. They are Pre Nectarian, Nectarian, Early Imbrian, Late Imbrian, Eratosthenian, Copernican. Since the beginning at about 4.5 billion year ago, the newly formed Moon was in molten state and was orbiting much closer to earth resulting in tidal forces. The tidal forces deformed the molten body into ellipsoid with major axis pointed towards the earth. Important event in geological evolution of Moon was crystallization of Magma Ocean. Minerals to form in the ocean were iron, manganese, silicate, olivine and pyroxene since they were dense than other minerals around. After the crystallization was 75% complete less dense plagioclase, feldspar crystallized and formed crust about 70 kilometers in thickness.

Physical Characteristics of Moon:

Study of moon's surface increased with the invention of telescope by Galileo in 1609 and in 1969 when first human actually set foot on moon's surface. The physical characteristics and surface has been studied telescopically, photographically and recently by different manned and unmanned spacecraft. The moon's diameter is about 3475 kilometers at equator of moon. Contrary to popular belief that moon does not have atmosphere, it has thin atmospheric layer that consists of helium, argon, methane and minute amount of oxygen. The density of lunar atmosphere is only 2105 particles per cubic centimeter. The thin and dry lunar atmosphere provides no substantial weathering agents hence erosion processes are greatly reduced to heating, cooling and slow geochemical changes. Thin atmosphere also offer no protection from meteor impact like the earth atmosphere layer does. Although Moon is quarter the size of moon it has only 1 to 2 percentage of Earth's mass and has acceleration due to gravity approximately $1.62 m/s^2$.

Moon is rocky and many craters are formed by the asteroid impacts millions of year ago but due to no atmosphere crater has not eroded. Elements known to be found or present in surface of moon include Oxygen (O), Silicon (Si), Iron (Fe), Magnesium (Mg), Calcium (Ca), Aluminum (Al), Manganese (Mn) and Titanium (Ti). Among which oxygen, silicon and iron are abundant.

Internal Structure of Moon:

Diffraction of seismic waves by seismometer placed by Apollo mission provided first clear cut evidence of lunar crust, mantle and core. Lunar crust is about 70 km thick making a moon a rigid solid.

The outermost crust is broken and jumbled due to all impact received due to meteors.

The rocky mantle is about 1330 km thick and is made up of dense rock in iron and magnesium. Unlike the volcanoes in earth, magma in mantle of moon made their way in surface in past and erupted volcanically for more than a billion of year.

The moon has very small core just 1 to 2 percent of moon's mass and about 680 km wide. It likely consists of mostly iron and also may contain large amount of sulfur and other elements.

Surface features of Moon:

Looking up at the moon one can tell that it is made up two distinct shades of materials. The lighter parts are called Highlands and darker parts are called Maria as termed by Galileo. The lunar surfaces which are mountainous are Highlands and the roughly circular plain are Maria. The lunar mountain ranges up to height of 7800 m. The highlands are densely scarred by thousands of craters; shallow circular depression usually ringed by well defined wall and posses a central peak. Craters range in diameter from a few feet to miles. Craters are also found in Maria but are in less number in compare to highlands.

Mare (singular Maria) and highland rocks differs in both appearance and chemical content. Mare rocks are rich in olivine, pyroxene and iron. Maria is basaltic rock i.e. igneous rock formed from magma. While highlands are largely Anorthosite a kind of rock igneous rock formed when lava cools but more slowly consisting of plagioclase and feldspar.

Rilles on moon are resulted from formation of localized lava channels. These usually fall into three categories consisting of sinuous, arcuate and linear shape.

Domes are variety of shield volcanoes found in selected area of lunar surface. They are believed to be formed by relatively viscous silica rich lava erupting from local vents. Lunar domes are wide, rounded, circular feature with gentle slope.

Surface of moon has been subjected to collisions with both small and large asteroids and meteoroids materials from billions of year. These impacts have pulverized and gardened the surface material forming a fine grained layer termed as Regolith. Thickness of regolith varies from two meters beneath the younger Maria to up to twenty meters beneath the oldest surface of the lunar highlands. Term mega regolith is used to describe the heavily fractured bedrocks directly beneath near surface of regolith layer. Regolith is composed of rock fragments of minerals from original bedrock and glassy particles formed by impact but the composition may vary according to location. The regolith of highland is rich in plagioclase, feldspar and silica while regolith of Maria is rich in iron and magnesium.

Relationship between Earth and Moon:

Being a neighborhood of Earth, Moon creates lots of effect to the Earth. Effects on Earth due to Moon are:

i.Tidal effects: The moon gravity pulls the earth causing predictable rise and fall in sea level known as tides. High tides are when water bulges upward and low tides when water drops down. High tide results on the side of earth nearest to moon due to moons gravity while the low tides occur on the opposite side of earth.

The pull of moon is also slowing the Earth rotation, this effect is known as tidal braking, causing increase of length of day by 2.3 milliseconds per century. The energy that earth loses is picked up by moon increasing the distance from earth which means the moon gets farther away by 3.8 cm annually.
The moon's gravitational pull is believed to make the earth a livable by moderating the degree of wobble in earth's axial tilt which leads to relatively stable climate over billions of year where life could flourish.

ii. Eclipse: Eclipse is the situation when moon, earth and sun are in a straight line or nearly so. Lunar eclipse takes place when earth gets between sun and moon and earth shadows moon. It only occurs during full moon. While solar eclipse occurs when moon gets between sun and earth and moon's shadow falls on us. Solar eclipse occurs only during a new moon.

iii. Season: The earth's axis of rotation is tilted in relative to ecliptic plane, an imaginary surface through earth's orbit around the sun. This means northern hemisphere and southern hemisphere will sometime point towards or away from sun depending on the time of year varying amount of light they receive and causing the season.

The earth's axis tilted at 23.5 degree but the tilt of moon's axis is only 1.5 degree. So the moon virtually has no season i.e. some are always lit by sunlight and other is perpetually draped in shadow.

Exploration and Research:

The Moon is the brightest object in night sky has created a rhythm that has guided humanity for millennia, the moon was studied and its apparent motion was recorded beginning in ancient time. The Babylonian and Mayas had precise calendar for eclipse and other astronomical events. Based on lunar phases, astronomers now recognize different months such as synodic months of 29 days 12 hours and 44 minutes,

the sidereal month of 27 days 7 hours and 43 minutes based on the phase of lunar revolution around the earth.

The legendary scientist Galileo Galilei was first to use a telescope to make scientific observation of moon, describing rough mountainous surface in 1609 was quite different from popular belief of his days that moon is smooth.

In 1959 Soviet Union first landed spacecraft to moon's surface and returned photographs of its far side. In 1969, 20th July US NASA landed spacecraft with Neil Armstrong, Michael Collin and Edwin Aldrin, Jr. where the Neil Armstrong was first man to step on Moon, was undoubtedly most famous NASA's achievement, they returned 385 kilograms of moon's rock and soil back to earth for study. Moon has remained only extraterrestrial body that human has ever visited

After long lunar exploration resumed in 1990's with US robotic missions Clementine and Lunar Prospector both suggesting that

water might be present on lunar poles. In 2011, NASA's Lunar Reconnaissance Orbiter spacecraft sent back the best moon map ever.

Conclusion:

Although many studies and research has been carried and is still been done, Moon remains a mystery. Its study is difficult and costly but beside these problems its study is important. Being a costly, for developing countries like Nepal its study is far beyond but we hope the study of moon will soon be carry out in few more decades. As the astronaut Neil Armstrong of Apollo 11 stated "One small step for man, giant leap for a mankind."

Acknowledgment:

I would to deeply express thanks to Department of Geology, Tri Chandra College; Dr. Tara Nidhi Bhattarai, Head of Department of Geology; Tri Chandra College and all the faculty members of Department of Geology; Tri Chandra College for providing students opportunity to write an article and publish them. Also I like to thanks Geo club of students for creating environment to write the articles and present the things that are remained closed in the heart of students. Since not being a fully research article I have tried to collect as much as correct data from many books and electronic media and I have tried to present them in very simple language. I hope the reader won't face difficulty reading this article. Many people have involved while preparing this article without them this would never be completed. I would like to thanks Mr. Roshan Ghimire Librarian of Fluorescent Higher Secondary School, Mahendra Maharjan, Sasmit Adhikari, Surenrdra Subba, Suman Maharjan for their help for preparing this article.

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Groundwater Use and Overuse

Maria Maharjan
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: mariya.maharjan@gmail.com

Background

Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

Groundwater is the largest source of useable fresh water in the world. It makes up about 20% of the world's fresh water supply, which is about 0.61% of the entire world's water, including oceans and permanent ice. In many parts of the world, especially where surface water supplies are not available, domestic, agricultural and industrial water needs can only be met by using the water beneath the ground.

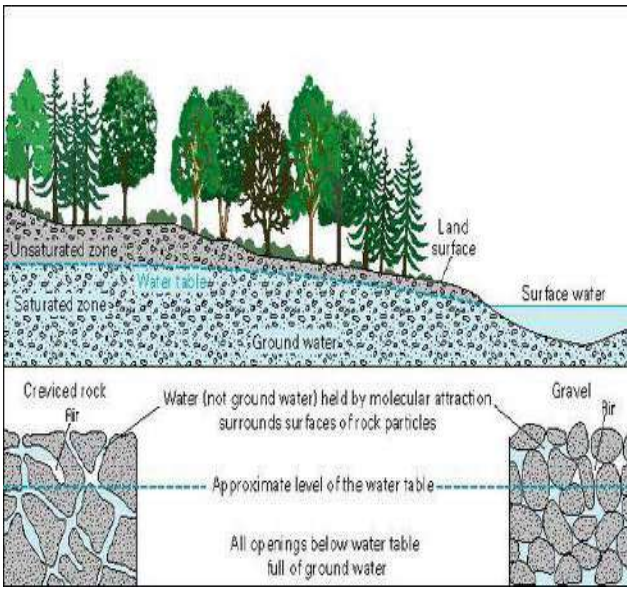

Figure showing the connection between groundwater and surface water

The U.S. Geological Survey compares the water stored in the ground to money kept in the bank account. If the money is withdrawn at the faster rate than new money is deposited, there will eventually be account supply problems. Pumping water out of the ground at a faster rate than it is replenished over the long-term, causes similar problems.

Groundwater in Nepal:

Groundwater is the important source of domestic, industrial and agricultural use in Nepal. Groundwater is abundant in the aquifers of Terai and the Kathmandu Valley. About 50% of the water used in the city of Kathmandu is derived from groundwater. The availability of groundwater is more limited in the populated hill regions because of the lower permeability of the indurate and crystalline rock types.

In the Kathmandu Valley (area around 500 square kilometers), groundwater is abstracted from two main aquifers within the thick alluvial sediment sequence. A shallow unconfined aquifer occurs at around 0-10m depth and a deep confined aquifer occurs at around 310-370m (Khadka, 1993). Exploitation of these aquifers, especially the shallow aquifer, has increased rapidly in recent years as a result of the increasing urbanization of the region.

Overuse of Groundwater and its effects:

Groundwater is highly useful and often abundant resource. However, overuse or overdraft can cause major problems to human users and to the environment, as it is an important element in maintaining the

ecosystem. Some of the effects of groundwater overuse are:

- **Lowering of the water table:**

Excessive pumping can lower the groundwater table and cause wells to dry up.

- **Increased costs:**

As the water table lowers, the water must be pumped farther to reach the surface, using more energy. This may be too expensive.

- **Reduced surface water supplies:**

Groundwater and surface water are connected. When groundwater is overused, the lakes, streams and rivers connected to groundwater can also have their supply diminished.

- **Land subsidence:**

When too much water is withdrawn from the ground, the land can collapse, a process called subsidence. When groundwater fills spaces in the soil, it supplies part of the internal strength of the ground. When the water is removed, leaving openings filled only with air, the weight of the overlying earth compacts and crushes the spaces.

- **Water quality concerns:**

Excessive pumping in coastal areas can cause saltwater to move inland and upward, resulting in saltwater contamination of water supply.

- **Rise of sea level:**

As people pump groundwater for irrigation, drinking water and industrial uses, the water doesn't just seep back into the ground, it also evaporates into the atmosphere, or runs off into rivers and canals, eventually emptying into the world's oceans. This water adds up, and a new study calculates that by 2050, groundwater pumping will cause a global sea level rise of about 0.8mm per year.

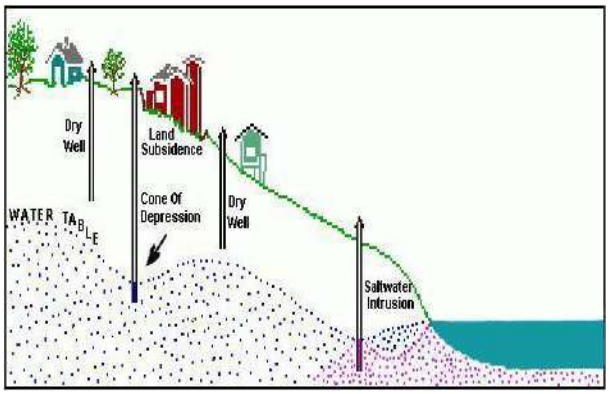

Fig. Impacts of overuse of groundwater

Objectives:

The main objective of this article is to know the importance of groundwater and the effects of groundwater overuse which is the rising problem waiting for the solution in the present condition.

Methodology:

The study is totally based on the secondary data like articles and journals on internet.

Field investigation and data collection:

Since the study is based on the secondary data, not any direct field investigation was carried out for the purpose of article. All the information is collected from different sites through internet.

Results and discussion:

Groundwater is the important source of water for agriculture, municipal and industrial use but these days due to human activities like excessive pumping groundwater is being depleted day by day. The impacts of its depletion are many and varied but the first and most direct one is the loss of base flow.

Conclusion:

Groundwater extraction indeed is important to support for daily water supply but

excessive use cause vital effect in the future. Therefore, other alternative water supply should be organized to overcome the groundwater problem.

Acknowledgement:

I would like to express my gratitude towards the Head of Department, Dr. Tara Nidhi Bhattarai, for inspiring us to write an article for the Bulletin "Geo-World". Similarly, I'm very thankful to my friends for their precious suggestions. I would not have been able to complete this article without their help and encouragement.

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Geothermal Energy and its status in Nepal

Navin Thapa
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: ecall2nbn@gmail.com

Introduction

Geothermal word is the union of words 'geo' means Earth and 'Thermal' means Heat indicate the heart energy generated and stored within the earth. The geothermal energy f the earth's crust originates from the original formation of planet (20%) and from radioactive decay of minerals (80%). As we know earth was molten mass of various minerals, rocks in its primitive and also still in molten form in its inner parts. The temperature is directly proportional to the increase in depth from the earth surface and it is termed as geothermal gradient.

Nepal is one of the five least energy-consuming countries in the world. Two types of energy resources are available with us- traditional resources like fuel wood, agricultural residues and cattle waste, and commercial resources such as petroleum products, coal, hydropower, solar, thermal, biogas, liquid biofuel, wind energy and geothermal energy. Geothermal energy is one of the renewable energy, is virtually uninterruptible and infinitely available because of its widespread complimentary technologies which accommodate Nepal's need to diversify supply.

Objective

1. To enhance information about the geothermal energy and its advantages and disadvantages.
2. To give information about the status of geothermal energy in Nepal.

Methodology

Different journals and articles were analyzed and the following comments were made.

Main Body

At the core of the earth, thermal energy is created by radioactive decay and temperatures may reach over 5000^0C. Heat spread out from the core to surrounding cooler rock. The higher temperature and pressure affect some rock to melt, producing magma convection upward since it is lighter than the solid rock. The magma heat rock and water in the crust, sometimes reaches up to 370^0C.

From hot springs, geothermal energy has been used for bathing since Paleolithic times and for space heating since ancient Roman times, but it is now better known for electricity generation. Worldwide 11,400 megawatts (MW) of generation power is online in 24 countries in 2011. An additional 28 Giga watts of direct geothermal heating capacity is installed for district heating, space heating, spas, industrial processes, desalination and agricultural application in 2010. Geothermal power is cost effective, reliable, sustainable, and environmentally friendly but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have drastically expanded the range and size of viable resources, especially for application such as home heating, opening a potential for widespread exploitation.

Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of fossil fuels. As a result,

geothermal power has the potential to help mitigate global warming of widely deployed in place of fossils fuels. Large quantities of heat that are economically extractable tends to be concentrated in places where hot or even molten rock (magma) exists at relatively shallow depths in the earth's outermost layer (the crust). Such hot zones generally are near the boundaries of slabs of rigid rock (called plates) that form the earth's lithosphere, which is composed of the earth's crust and the uppermost , solid part of the underlying denser, hotter layer(the mental). According to the now widely accepted theory of plate tectonics, these large, rigid lithospheric plates move relative to one another, at average rates of several centimeters per year, above hotter, mobile mantle material. These regions are also seismically active.

Advantages of Geothermal Energy:

As our reliance on fossil fuels have started to increase, geothermal energy is seen as the new source of power generation by digging out the heat stored inside the earth. It is not used fully due t factors such as location and high costs but in the years to come when fossils fuels would stars to diminish, it will turn out to be the cheapest source of power generation. Geothermal energy suffers from its own advantages and disadvantages as described below.

1. **Significant cost saving:**

Geothermal energy generally involves low running costs since it saves 80% costs over fossil fuels and no fuel is used to generate the power. Since, no fuel is require s csts for purchasing, transporting and cleaning up plants is quite low.

2. **Reduce reliance n fossil fuels:**

Dependence on fossil fuels decreases with the increase in the use of geothermal energy. Many countries are pushing companies t adopt these clean sources of energy. Burning of fossil fuels releases greenhouse gases which are responsible for global warming.

3. **No pollution:**

This is one of the main advantages of using geothermal energy since it does not create any pollution and help in creating clean environment. Being renewable source of energy, geothermal energy has helped in reducing global warming and pollution.

4. **Direct use:**

Since ancient times, people having been using this source of energy for taking bath, heating homes, preparing food and today this also used for direct heating of homes and offices.

5. **Job creation and Economic benefits:**

Governments of various countries are investing hugely in creation of geothermal energy which on other hand has created more jobs for the local people.

Disadvantages of Geothermal Energy:

Energy created form geothermal power is safe, clean, simple, and reliable and environment friendly as it is extracted from deep within the earth's surface. But despite these disadvantages, geothermal energy is not being widely. Geothermal energy suffers from its disadvantages as described below.

1. **Not widespread source of energy:**

Unavailability of equipment, staff, infrastructure, and training pose hindrance to the installation of geothermal plants across the globe due to which this type of energy is not widely used.

2. **High installation costs:**

To get geothermal energy, it requires installation of power plants to get steam from deep within the earth and this requires huge one time investment and requires hiring a certified installer and skilled staff needs t be recruited and relocated to plant location. Moreover, electricity towers, station need to set up to move the power from geothermal plant to consumer.

3. Suited to particular region:

It is suitable for region which has hot rocks below the earth and can produce steam over a long period of time. For this research is required which is done by the companies before setting up the plant and this initial cost runs up the bill in setting up the geothermal power plant. Some of these regions are near hilly areas or high up in mountains.

4. May release harmful gases:

Geothermal sites may contain some poisonous gases and they can escape deep within the earth, through the holes drilled by the constructors. The geothermal plant must therefore be capable enough to contain these harmful and toxic gases.

5. Transportation:

Geothermal energy cannot be easily transported. Once the tapped energy is extracted, it can be only used in the surrounding areas. Other sources of energy like wood, coal or oil can be transported.

Status of Geothermal energy in Nepal:

Most of the major geothermal springs of Nepal arc localized close and north of the Main Central thrust and south of the Main Boundary Fault. Three springs have a surface temperature above 69^0C. The temperatures of eight springs are in the range of 80 to 115^0C. At present the use of these thermal springs is largely confined to bathing and laundering purposes. The location of these springs in sparsely populated areas, mostly in the remote, steep Himalayan terrain, and the absence of adequate knowledge of the utilization of low temperature thermal waters have been the major impediments to the promotion of this resource. Heavy dependence on biomass, mainly wood, as the major fuel has given rise to serious environmental problems in the mountainous parts of Nepal. There is a good potential for the use of some the accessible thermal waters for a wide range of economically productive purposes and for combating environmental pollution. Detailed scientific studies should be conducted to gain more information about the reservoirs.

Twenty three major geothermal springs have been identified in different parts of Nepal (as shown in fig1) and some geothermal localities and their brief information is as shown in figure2.

Conclusion:

Nepal is still in the infancy stage in the field of geothermal energy exploration. So far, surface temperature measurements and chemical analysis have been made of 14 thermal springs. In view of the above situation, the utilization of geothermal resources can be a very good option for many purposes. The available low temperature geothermal fields in Nepal can be extensively used for a wide range of economically productive purposes, for example, hatching of fish and fish farming in most of the colder areas in the north where fish is scarce and available only at a very high cost because of the need to import from distant sources. Sail heating in such areas would also allow double cropping rather than the present single cropping. Space heating would not only provide clean environment but also reduce the dependence

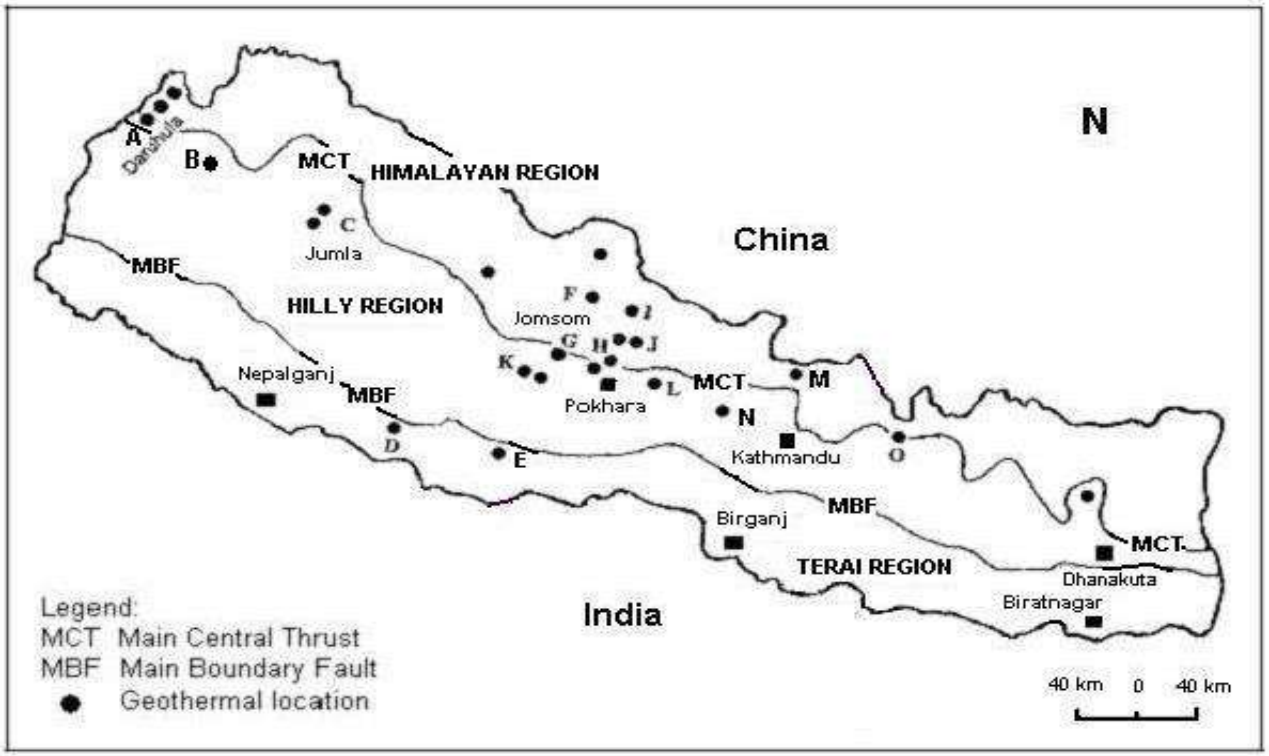

Fig1: Location of Geothermal Springs

Locality	Symbol	Location		Flow rate	Surface Temp.	Geothermometer temp. (°C)			Ionic balance diff. (%)	Discharge enthalpy (kJ/kg)
		Lati. (E)	Long. (N)	(l/s)	(°C)	SiO_2	Chalcedony	Na/K ratio		
Darchula	A									
Sribagar		80.6°	29.9°	0.9	73	85.1				380
Sina Tatopani		80.7°	29.9°	0.8	30					255
Chamaliya		80.6°	29.7°	0.3	30	37.6				158
Tapoban	B	81.2°	29.6°	0.3	31	55.1				126
Jumla	C									
Dhanchauri-Luma		82.3°	29.3°	0.8	24	106.9		88.2		448
Tilanadi		82.1°	29.2°	1.3	42	110.6			-34.3	464
Riar	D	82.7°	27.9°	1.5	33		54.2	52.3		227
Surai Khola	E	83.3°	27.8°	1.7	36		50.1	100.4	4.8	210
Jomsom	F	83.7°	29.8°	3	22	50.3			1.61	211
Bhurung Tatopani	G	83.7°	28.5°	1.8	72	115.4			-0.19	484
Sadhu Khola	H	84.2°	28.4°	1.5	68	109.8		115.3	4.52	460
Kharpani	I	84.1°	28.4°	0.4	49					
Mayangdi	J	83.5°	28.4°	2	40	89.8			-21.03	376
Singha Tatopani	K	83.3°	28.2°	6	54	91				452
Bhulbhule Khar	L	84.2°	28.2°	1.2	34					
Chilime	M	85.3°	28.3°	0.9	48	98.8				386
Syabru Besi	N	85.2°	28.1°	0.4	34	86.5	55			365
Kodari	O	83.9°	27.9°	5.5	42	96.5				17

Fig2: Geothermal Localities and general information

on the scarce domestic energy resources of the present. Likewise, mushroom growing and greenhouse production employing this resource can increase food production. Electricity will. However, mostly be produced by hydropower, as the geothermal springs are of relatively low temperature.Extremely cold climatic conditions in the northern hilly regions have made it very difficult for people of the population centers seeking to have regular baths. Swimming pools built in such areas could indeed be important from the hygienic viewpoint and the general wellbeing of the people.

Absence of adequate knowledge of the utilization of low temperature springs has remained the major mpediment to the promotion of geothermal energy in Nepal. This energy sub-sector is treated only with a view to electricity generation which evidently precludes its viability as an alternative source. It is further overshadowed by the availability of abundant hydroelectric potential. Optimally estimated at 83 thousand MW. The location of the geothermal springs in sparsely populated areas, mostly the remote and steep Himalayan terrain is the natural constraint inhibiting their development. Lack road networks preclude the possibility of detailed reservoir estimates. However, where such an infrastructure exists, scientific studies should be made to gain more information on the reservoirs.

Acknowledgement

I would like to express my gratitude to our sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. I would like to thank my friends as well as my editorial team friends for their immense support and hard work throughout the journey. Also I would like to thank Madhavi Regmi, Govind Joshi, Jay Raj Bindai for their support in completion of my articles and various published literature as well as my all other teachers and my colleagues for the support and hope to get it again and again.

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How to Control pollution in rivers

Nawraj Sapkota
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: sapkotanawraj8@gmail.com

Introduction

Occurrence of foreign particles or unwanted particles in rivers is refered to as river pollution. The pressure of increasing population, growth of industries, urbanization, energy intensive life style, loss of forest cover, lack of environmental awareness, lack of implementation of environmental rules and regulations and

Photo: Boy collecting useful material from waste in river
Photo by: Google.com

environment improvement plans, untreated effluent discharge from industries and municipalities, use of non-biodegradable pesticides/fungicides/herbicides/insecticides, use of chemical fertilizers instead of organic manures, etc are causing river pollution. Water pollution is the major global warming problem. It is the leading worldwide cause of death and diseases. Generally rivers, lakes and sea are the victim of pollution. River is the major victim of pollution because polluted river makes the lakes and seas polluted.

Objectives

-To know the effects of river pollution,
-To identify the various components of river pollution,
-To identify the control measures of river pollution.

Methodology

All the data are collected from various sources such as books, various websites, articles published in journals etc.

Causes of river pollution

Various components are responsible for river pollution. Solid and inorganic waste from industries, municipalits is the main cause of river pollution. Indiscriminate use of toxic chemicals, pesticides, insecticides and fungicides causes the leaching of soils and rocks. Oil and oily substances from the lubricating oils, greases and liquid fuels or refining industries makes the river.

Photo: use of pesticides on paddy field
Photo by: Google.com

Decomposed organic matter in stream depletes dissolve oxygen content of water which may stifle (suppress) the fish and aquatic life due to lack of oxygen. Untreated sewage is the biggest pollutant and causes pathogens in water. Also, inorganic dissolve salts, acids, alkali's, toxic chemicals and heavy metals, radioactive materials, foam and colour microorganisms and electrical waste causes the river pollution.

Effects of river pollution

There are several effects of river pollution, which are listed as:

- Adverse effect in flora and fauna,
- Lack of pure water,
- Adverse effect in human health,
- Unwanted odor and taste from polluted rivers causes the air pollution
- Polluted river destroy the environmental beauty of city,
- Polluted river also effects the national tourism industry.
- Polluted river water is a source for many water born diseases which are typhoid, cholera, paratyphoid, gastroenteritis, bacterial dysentery, poliomycetis, diarrhea, amoebic dysentery, schistosomiasis, sleeping sickness, malaria, hookworms etc.

Control measures of river pollution

Although there are many causes and effects of river pollutions. If they are left untreated they will cause very serious and lethal effect on human civilization and surrounding environments. So the pollution in river has to be controlled immediately. Pollution is the long term process, so it cannot be removed drastically with in short period of time, or by the effort of single person and organization. For the permanent solution of river pollution, government should have to make sophisticated laws and orders and mobilized them. The important and effective method of pollution control was public awareness. Until the public is not aware, any programme cannot give the positive results.

Photo: Fisherman collecting dead fish from polluted river (Photo by:Google.com)

Some methods of control of river pollution

- Analysis of the pollution is the first and most important step of pollution control because without analysis nothing can done. Analysis gives information about nature of polluted water, its toxicity, its response with various treatments etc.
- After analysis the actual water treatment starts as per the results & it is totally depended on analysis results. During water treatment there should be strict following of rules that pollution should not enter the river by any way otherwise the water pollution control is not effective. There should be total banded on

industries to allow wastewater or other products to enter river.

Conclusion

The population of the world is increasing day by day, with this, the rate of pollution in rivers is also increasing. Pollution and population are mutually related to each other, if solid method of control is not mobilized rapidly, it will lead the human civilization towards end. So sincere efforts are taken in a planned manner, then it is very easy for controlling river pollution.

For pollution control there is need of awaking people and educating them about how river pollution is caused, what are its effects, what can be done & also they should know that many people are daily losing their lives because of this pollution. In many Religions Rivers are treated as god, people are taking this in different way & perform many rituals and many things which pollute rivers. This should be managed first.

Acknowledgments

I am very thankful to Dr. T. N. Bhattarai; (Head of the Department of Geology, Tri Chandra multiple campus) for providing such a great opportunity to me. I am also thankful to all of my colleagues and to the editorial board for their tremendous support, valuable comments and suggestions.

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Water pollution management, control and treatments, Yamuna river, India

Geology of Kathmandu Valley

Prabin Pranod Khatiwada
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: prabinpkhatiwada@gmail.com

Introduction

The Kathmandu basin is an intermountain basin located in the Central Himalaya and surrounded by mountains of 2500 to 3000 m above the sea level. The basin is in the Midland of the Lesser Himalaya, and bounded by the Mahabharat Lekh to the south and Shivapuri Lekh to the north. Deep valleys of the Likhu Khola and Shindhu Khola (600 to 1300 m above sea level) separate the Shivapuri Lekh from the Great Himalaya. In the eastern and western ends, the hills are lower than the surrounding areas with an altitude of only about 1500 m. An average elevation of the valley floor is about 1340 m and the lowest elevation is 1220 m at the southern end of the valley.

The Kathmandu valley has a diameter of about 30 km in E-W and 25 km in N-S directions, and covers an area of about 650 km^2. Only one river, called the Bagmati Rivers, cuts the Mahabharat Lekh in the south and drains the rivers water to the Gangetic Plain. The catchment area of the river is limited to the inside slope of the Kathmandu Valley. It means that the basin-fill sediments are supplied only from the mountains surrounding the valley.

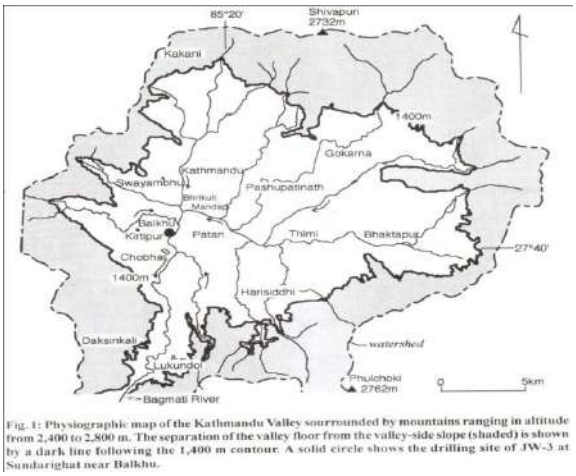

Fig. 1: Physiographic map of the Kathmandu Valley sourrounded by mountains ranging in altitude from 2,400 to 2,800 m. The separation of the valley floor from the valley-side slope (shaded) is shown by a dark line following the 1,400 m contour. A solid circle shows the drilling site of JW-3 at Sundarighat near Balkhu.

In the southern piedmont of the Shivapuri Lekh, remarkable alluvial fans are formed, several terraces of alluvial fan are distributed on the northern slope of the Mahabharat Lekh: the geomorphic surface of Pyangaon (1500~1450 m), Chapagaon (1450~1400), and Baregaon (1400~1370m), (Yoshida and Igarashi 1984). Two distinct lacustrine terraces are extensively distributed in the central part of the valley and its northern hill area: Gokerna surface (1386~1340m) and Thimi surface (1340~1320m). The Kathmandu and Patan cities essentially spread over the Patan geomorphic surface with an altitude around 1310m. The Patan geomorphic surface is considered to have been formed in the last glacial stage) (Yoshida and Igarashi 1984).

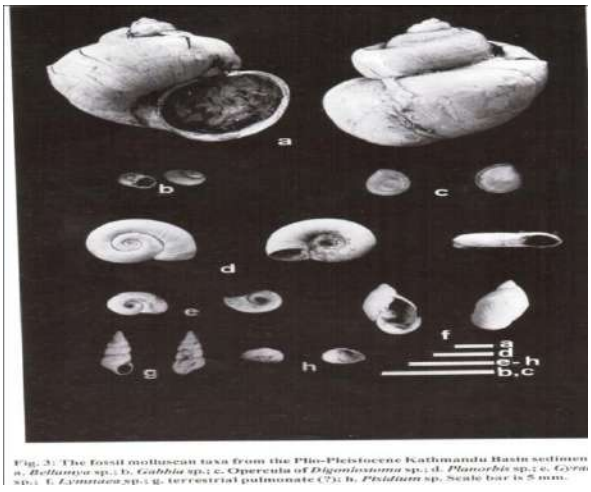

Fig. 3: The fossil molluscan taxa from the Plio-Pleistocene Kathmandu Basin sediments a. *Bellamya* sp.; b. *Gabbia* sp.; c. Operecula of *Digoniostoma* sp.; d. *Planorbis* sp.; e. *Gyraulus* sp.; f. *Lymnaea* sp.; g. terrestrial pulmonate (?); h. *Pisidium* sp. Scale bar is 5 mm.

Evolution of Paleo-Kathmandu Lake

It is well known that the Kathmandu Valley was once occupied by a lake around 11,000 year before, which was named the paleo-kathmandu Lake (Sakai et al. 2000, 2002).This basin is very thick (upto 550 m thick) sequence of lacusrtine (by lake) and fluvial (by river) deoisits of Plio-Pleistocene age, (Yoshida and Igarashi; 1984, Moribayashi and Mauro 1999). The lake was formed over one million years ago with the tectonic uplift of the southern edge of the Valley and the damming up of the proto-Bagmati River, probably where Katuwal Daha is today. As the southern rim of the Valley rose at a geologically rapid 3cm a year, the lake shifted northwards. The level of the lake ebbed and rose between 1,400-1,440m, depending on the prevailing climate, making it about 200m deep in places. Geologists have found the fossil remains of the extinct ancestors of mammoths, hippos and crocodiles in the Kathmandu Valley.

They have pollen-dated the sediment, indicating that the shoreline of the Kathmandu Lake was heavily forested with pine and hemlock and teeming with wildlife. The last Ice Age cooled and dried the Himalaya and the lake started to shrink starting 30,000 years ago. The main water body carved its way through the soft limestone at Chobhar, leaving behind a shrinking lake and three smaller ones at Gokarna, Pashupati and Kitni. These lakes later carved 'mini-Chobhars' and emptied into the main lake. As the lake receded, flats emerged above the water that was later separated by the tributaries of the Bagmati, which sliced channels through the soft clay. The airport is one such flat from the Gokarna Period 30,000 years ago, and geologists think Thimi and Patan surfaced 25,000 and 18,000 years ago respectively.

According to the legend in Nepal, the Bodhisattva Manjusri from Tibet cleft the mountains at chovar with one blow of his sword, and the lake-water was drained. In fact, there is an active fault at chovar (saijo et al. 1995), and the Chovar fault seems to have played an important role for the basin development of the Katmandu valley (Sakai 2001). However, it is difficult to consider that these faults were responsible for draining of the Palaeo-kathmandu Lake, because the final draining of the lake water must have been taken place at a site further to the south neat Danuwargaun. The continuation of the lake further towards south is evidenced by thick lacustrine sediments in the area between Chovar and Danuwargaun.

Though the exact time of the disappearance of the Kathmandu Lake will be known only from more research in future, however, on the available radiocarbon dating (Yoshida and Igarashi 1984) the lake may have disappeared at the end at the last Glacial Epoch (about 1100 B.C.). After the lake had disappeared, the sediments were subjected to sustained fluvial denudation which has given rise to the present morphology of the valley sediments and have produced carious levels of terraces in the valley.

Geology and Structure

Geologically, the Kathmandu Basin lies on the Kathmandu Nappe which consists of metamorphic nappe and the overlying fossiliferous Tethyan sediments; both belonging to the Kathmandu Complex (Stocklin 1980; Stocklin and Bhattarai 1981). The Kathmandu nappe is composed of the Shivapuri gneiss and granite injection complex and schistose rocks and marbles of the Bhimphedi Group. The early Paleozoic

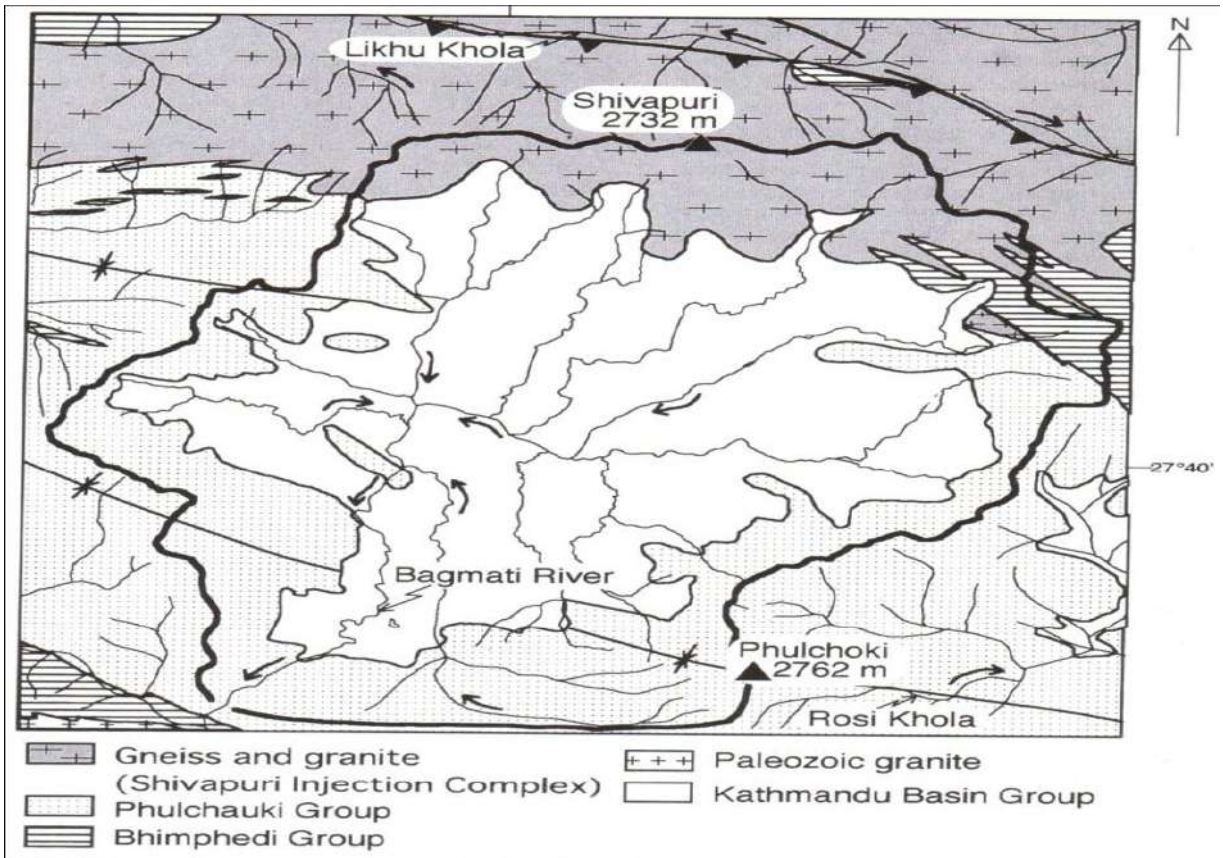

Fig. 5: Simplified geological map showing limited provenance of the Kathmandu Basin Group from the Shivapuri Injection Complex and the Kathmandu Complex (modified from Stöcklin and Bhattarai 1981).

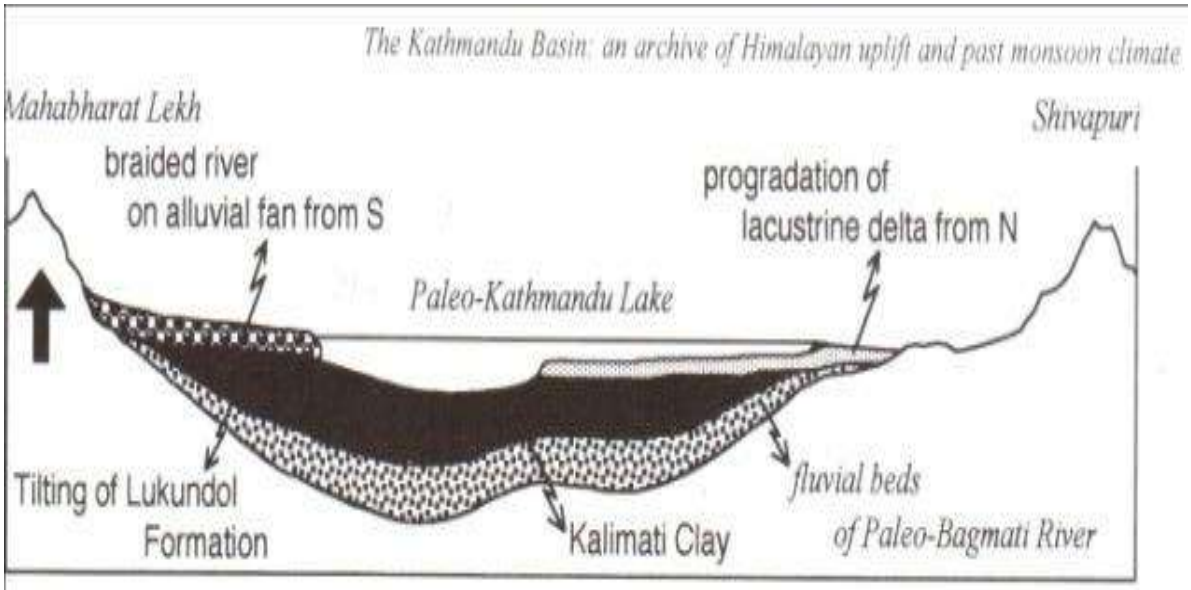

Fig. 7: Schematic geological cross-section showing the stratigraphic framework and depositional environments of the Kathmandu Basin sediments during the late Pleistocene (modified from Sakai et al. 2002).

Tethyan rocks, named as the Phulchauki Group, overlie the Bhimphedi Group. Total thickness of both groups attains 13 km. The northern Slope of the Kathmandu valley is mainly composed of gneiss, schist and granite, but the other slopes and the central part of the valley consists of weakly metamorphosed Phulchauki Group. The Bhimphedi Group and Paleozoic granite bodies are exposed to the south, outside of the watershed of the Kathmandu Valley.

Therefore, the source rocks of the basin –fill sediments are limited to the Phulchauki Group and Shivapuri injection Complex.

The Kathmandu complex occupies the core of the synclinorium, the axes of which trends WNW-ESE directions. The main fold axis lies on a line connecting peaks of Phulchauki (1765m) and Chandragiri (2550m). Many longitudinal faults run parallel to the fold axes, and the northern margins of the basin area bounded by the Kalphu-Dhanr Khola Fault and Chandragiri Fault, respectively. Both are active faults cutting the late Pleistocene sediments of the Kathmandu Basin (Nakata 1984; Saijo et al.1995). The Shivapuri Lekh is on the ramp formed by fault-bend folding in the hanging wall of the out of sequence thrust (Arita and Ganzawa 1997; Pandey et al. 1999). Therefore, from the tectonic view point, the Kathmandu Basin is considered to be a piggy-back basin lying between the pop up mountains of the Mahavharat Lekh to the south and Shivapuri Lekh, situated on the ramp, to the north.

Kathmandu basin and Sediments

The Kathmandu valley is filled with the late Pliocene to Pleistocene thick basin-fill sediments (Yoshida and Igarashi 1984; Yoshida and Gautam 1988). Based on the gravity measurements in the Kathmandu valley, Moribayashi and Maruo (1980) estimated the maximum thickness of the basin fill sediments to be 650m. In fact, a number of drill-well data prove that more than 300m thick muddy and sandy sediments are extensively distributed under the Kathmandu Basin (Katel et al. 1996; Kharel et al. 1998). At Bhrikutimandap in the central part of Kathmandu city, a drill-well hit the basement rocks at a depth of about 550m. The drilling data at Harisiddhi, in the southern part of the valley, show that the sediments are more than 457 m thick (Katel etal. 1996). Fence diagrams of subsurface structure of Kathmandu basin compiled by Katel at al. (1996) Iindicate extensive distribution of black clayey sediments of lacustrine origin. The clay exposed on the present surface, locally called Kalimati Clay, is rich in organic matter. Occurrence of natural gas in the valley suggests that the clayey sediments beneath the surface also contain abundant organic matter (Natori et al. 1980 a,b). sedimentological and palynological studies of a series of similar taken from a drill-well of 284m at Sundarighat near Balkhu demonstrate that the organic clay has well preserved paleoclimatic and tectonic history of the Kathmandu valley during the last 2.5 million year (Fujii and sakai 2002; sakai et al. 2001).

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Study of Geology Subject in School Level

Pranav Raj Bakhrel
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Geology is the science that deals with the physical structure and substance of earth's history and the processes which act on them. An extra-ordinary revolution in our knowledge of planet earth during the latter half of the twentieth century has transformed earth science. We have viewed earth from space and landed on its moon, we have seen the ocean floor and mapped its shaped and structure and also we applied modern technologies to investigate earth's interior and we know volcanism, earthquakes, mountain building process, drifting and colliding process of continents. And knowledge of geology is useful in day to day life and we have to face the results of every action we act on earth which we live. So we should learn and make aware how to take care of earth.

But still Nepal's government's Curriculum Development Centre (CDC) lacks adequate balanced educational stuffs regarding earth science. Day by day earth is changing due to human action and we are getting different impacts. All the creatures of the earth must face all the bad impact as we all are living on same earth. As we know that school is the best medium to transfer knowledge to whole society and whole nation. So Curriculum Development centre should add and update more stuff on earth science not only to save earth but also to compete in the modern civilization.

Merits of studying geology in school level

The scope of geology is very vast and vital to the human lives and is difficult to imagine the modern civilization without the resource geological inputs of coal, oil gas metals and minerals. Besides, the internal and external geological processes of the earth have been responsible for the present landforms including soil for agriculture and surface of subsurface water bodies, so essential for lives.

Geology provides a systematic knowledge of construction materials, their structure and properties. Geology is significant in locating water supplies, building & highway placement and mineral resources such as gravel, stone, oil, coal, water, and mineral deposits. The knowledge of ground water Geology is necessary in connection with excavation works, water supply, irrigation and many other purposes. Knowledge about the nature of the rock and mineral properties is very necessary in tunneling, construction roads and in determining the stability of cuts and slopes. The foundation problems of dams, bridges and buildings are directly related with geology of the area where they are to be built. The knowledge of Erosion, landslide, Transportation and Deposition by surface water helps in soil conservation, river control, coastal and harbor works. It is developing predictive models for earthquake, volcano eruption, and tsunami activity. Understanding the development of life on Earth is done by Geology. Geology provides Fundamental knowledge to the field of Earth and planetary sciences, determining planetary histories. Pre-geological survey of the area concerned reduces the cost of engineering work. Geological maps and sections help considerably in planning many engineering projects. Geological features like faults, joints, beds, folds, solution channels are

suitably treated to increase stability of the structure.

- an understanding of planet Earth, its systems and their geological processes, and human interaction with these systems
- a knowledge and understanding of the dynamic nature and natural hazards of earth's systems
- an appreciation of the methods that have enabled earth scientists to interpret the past, understand the present, and predict the future of the earth and its space environment
- an awareness of how the impacts of natural hazards such as floods, cyclones, landslides, earthquakes, and beach erosion can be minimized
- an understanding of environmental problems such as global warming, ozone holes, resource depletion, and of the need for hazardous waste disposal in a geologically responsible manner
- a capacity to identify, gather and process information in the context of earth science investigations, including those that are based in the field or laboratory
- language skills specific to English language and earth science, through explicit teaching of, and immersion in, the language of earth science
- An ability to contribute to debates and decisions on ecologically sustainable development as informed and responsible citizens.

Scope of studying geology

In Civil Engineering: Information about the site of construction materials used in the construction of buildings, dams, tunnels, tanks, reservoirs, highways and bridges is provide by Geology. It is most important planning phase, design phase and construction phase of an engineering project.

In Mining Engineering: Geology is useful to know the method of mining of rock and mineral deposits on earth's surface and subsurface.

In Ground Water: Hydrogeology and Hydrology is applied in various aspects of resources and supply, storage, filling up of reservoirs, pollution disposal and contaminated water disposal.

In Sedimentology: petroleum oils, Coal and oil shale are found in sedimentary rocks.

Land pollution
Nuclear explosion
Exploration Geophysics
Oceanography
Paleontological exploration
Space exploration
Planetary exploration

C.D.Cs stuffs for Earth Science on School

Grade 9 Science

- Natural calamities (landslide, flood, earthquake, volcanoes) causes, effects and preventive measures
- Rotation and revolution of the Earth
- The Sun, the Moon and the Earth

Grade 10

- Study of history of earth through fossils and rocks
- Atmosphere
- Ozone layer depletion and effects of C.F.C
- Green house effects
- Fossil fuels
- Pollution

Necessary stuffs to be included in C.D.Cs Curriculum

Earths internal structure, atmosphere, definition of different types of rocks and short description on natural calamities are included on school level syllabus of science and some points on environment science are included which is not adequate.

The necessary points to be included are rock cycle branches of geology are to be introduced. And the topics which have vital importance are included but aren't explained in terms of geology.

Earthquake: - In syllabus the topics on earthquakes are included as natural calamity and have no explanation on seismic waves that causes earth quake. There is importance of geology and geologist on building infrastructures, houses to protect ourselves from destruction brought by earth quake.

Flood: - Lots of lives are lost in flood because of negligence and ignorance about flood. Construction over river side and changing the active channel causes heavy loss. Thus syllabus has failed to describe flood in geological view and also has failed to make people aware to conduct geological survey before constructing houses and infrastructures.

Landslide: - Landslide is another major factor to be included on syllabus. Landslide and its causes, triggering agents and preventive measures should be included. Land slide is described as result of deforestation only but other triggering agents and controlling methods aren't described in school level syllabus.

Land use: - Land use is the human use of land which involves the management and modification of natural environment into built environment such as fields pasture and settlements. We should make aware what type of land is for settlements and what type of land for agriculture. Proper land use and impact of improper land use should be explained the proper way of land use should be added on syllabus.

Ground Water: - It is the most important topic to be included in syllabus. Improper boring ground water causes depletion of water level can .Ground water level depletion can create voids and results sinking of earth surface. The inclusion of such stuffs can create awareness in people about improper boring of water and depletion of ground water. Also chemical pollution of ground water is to be included in syllabus.

Practical: - It is very difficult to learn geology with practical knowledge. Students should learn to use topographic maps on sites and legends of maps .They also should learn different types of rocks with visits on sites.

Necessity of Geology in HSEB Curriculum

Higher secondary education board's curriculum doesn't have any subjects on earth science. It has physics, chemistry, biology, computer science and mathematics but have there is no subject of earth science which is equally important in modern civilization. Earth Science and its branches are important to other subjects like paleobiology which is important to biology. It's equally important on Physics and chemistry, but HSEB"s Curriculum have failed to introduce the importance of earth science on the respective subjects. So earth science is another subject to be added on Science stream of Higher secondary Education Board's Curriculum.

Conclusion

Therefore it is very necessary CDC has to update its syllabus and add more stuffs on earth science. The negligence on this subject at junior level is a major cause of the lack of awareness about environment protection, energy and other geological raw materials conservation related issues among future citizens and policy makers of the developing countries like Nepal. Education in schools will help making youths more careful about their health and hygiene,

physical environment, geohazards and quality water use as well as energy conservation. This will also help in making the geologists as better professionals and others, more aware and concerned inhabitants of this planet.

Acknowledgement

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Geological Evidences in Support of Vedas and Ancient Aryan Texts

Rahul Poudel
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: rahulpoudel5972@gmail.com

Introduction

Before I start entering on my article let me remind about that religion and science are closely associated with each other. The theory of relativity and derivation of famous equation "$E=mc^2$" by Alert Einstein has changed a lot of prospective on modern physics. Geological evidences from the fort of 'Mahabharata' proves that some atomic weapons had been used at that time which was described as 'Brahma Astra' in Aryan texts. One of the famous astrologers Bhrigu discovered the way of predicting future by analyzing the position of planets and stars thousands of year ago. So it is clear that the modern science is closely related with ancient civilization.

Objective

To relate present geological evidences with Vedas and ancient Aryan texts.

Main Body

It is known as 'Vedanga Jyotisa' or the 'Astroscience' of Vedas propounded the Yuga theory of measuring time in millions of years and Vedic calendar has 4320 million solar years as a day of Brahma. A cycle of 308 million years is called 'Mahavantara' and according to the Vedic calendar the present years is the 5077th year of Kali Yuga in the 28th Mahayuga of the 7th Mahavantara called Vaiwaswat equitable to a total solar composition of 1,955,885,077 years from the beginning of the universe.

It is known that 'Ramayana' occurred some 15,135,079 years back, further the 'Mahabharata' occurred in 'Dwapara Yuga' well known to be 3102 B.C. These statements are simply difficult to be believed in the context of modern scientific evidences of human evolution, which proclaims that man was evolved only during last couple of million years. It is hard to discard some of the more important and well known geographic locations like Ujjain, Lanka, Ayodhya etc. From astrological data mentioned in those texts, a correlation may be effected to find out wheather the antiquity known to these cases are really agreeable or not from modern concepts of the Earth science desciplines.

In the 'Bhugoladhyaya' of the 'Suryasiddhanta' the following verses are important

"Bhuvrttapade purvasyam yama
Kotiti visruta-Bhadraswavarsanagari
Swarnaprakara torana, M-38
Ya mayayam Bharate verse Lanka
Tadwanmahapuri
Pascime Ketumalakhye Romakkhya prakirta -39
Udaksiddhapuri Nama kuruarse prakirtitia
Tasyam siddha mahatmano Nivaasnti
Gatavy athaha" -40

Meaning that the equator Yavakoti (Java isle) in the east is located in Bhadraswavarsa; to the south of this Lanka is located; to the west is Ramkadesa in Ketumala Varsa; and in north is Siddhapuri.

The other verse from Vedas says, when there is sunrise in India, it is midnight in Ketumalaversa. Similarly sun's apparent

movement will cause midnight and sunset moving over in clockwise direction. These observations make it clear that the author had the geographical knowledge of the distribution of Java, Ceylon, Rome and Siddhapuri (equated perhaps to the Maya and Inca areas of the Americas), specially located at equidistance on the equator.

According to Aryabhata:

" Sthala Jala Madhyalanka Bhukaksyayam bhavet
Caturbhage Ujjayini Lankayas taccaturthamse samottarataha"

Meaning that Ujjain is located to the north of Lanka at a distance a fourth of the equator of equatorial distance. A forth of the equatorial distance is 90˚ and quarter of that distance is 22˚30'. Hence it is clear that Ujjain is 22˚30' north of Lanka which is situated on the equator for , he states in another verse supporting the earlier 'Suryasiddhanta' statement of distribution of four well known cities of that time at equidistance on the equator.

Presently Ujjain is just near Tropic of Cancer i.e. 23˚30' a difference of 1˚ amounting to nearly 90 km. since Aryabhata mentions this supporting the geographic distribution of the 'Suryasiddhanta', it is to be consider that the distance was maintained at the time of the composition or discussion of 'Suryasiddhanta' but not at the time of Aryabhata for, at the time of Aryabhata the situation of Lanka was not on the equator. Should this be the consideration as it is now understood, then we have to account for the change in the distance of 90 km from the position of Ujjain at the time of 'Suryasiddhanta' to the present. This will be made clear by considering the modern geological concepts.

Similarly the situation of Lanka on the equator as mentioned by the 'Suryasiddhanta' needs a little elaboration. Now the northern tip of Ceylon is close to 10˚N latitude. The island is about 4˚ in length in N-S direction. Hence it is at a distance of about 6˚ from the equator. In the essence of Siddhantas earlier to the 'Suryasiddhanta', which most likely incorporates theearlier ideas as in other texts of Sanskrit, the position of Lanka during the time of the text although might have been different from the present disposition, perhaps was not on the equator, but incorporated from the earlier texts. The earlier texts ar composition like Ramayana should be considered for the disposition of the island Lanka and it stands to reason that in the 'Sundarakanda' of Valmiki Ramayana, it is stated that "Yojananam satasyante vanarajim Dadarsasaha". Meaning that Hanuman saw the land with forest after his fight of 100 Yojanas. One yojana is considered to be about 4.9 or m miles and it would be amounting to same 500 miles(or about 800 km.) from the southern tip of Mahendragiri from where Hanuman flew for Lanka. From this it is clear that island of Lanka has been closer to main land of India from the time of Ramayana by a distance as much as 800 km or less.

The above narrations suggest that the main land of India with Ujjain has moved about 90 km, during the last 2 million years or so (the time of Suryasiddhanta) and the island of Lanka has moved some 100 km, or less or so during the last 15 million years (from the time of Ramayana). Could there be movement of landmass? This is an astounding as the antiquity of the text themselves. But the modern Earth's scientist believe that continents and land masses are moving continuously and paleomagnetic evidents shows that the sea floor is spreading at varying rates from about 2 toseveral cms per year. Geologist,

the world over now believe in the movement of land masses which were once together, based on various geological evident. The continents of the southern hemisphere were together before 200 million years ago with the South Pole somewhere about the present day. Natal in Africa and that single large continent is called 'Gondwana'. Similarly the continents of the northern hemisphere were together and called 'Laurasia". These two large landmasses were separated by 'Tethys', which contains the sediments which have been responsible for the formation of the present days Alpine-Himalayan mountains, being uplifted by the equator ward moving landmass of the Gondwana land, being rifted up. With the Indian peninsula moving northeastward, it is estimated that it has moved some 9000 km. during the last 200 million years (Dietz and Holden).

This may look fantastic but the theory which originally proposed by Wegener, 1924 as the origin of continents and oceans, has now became the major concern of the student of the Earths science, especially under the modern title 'The theory of plate tectonics'. Each land mass is supported on a plate and some 6 major plates and over 15 minor plates have been recognized to constitute the crust of the earth. Extensive researches are being carried out to ascertain the rates of spreading ocean floor and the migration of land masses. Hence it can safely be assumed that the Indian texts which have fantastic observations are no more fantastic but hard truth.

In the contest of the above observation the problem can be examined. The Indian peninsula has moved nearly 9000 km, during the last 200 million years. If it be so, the time that is necessary to move a distance of about 90 km (of Ujjain from 22˚30' to 23˚30' northwards) at the average rate would be about 2 million years. The 'Suryasiddhanta' text records that the discussion took place about 2 million years ago. (Alpavasiste tu krite etc. etc.).

One the some line the movement of Ceylon can be accounted. On an average rate the island could move some 675 km, during the past 15 million years. Nut the rates of migration vary and the distance of 800 km, between Mahendragiri in the south end of the Indian peninsula and Ceylon may be nearer to the truth. If it is only 6˚ then a distance of 540 km, can be accounted easily by the moving island. This would support the antiquity of Ramayana and somehow increase the possibility of Vedas to be explore in the modern science.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friend as well as the editor Basant Bhandari for his valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Sinkhole: A Hazard

Rasila Koirala
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: black1slirva@gmail.com

Introduction

A sinkhole is a natural depression or hole in the ground caused by some form of collapse of the surface layer. It is a hole in the ground that forms when water dissolves surface rock. Often, this surface rock is limestone, which is easily eroded, or worn away, by the movement of water. Sinkholes may vary in size from 1 to 600 m (3.3 to 1970 ft) both in diameter and depth, and vary in form from soil- lined bowls to bedrock-edged chasms. Sinkholes are often funnel-shaped, with the wide end open at the surface and the narrow end at the bottom of the pool.

These sinkholes can be very dangerous to our lives and properties. If these sinkholes are under or near a structure, the structure's integrity can be destroyed. Formation of the sinkhole can also result in the plugging of underground drainage patterns and a lake can form in the newly formed depression area. One hazard associated with sinkholes is the possibility of health problems caused by chemicals and other materials contaminating the drinking water supply. Sinkholes may be formed gradually or suddenly, and are found worldwide.

Objective

The main objectives of this article are:

- To give general idea about sinkholes.
- To provide knowledge about its hazardous impact in the environment.
- To provide general safety measures about sinkholes.

Methodology

The necessary information for this article were collected through the secondary sources such as books, articles website etc.

Sinkhole

A sinkhole is a natural depression or hole in the ground caused by some form of collapse of the surface layer. Some are caused by karst processes the chemical dissolution of carbonate rocks or suffosion processes in sandstone. Others formed as a result of the collapse of old mine workings close to the surface are not natural and therefore not sinkholes (crown holes). These are found worldwide which may be formed gradually or suddenly and may vary in size from 1 to 600 m (3.3 to 1970 ft) both in diameter and depth, and vary in form from soil- lined bowls to bedrock-edged chasms.In context of our country Nepal, recently a sinkhole is reported in Armala, pokhara.**Figure:**

Armala Sinkhole

Formation

Sinkholes can be formed naturally or by human activities:

- **Natural processes:** sinkholes may capture surface drainage from running or standing water, but may also form in high and dry places in certain locations. The formation of sinkholes involves the natural process of erosion or gradual removal of slightly soluble bedrock such as limestone by percolating water, the collapse of a cave roof, or a lowering of water table. Sinkholes often form through the process of suffusion. Thus for example, groundwater may dissolve the carbonate cement holding the sandstone particles together and then carry away the lax particles, gradually forming a void.

- **Artificial processes:** sinkholes also form from human activities too. These are rare but still occasional collapse of abandoned mines and salt carven storage in salt domes in places like Louisiana, Mississippi and Texas are common. They can also occur form the over pumping and extraction of groundwater and subsurface fluids. Sinkholes can also form when natural water-drainage patterns are changed and new water-diversion systems are developed. They can also be formed while constructing roads, tunnels, aquifers, or other types of construction.

Occurrence

Sinkholes are frequently linked with karst landscapes. In such regions, there may be hundreds or even thousands of sinkholes in a small area. Sinkholes are reported in many parts of world causing serve damage to human lives and property. Examples of karst landscapes dotted with numerous sinkholes are Khammouan Mountains (Laos) and Mamo plateau (Papua New Guinea). The state of Florida in the United States is known for having frequent sinkholes collapses. The land surrounding the Dead sea in the Middle East is porne to sinkholes because of the prevalence of rock salt which is easily dissolved by water. Recently a sinkhole is reported in Armala, Pokhara.

Can we predict sinkholes?

Strictly speaking, A Sinkhole formation or its presence cannot really be predicted. The moment a sinkhole collapses, anyone or anything that happens to be on the topsoil at that second is in danger. As sinkholes appear more and more often in crowded, urban areas, they represent more danger to people. In 2007, a monstrous sinkhole, which was over 330 feet (101 meters) deep, appeared almost instantly in Guatemala City, killing at least three people and swallowing the homes and buildings that had been on top of it.Even though the actual sinkhole usually reveals itself suddenly, the erosion occurring below it can go on for years. Despite the facts about its prediction, there are things that people can watch for and precautions that can be taken.

Signs of a sinkhole can vary depending on the type of sinkhole you may have. Some of the common signs are as follows:

- Damage to the foundation of houses.
- Many sinkholes are caused by increased water flow, so anything that indicates unusual water activity may be a clue. For example, dying of vegetation.
- Finding of cracks in interior as well as exterior wall of homes. Depressions in yard, street etc.

- Finding sediment in water and noticing small amounts of water collecting in pond like areas, which have never formed before.
- Observing an actual cavity beginning to open.

Problems & Some Preventive Measures

Sinkholes can be a challenging problem to we people. There are many hazards caused by sinkholes. A sinkhole under or near a structure can destroy the structure's integrity causing cost to life and property. Formation of the sinkhole can also result in the plugging of underground drainage patterns. One hazard associated with sinkhole is the possibilities of health problems caused by chemical and other material contaminating the drinking water supply. A sinkhole can be thought of as a hypodermic needle with a direct line into the water supply. Despite of the problems, there are things that people can watch for and precautions that can be taken.

- Construction of house, roads and any other properties should not be done.
- Sinkholes should not be used as discharge points for drainage lines or septic tanks. They should not be used as dump sites for trash dumping. Otherwise it may lead to contamination of water supplies.
- Soil tests can be taken before any construction process to ensure if a sinkhole cavern exists.
- Motorists or pedestrians should be made alert about sinkholes as they can form in the highways. Barricading of it should be done with ample room to spare so that motorist or pedestrians can be prevented getting close to it.
- Strips of land adjacent to sinkholes can be planted with grass rather than with a field crop. It is because the grass will serve as a buffer zone to prevent direct chemical run-off into sinkhole.
- Heavy machineries should be kept far enough away from the sinkhole, since the ground near the edge can easily give away.

Conclusion

A sinkhole is a natural depression or hole in the ground caused by some form of collapse of the surface layer. It is formed by natural and artificial process. We cannot predict them but there are things that people can watch for and precautions that can be taken. Many people are ignorant about this type of geological hazard. So, people should be made aware about them. Sinkholes can be filled. However, this does not guarantee that they won't redevelop.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friends and also all other friends of editorial board for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Dating Rocks and Fossils Using Geologic Methods

Rhythm Rai
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Introduction

Despite seeming like a relatively stable place, the Earth's surface has changed dramatically over the past 4.6 billion years. Mountains have been built and eroded, continents and oceans have moved great distances, and the Earth has fluctuated from being extremely cold and almost completely covered with ice to being very warm and ice-free. These changes typically occur so slowly that they are barely detectable over the span of a human life, yet even at this instant, the Earth's surface is moving and changing. As these changes have occurred, organisms have evolved, and remnants of some have been preserved as fossils.

A fossil can be studied to determine what kind of organism it represents, how the organism lived, and how it was preserved. However, by itself a fossil has little meaning unless it is placed within some context. The age of the fossil must be determined so it can be compared to other fossil species from the same time period. Understanding the ages of related fossil species helps scientists piece together the evolutionary history of a group of organisms**.**

For example, based on the primate fossil record, scientists know that living primates evolved from fossil primates and that this evolutionary history took tens of millions of years. By comparing fossils of different primate species, scientists can examine how features changed and how primates evolved through time. However, the age of each fossil primate needs to be determined so that fossils of the same age found in different parts of the world and fossils of different ages can be compared.

There are three general approaches that allow scientists to date geological materials and answer the question: "How old is this fossil?" First, the relative age of a fossil can be determined. Relative dating puts geologic events in chronological order without requiring that a specific numerical age be assigned to each event. Second, it is possible to determine the numerical age for fossils or earth materials. Numerical ages estimate the date of a geological event and can sometimes reveal quite precisely when a fossil species existed in time. Third, magnetism in rocks can be used to estimate the age of a fossil site. This method uses the orientation of the Earth's magnetic field,

which has changed through time, to determine ages for fossils and rocks.

Fig: Dating of fossils

Objective

To provide information of methods of rock dating by fossils use

Relative dating to determine the age of rocks and fossils

Geologists have established a set of principles that can be applied to sedimentary and volcanic rocks that are exposed at the Earth's surface to determine the relative ages of geological events preserved in the rock record. For example, in the rocks exposed in the walls of the Grand Canyon (Figure 1) there are many horizontal layers, which are called strata. The study of strata is called stratigraphy, and using a few basic principles, it is possible to work out the relative ages of rocks.

Figure 1: Individual rock layers, or strata, can be seen exposed in the wall of the Grand Canyon in Arizona, USA.

Just as when they were deposited, the strata are mostly horizontal (principle of original horizontality). The layers of rock at the base of the canyon were deposited first, and are thus older than the layers of rock exposed at the top (principle of superposition).

Layers of rock are deposited horizontally at the bottom of a lake (principle of original horizontality). Younger layers are deposited on top of older layers (principle of superposition). Layers that cut across other layers are younger than the layers they cut through (principle of cross-cutting relationships).

The principle of superposition builds on the principle of original horizontality. The principle of superposition states that in an undeformed sequence of sedimentary rocks, each layer of rock is older than the one above it and younger than the one below it (Figures 1 and 2). Accordingly, the oldest rocks in a sequence are at the bottom and the youngest rocks are at the top.

Sometimes sedimentary rocks are disturbed by events, such as fault movements, that cut across layers after the rocks were deposited. This is the principle of cross-cutting relationships. The principle states that any geologic features that cut across strata must have formed after the rocks they cut through

According to the principle of original horizontality, these strata must have been deposited horizontally and then titled vertically after they were deposited. In addition to being tilted horizontally, the layers have been faulted (dashed lines on figure). Applying the principle of cross-cutting relationships, this fault that offsets the layers of rock must have occurred after the strata were deposited.

According to the principle of original horizontality, these strata must have been deposited horizontally and then titled vertically after they were deposited. In addition to being tilted horizontally, the layers have been faulted (dashed lines on figure). Applying the principle of cross-cutting relationships, this fault that offsets the layers of rock must have occurred after the strata were deposited.

The principles of original horizontality, superposition, and cross-cutting relationships allow events to be ordered at a single location. However, they do not reveal the relative ages of rocks preserved in two different areas. In this case, fossils can be useful tools for understanding the relative ages of rocks. Each fossil species reflects a unique period of time in Earth's history. The principle of faunal succession states that different fossil species always appear and disappear in the same order, and that once a fossil species goes extinct, it disappears and cannot reappear in younger rocks.

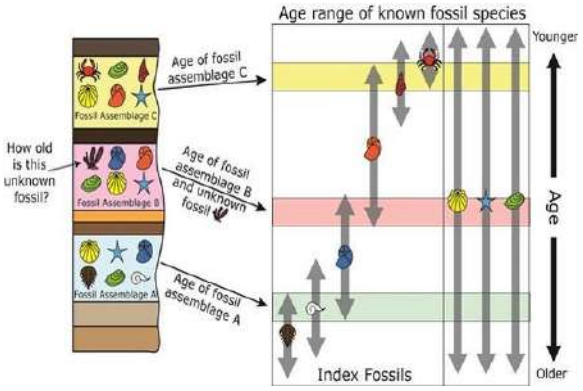


Figure 2: The principle of faunal succession allows scientists to use the fossils to understand the relative age of rocks and fossils.

Fossils occur for a distinct, limited interval of time. In the figure, that distinct age range for each fossil species is indicated by the grey arrows underlying the picture of each fossil. The position of the lower arrowhead indicates the first occurrence of the fossil and the upper arrowhead indicates its last occurrence – when it went extinct. Using the overlapping age ranges of multiple fossils, it is possible to determine the relative age of the fossil species (i.e., the relative interval of time during which that fossil species occurred). For example, there is a specific interval of time, indicated by the red box, during which both the blue ammonite and orange ammonite co-existed. If both the blue and orange ammonites are found together, the rock must have been deposited during the time interval indicated by the red box, which represents the time during which both fossil species co-existed. In this figure, the unknown fossil, a red sponge, occurs with five other fossils in fossil assemblage B. Fossil assemblage B includes the index fossils the orange ammonite and the blue ammonite, meaning that assemblage B must have been deposited during the interval of time indicated by the red box. Because, the unknown fossil, the red sponge, was found with the fossils in fossil assemblage B it also must have existed during the interval of time indicated by the red box.

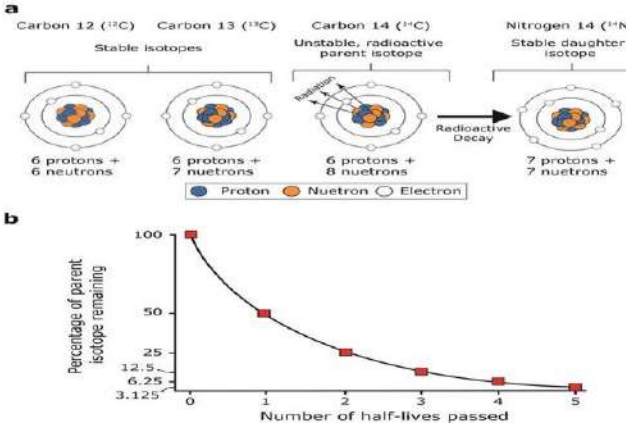
Fossil species that are used to distinguish one layer from another are called index fossils. Index fossils occur for a limited interval of time. Usually index fossils are fossil organisms that are common, easily identified, and found across a large area. Because they are often rare, primate fossils are not usually good index fossils. Organisms like pigs and rodents are more typically used because they are more common, widely distributed, and evolve relatively rapidly.

Using the principle of faunal succession, if an unidentified fossil is found in the same rock layer as an index fossil, the two species must have existed during the same period of time (Figure 4). If the same index fossil is found in different areas, the strata in each area were likely deposited at the same time. Thus, the principle of faunal succession makes it possible to determine the relative age of unknown fossils and correlate fossil sites across large discontinuous areas.

Determining the numerical age of rocks and fossils

Unlike relative dating methods, absolute dating methods provide chronological

estimates of the age of certain geological materials associated with fossils, and even direct age measurements of the fossil material itself. To establish the age of a rock or a fossil, researchers use some type of clock to determine the date it was formed. Geologists commonly use radiometric dating methods, based on the natural radioactive decay of certain elements such as potassium and carbon, as reliable clocks to date ancient events. Geologists also use other methods - such as electron spin resonance and thermoluminescence, which assess the effects of radioactivity on the accumulation of electrons in imperfections, or "traps," in the crystal structure of a mineral - to determine the age of the rocks or fossils.



All elements contain protons and neutrons, located in the atomic nucleus, and electrons that orbit around the nucleus (Figure 5a). In each element, the number of protons is constant while the number of neutrons and electrons can vary. Atoms of the same element but with different number of neutrons are called isotopes of that element. Each isotope is identified by its atomic mass, which is the number of protons plus neutrons. For example, the element carbon has six protons, but can have six, seven, or eight neutrons. Thus, carbon has three isotopes: carbon 12 (^{12}C), carbon 13 (^{13}C), and carbon 14 (^{14}C)

Through geologic time, the polarity of the Earth's magnetic field has switched, causing reversals in polarity. The Earth's magnetic field is generated by electrical currents that are produced by convection in the Earth's core. During magnetic reversals, there are probably changes in convection in the Earth's core leading to changes in the magnetic field. The Earth's magnetic field has reversed many times during its history. When the magnetic north pole is close to the geographic north pole (as it is today), it is called normal polarity. Reversed polarity is when the magnetic "north" is near the geographic south pole. Using radiometric dates and measurements of the ancient magnetic polarity in volcanic and sedimentary rocks (termed *paleomagnetism*), geologists have been able to determine precisely when magnetic reversals occurred in the past. Combined observations of this type have led to the development of the geomagnetic polarity time scale (GPTS) (Figure 6b). The GPTS is divided into periods of normal polarity and reversed polarity.

Geologists can measure the paleomagnetism of rocks at a site to reveal its record of ancient magnetic reversals. Every reversal looks the same in the rock record, so other lines of evidence are needed to correlate the site to the GPTS. Information such as index fossils or radiometric dates can be used to correlate a particular paleomagnetic reversal to a known reversal in the GPTS. Once one reversal has been related to the GPTS, the numerical age of the entire sequence can be determined.

Conclusion

Using a variety of methods, geologists are able to determine the age of geological materials to answer the question: "how old is this fossil?" Relative dating methods are

used to describe a sequence of events. These methods use the principles of stratigraphy to place events recorded in rocks from oldest to youngest. Absolute dating methods determine how much time has passed since rocks formed by measuring the radioactive decay of isotopes or the effects of radiation on the crystal structure of minerals. Paleomagnetism measures the ancient orientation of the Earth's magnetic field to help determine the age of rocks.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friends and also all other friends of editorial board for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Seti River flood, 5th May 2012

Rishi Dev Chudal
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Introduction

On May 5, 2012, a flash flood surged down the Seti River in Nepal, sweeping away people and buildings along the riverbanks killing more than 40 persons and 30 persons are still missing. The same day, a seismic network half a world away (Lamont-Doherty Earth Observatory (LDEO) at Colombia university) detected a large landslide above the river's headwaters. The landslide occurred on a ridge below the summit of 7,525-meter (24,688-foot)-tall Annapurna IV, one of the peaks of the Annapurna massif. The flood disaster is explained by so called sturzstrom {A sturzstrom [German word composed of Sturz (fall) and Strom (stream)]} is a unique type of landslide consisting of soil and rock which has a great horizontal movement when compared to its initial vertical drop — as much as 20 or 30 times the vertical distance). It developed from a huge rock fall onto a glacier in high-mountainous depression and then transformed into a concentrated debris flow devastating the upper reach of Seti Khola valley.

Geological background

The Seti river originated from a huge bowl-shaped depression, Sabche Cirque; surrounded by the peaks Machhapuchhre (SW), Annapurna III (NW) and Annapurna IV (East). The circular valley is glaciated in the higher altitude as seen in picture below (1.)

The beautiful valley of Pokhara, its smooth valley floor and its lakes are result of at least two major debris-flow events (Yamanaka et al. 1982; Fort 1987). One took place around 12,000 B.P., at the end of last glaciations (Koirala and Rimal 1996; Koirala et al. 1998) and led to so called Ghachok Formation. It covered the valley with an up to 60 m thick cover of debris and the source area of the originally glacial sediment masses has been identified to be a large high-mountain depression, the so called Sabche Cirque.

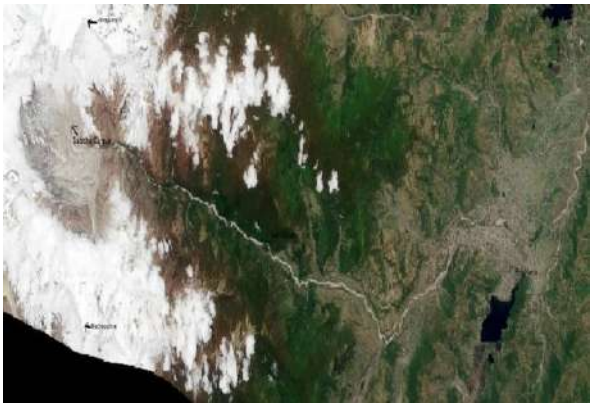

Fig. 1. 20th May NASA image of the Seti River from the landslide source (Sabche Cirque, now covered in snow) down to Pokhara.

The second event of similar gigantic nature occurred around 750 B.P. (Koirala et al. 1998; Hanisch and Koirala 2010) and resulted in the "Pokhara Formation"; several km^3 of mud and debris of all sizes were transported by the flow to fill the Pokhara Valley again to a level up to 60 m. all tributary valley were blocked and lakes quickly formed, three of which are still present. The flat gently inclined surface of these debris-flow sediments and terraces molded into them form the basis of the highly populated Pokhara valley (Koirala et al. 1996).

Sturzstrom on 5th May 2012

Large rockfalls commonly generate fast-moving streams of debris that have been called "sturzstroms." The geometry of sturzstrom deposits is similar to that of mudflows, lava flows, and glaciers. Sturzstroms can move along a flat course for unexpectedly large distances and may surge upward by the power of their momentum. Such a flow was initiated on the morning of 5th may from one of the steep western slope of Annapurna 4 and reached Pokhara.

Fig 2a. The dark brown cloud indicated by the circle observed by Capt. Maximov. (copyright: Avia Club Nepal)

Fig 2b. The triangular peak is Annapurna VI and below it the huge area overrun by the avalanche. Photo courtesy; Avia Club Nepal.

There was in the initial stage of investigation, the exact cause of the debris-flow was uncertain and most common speculation was GOLF then blockage of river by landslide but when a video was published taken by Capt. Maximov of Avia Club Nepal 2012 during one of his regular sightseeing flight, it became clear that the souse area lies high among Himalaya, in Sabche Cirque(Fig 2a).

After looking at seismic data (Petley and stark 2012; Duvadi and Sapkota 2012) and satellite imagery (Google earth and NASA), it was observed that roughly 22 million cubic meters (777 million cubic feet) of rock broke off the slope of Annapurna IV. Falling off elevation of about 6,000 meters, the slid snow (ice pieces) and debris, which might have been close to melting point?

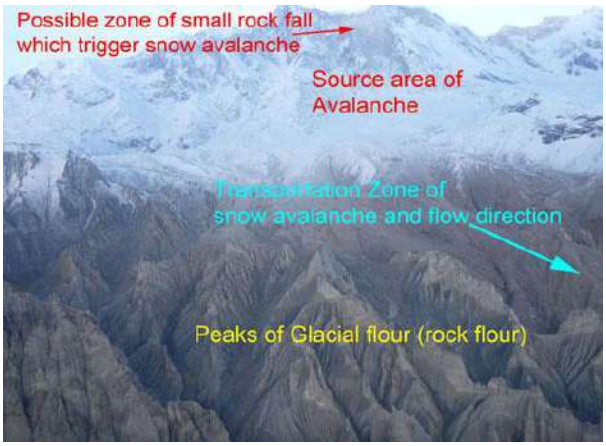

Fig: Southern Part of Sabche Cirque

Produced frictional heat leading to sudden slurrification, probably within 5-10 minutes. In the transportation zone of avalanche (about 3500 m), the avalanche also hit huge moraine and glacial flour (rock flour) deposit with ice-capped peaks in the cirque (Fig 2b). Finally, the slurry-debris fell into the gorge where one could see destroyed tree trunks in mass near the confluence of Seti river and its tributary (southern part of Sabche Cirque)) at an altitude of 2,800 m (Fig 3). We suppose that it happened

because the debris slurry hit the standing trees.

Though there had been a series of warning issued, for the people living near the river in Kharapani, these warnings unfortunately came too late (Fig 4), when the first surge of the flood arrived at 9:38. The next time mark of the front of the surges was recorded at 10:35 near the irrigation dam about 20 km downstream of Kharapani. Near Kharapani, the front was described to have been as high as 30 m (Bhandary et al. 2012; Shresthat et al 2012). The number of surges of debris hyper-concentrated flow is reported to have been 8 and 27.

Fig 4: Before and after situation at Kharpani, Tatopani

We also felt that millions of cubic meters of debris slurry was transported in this event, but by the time it arrived in Pokhara city area, we could only see muddy flood water mixed with fine silt, which is found as similar to glacial flour deposit at the source of Seti River itself .

Fig 5.The flood as it raced past the Pokhara-Baglung Highway near Hyangja.

Conclusion:

In the morning of 5th may 2012, a major wedge of rock with some snow detached from one of the sheer western slope of Annapurna IV. And after an almost free fall of 1500m, the rocks struck the foot of the slope at about 5,500m altitude at 9:09:56 a.m. Nepali time. As a result of the heavy impact, that caused seismic activity equivalent to 3.8-4 Richter scale in magnitude, the rock mass had probably disintegrated and removed large ice masses from the glacier at the bottom (Dwivedi and Neupane 2012, cf. Huggel et al. 2005). A sturzstrom then developed with a huge cloud. It moved towards the bottom of the Sabche Cirque along up to 2 km wide path, reached mouth of the Seti gorge. There by an up-to-date unknown process, the sturzstrom transformed into a debris hyper concentrated flow and entered the narrow gorge of upper Seti river leaving ample of trunks, rock and ice behind(according to Capt. Maximov in Dixit 2012).Then, caused great destruction on its way to Pokhara valley.

As mentioned above, the last gigantic debris-flow disaster happened about 750 years ago during the medieval climate change. We are now experiencing a period of rapid climatic change, so a thorough investigation on the topic and its resemblance with May 5th disaster should be done. In addition to remote sensing techniques the on-site investigation under the harsh high-mountain conditions is of vital importance. There is also a need of proper warning system and awareness in people regarding such crisis.

Acknowledgement

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Use of Microfossil in Petroleum Exploration

Ronash Adhikari
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: ronash1990@hotmail.com

Background

Fossils are not only used for establishing a biostaratigrahy, correlation, study of paleoclimate and paleoecology. Nowadays fossils are extensively used in other branches of Geology. Fossils are used nowadays in finding and exploring various petroleum deposits. So a competent paleontologist is required for finding the petroleum deposits and is a important member in the team of petroleum explorer.

Objectives

This article primarily focuses on the use of paleontological knowledge and techniques in petroleum exploration. This article focuses on the role and requirement of a paleontologist in petroleum exploration.

Methodology

There are a great number of different types of microfossils available for use. There are three groups which are of particular importance to hydrocarbon exploration. The three microfossil groups most commonly used are: foraminifera, calcareous nannofossils, and palynomorphs.

Foraminifera (Figure 1) are protists that make a shell (called a "test") by secreting calcium carbonate or gluing together grains of sand or silt. Most species of "forams" are bottom- dwellers (benthic), but during the Mesozoic Era a group of planktonic foraminifera arose. These forms (Figure 2) were (and are) free-floating in the oceans and as a result are more widely dispersed than benthic species. After death, the planktonic foraminifera settle to the bottom and can be fossilized in the same rocks as contemporaneous benthic species.

Figure 1: Benthic Foraminifera (after F.V.P Van Morkhoven, unpublished training manual)

Benthic foraminifera tend to be restricted to particular environments and as such provide information to the paleontologist about what the environment was like where the rock containing the fossils formed. For example, certain species of foraminifera prefer the turbid waters near the mouths of rivers while others live only in areas of very clear water.

These preferences are recognized by two methods: (1) studies of the distribution of modern foraminifera and (2) analysis of the sediments containing ancient microfossils. In the first case, if the modern species has a fossil record, one can reasonably assume that the fossil ancestors had similar modes of life as the living organism. However if the species in question is extinct, then one examines modern forms, inferring that the fossil forms had similar environmental

preferences. In thelatter case, studies of the rock containing the fossils (sandstone, shale, limestone, etc.) give further clues to the environment of deposition. If a given species is always found in sandstones deposited in river deltas, it is not too much of a guess to suggest that this species preferred to live in or near ancient river deltas. If a company is drilling for oil in deltaic reservoirs, then such information can be very useful by helping to locate ancient deltas both in time and space. For instance, the delta for the ancestral Mississippi River during the late Pliocene was not southeast of New Orleans as it is today, but rather far to the west, south of the Texas-Louisiana border (Galloway et al., 1991).

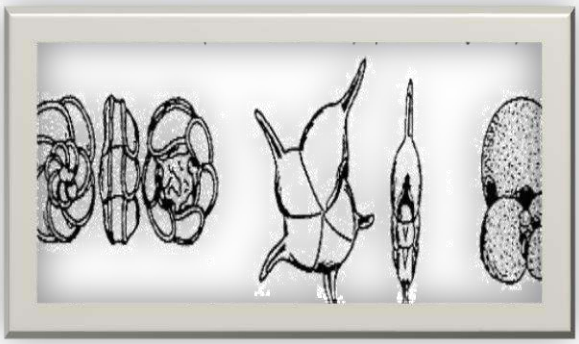


Figure 2: Planktonic Foraminifera

Planktonic foraminifera provide less information concerning the environment of deposition, since they lived floating in the water column; but they have other advantages. Whereas benthic foraminifera are restricted to certain environments, planktonic foraminifera are dispersed over a much broader part of the world oceans and often are found in large numbers. On a geologic time-scale, events such as the first appearance of a given species or its extinction can happen very quickly. For the paleontologists, these correlate points in time and space across a depositional basin (like the Gulf of Mexico) or even across whole oceans. However, local conditions may exclude a species from one area while it persists somewhere else. This gives a "suppressed" extinction point (i.e. the species disappears locally earlier in geologic time than it does in other parts of its range.

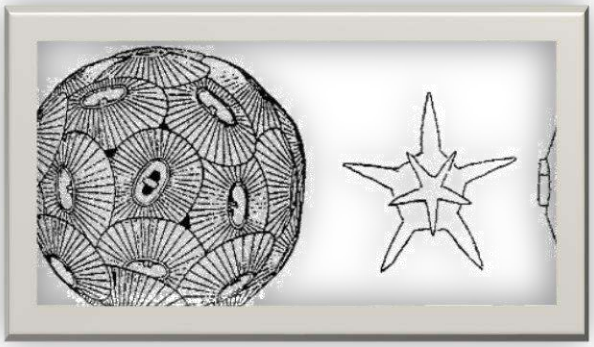
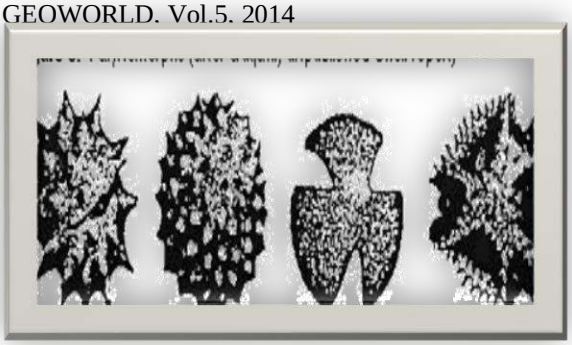


Figure 3: Calcareous nannofossils (after B. Prins, M. Styzen, unpublished shell reports)

Calcareous nannofossils are extremely small objects (less than 25 microns) produced by planktonic unicellular algae (Figure 3). As the name implies, they are made of calcium carbonate. Nannofossils first appeared during the Mesozoic Era and have persisted and evolved through time. The function of the calcareous "plates", even in living forms, is uncertain. One extant group that produces "nannofossils" is the Coccolithophorans, planktonic golden-brown algae that are very abundant in the world's oceans. The calcareous plates accumulate on the ocean floor, become buried beneath later layers, and are preserved as nannofossils. Some chalks, such as those comprising the White Cliffs of Dover, are composed almost entirely of nannofossils.

Figure 4: Palynomorphs (after Gutjahr, unpublished shell report)



The third and final group of microfossils to be discussed here are the palynomorphs (Figure 4). These are organic walled fossils and include fossil pollen and spores, as well as certain marine organisms such as dinoflagellates (the red algae which make up the "red tides" in modern oceans). Pollen and spores are transported by wind and water and can travel long distances before final deposition. They are surprisingly resistant to decay and are common as fossils. Because of the long transport before deposition, they usually tell us little about the environment of deposition, but they can be used for biostratigraphy. Fossil pollen and spores can also give us information about ancient climates. Additionally, the organic chemicals which comprise palynomorphs get darker with increased heat. Because of this color change they can be used to assess the temperature to which a rock sequence was heated during burial. This is useful in predicting whether oil or gas may have formed in the area under study; because it is h eat from burial in the Earth that makes oil and gas from original organic rich deposits.

Field Investigation and data collection

Biostratigraphy plays a critical role in the building of geologic models for hydrocarbon exploration and in the drilling operations that test those models. The fundamental principal in stratigraphy is that the sedimentary rocks in the Earth's surface accumulated in layers, with the oldest on the bottom and the youngest on the top (Figure 5). Putting these two concepts together, we observe that different layers of sedimentary rocks contain different fossils. When drilling a well into the Earth's crust in search of hydrocarbons, we encounter different fossils in a predictable sequence below the point in time where the organism became extinct. In our simplified case (figure 5), the extant species C is present in the uppermost layers. Species B is only found in lower layers. The well does not penetrate

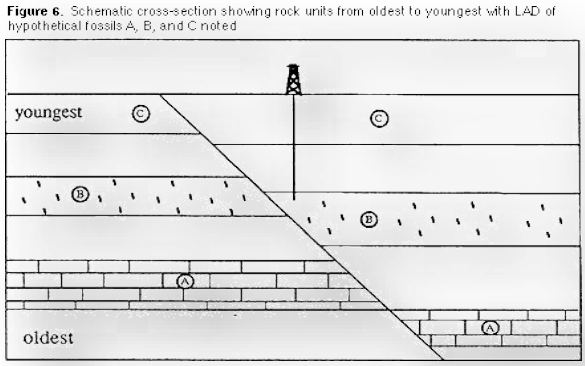


Figure 5: Schematic cross section showingrock units from oldest to youngest with LAD of hypothetical fossils A, B and C noted.

any layers containing fossil A. In a simplified case, the LAD in one sequence of rock represents the same geologic moment as the LAD in another sequence. These are our points of correlation between wells. Another well drilled in this area should penetrate the same sequence, but most likely at different depths than the original well.

In addition to the LAD, another useful event is the First Appearance Datum (FAD). This may be difficult to recognize in a well, because rock from higher in the well bore may slough off the wall and mix with rock from the bottom of the hole. However, in studies of rock units exposed at the surface of the Earth and in some cases from well

bores, these FADs are extremely useful biostratigraphic events.

By studying the fossils in many wells, a geologic model for the area can be built up.

Result and discussion

Thus use of microfossils greatly aids to establish the correlation between the rock units which contains petroleum fuel. So this method must be implemented primarily in exploration of petroleum products.

Conclusion

The microfossils are immensely important in petroleum exploration. The geological sciences have a lot of importance in boosting economic activities. The theoretical geological knowledge and finding has to be used in applied field. The theoretical knowledge has to be transformed and decoded in applicable knowledge.

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http://www.ucmp.berkeley.edu/fosrec/ONeill.html

Nubian Sandstone Aquifer System; Fossil Water Mining, Transboundry Sharing or Dispute

Sameer Poudel
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: poudelsameer@gmail.com

Abstract

This article describes Fossil water as well as its mining/extraction in the different part of world for drinking as well as well as for irrigation. The fossil water is concentrated on Nubian Sandstone as well as in the Sahara, the Kalahari, and the Ogallala underlying the US Great Plains. A further potential store of ancient water is Lake Vostok, a subglacial lake in Antarctica. The Nubian Sandstone Aquifer System (NSAS) at the North Eastern part of Africa is a Transboundary Aquifer shared between Chad, Egypt, Libya and Sudan with almost comparable surface areas in each of four countries.

Introduction

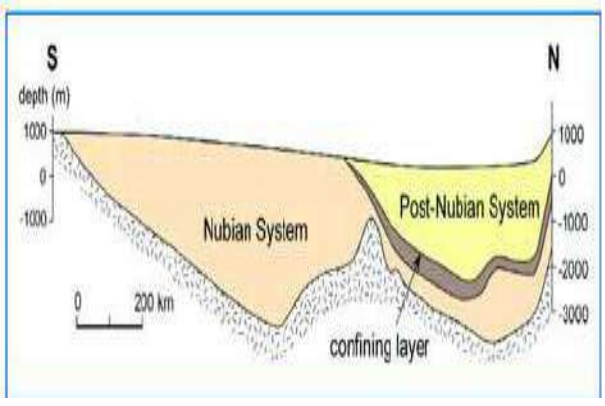
Fossil water or **paleowater** is groundwater that has remained sealed in an aquifer for a long period of time. Water can rest underground in "fossil aquifers" for thousands or even millions of years. When changes in the surrounding geology seal the aquifer off from further replenishing from precipitation, the water becomes trapped within, and is known as fossil water.

The **Nubian Sandstone Aquifer System** (NSAS) is the world's largest known fossil water aquifer system. It is located underground in the Eastern end of the Sahara desert and spans the political boundaries of four countries in north-eastern Africa. NSAS covers a land area spanning just over two million km^2, including north-western Sudan, north-eastern Chad, south-eastern Libya, and most of Egypt, Containing an estimated 150,000 km^3 of groundwater. The significance of the NSAS as a potential water resource for future development programs in these countries is extraordinary. The NSAS is shared by Libya, Egypt, Sudan and Chad and covers approximately 2.2 million km^2, of which 235,000 km2 are in Chad (11 %), 828,000 Km2 in Egypt (38 %), 760,000 km2 (34 %) in Libya, and 376,000 km2 in Sudan (17 %) (CEDARE 2002 cited in: Bakhbakhi 2006, 75; Abu-Zeid). Recently the Great man-made River Project GMRP in Libya began extracting substantial amounts of water from this aquifer, removing an estimated 2.37 km^3 per year.

Geology

The Nubian sandstone complex has a thickness varying from under 500 m to over 3000 m, resting on the Precambrian basement. This is complicated by various structural faults and fold axes traversing the region in a north-eastern direction. Maximum development occurs in the Ain Dalla basin, a downthrown structural block south-west of the Bahariya oasis. Basement features present a dominant control on the complex's structural and sedimentological form. Despite many structural complications, Nubian sandstone likely constitutes a single hydrogeological system west of the Suez gulf. To the east, on the

Sinai Peninsula a second system might exist with some connection to the primary western system in the north. The main western system, extending into Libya and Sudan, consists of a multi-layered artesian basin where massive groundwater reserves accumulated, principally during pluvials of the Quartenery. Locally, carbonate rocks overlying the complex display Karst features and are recharged by upwards leaks from the underlying major aquifer.Fluvial and structural interpretations from 2007 show the desert in western Egypt was induced by fluvial action, including recently mappable alluvial fans. In central areas, braided channels are spatially aligned to a north-east structural trend, suggesting preferential water flow paths. Alluvial fans and structurally enclosed channels coincided to gentle slopes and optimal recharge conditions between 1 and 5%, indicating high groundwater potential. Synthetic Aperture Radar(SAR) interpretations correlated with anomalies from groundwater in 383 wells, suggesting a connection between the spatial organization of fluvial and structural features with low-salinity groundwater, which exists adjacent to alluvial fans and the south-west reaches of structurally enclosed channels. Wells in the vicinity of structures contained low-salinity water.



Geological cross section showing NSAS Source: Bakhbakhi (2006, 76)

NSAS Water Extraction

Libya meets 95 % of its water requirements mostly from non-renewable groundwater.60 Groundwater accounts for 98.72 % of the water used in irrigated agriculture, which produces more than 60 % of the country's crops (FAO Country Profile). This underscores Libya's dependence on non-renewable groundwater resources.

The primary objective of the GMRP is to achieve a secure supply of food and a stable supplyof water for domestic consumption. Libya's most densely populated region in the north is inadequately supplied with water. The situation has worsened since saltwater intrusion following
a water table decline induced by over-pumping made water in the coastal aquifers unsuitable for human consumption. The Great Manmade River Project is designed to transport eventually 2.3 BCM of fossil water from the south of Libya to the north.

Egypt's water dependency ratio, which is defined as the percentage of renewable water resources originating outside the country, is at 97 %. The most important water source for Egypt is the Nile; Egypt meets only 7 % of its water demand from groundwater (Foster / Loucks 2006, 19). Of this, only 1.2 %62 is fossil groundwater from the NSAS63 (FAO 2005b). The FAO Aquastat country profile (2005) does not provide figures how this amount is split among domestic, industrial and agricultural use.

The northern part of Chad has a very dry climate and is only sparsely populated (0.2 capita/km²; FAO Country Profile Chad). The figures published by the CEDARE do not indicate the amount of extraction from the NSAS on Chadian territory (Bakhbakhi 2006, 79), nor is the NSAS mentioned in the FAO Aquastat Country Profile Chad

(2005a). Nevertheless, it can be assumed that Chad is extracting water from the NSAS to such a limited extent that this is not monitored and is not thought to have any transboundary implications.

The NSAS area in the north of Sudan receives an average annual rainfall of only 25 mm. As a consequence, the area is sparsely populated and is used by nomadic and semi-nomadic herders for extensive animal production. The FAO Aquastat country profile for Sudan (2005d) indicated that groundwater use is confined mainly to domestic purposes. Only 4 % of the irrigated area is supplied by groundwater, and this is probably not extracted from the NSAS, since the irrigated area is confined to the southern part of the country (FAO 2005).

The Nubian Sandstone Aquifer's Vulnerabilities

A. Geological Vulnerabilities

While much of what makes the NSAS vulnerable comes from outside the aquifer itself, it is one defining geological feature—that the NSAS is for all intents and purposes a non-recharging aquifer—that most clearly demonstrates the need for a comprehensive treaty. Non-recharging aquifers are non-renewable resources and thus can be completely depleted through artificial consumption. On the other hand, recharging aquifers are recharged to varying extents by rainwater or seepage from overlying rivers and lakes. An aquifer is "a relatively permeable geologic formation (such as sand or gravel)" through which water can flow. For the NSAS, the permeable geologic formation is mainly sandstone laid down during the Paleozoic and Mesozoic eras.

The NSAS was likely filled with water at the end of a more recent geological era when the Sahara was lush and wet. According to recent dating attempts, some Nubian water is 200,000 to 1.5 million years old. Non-recharging aquifers also have limited flow, the geological process by which water moves laterally from one part of the aquifer to another, caused in recharging aquifers by recharge from surface water sources.37 However, flow speeds up near artificial extraction points like wells and pipelines. This extraction creates a cone of depression, which causes water from elsewhere to shift toward the extraction point as a result of gravity. As the water flows toward the point of extraction, the ground water table within the "radius of influence" of the cone of depression drops.

Desert lakes in Libya linked to Kufra Basin oases have begun drying up because of groundwater pumping. Scientists hypothesize that Egyptian extraction will soon begin lowering the Sudanese water table. Eastern Sudan's section of the NSAS already contains little water in comparison with most other areas of the NSAS. In addition to having no natural recharge, the NSAS loses water independent of human extraction. In the 5,800 square kilometer Qattara Depression in Egypt water from the NSAS is continually surfacing and evaporating in small but not negligible amounts. Drought and climate change have lowered the water table in Chad, forcing some Chadians to move in order to find sufficient water

B. Climatic Vulnerabilities

The NSAS underlies the extremely arid Sahara Desert. The land above it is largely uninhabited desert. Naturally, surface water above the NSAS is scarce. Libya, for example, has no permanent rivers. Refugees in Chad and Sudan are regularly forced to endure potentially fatal water shortages.

Other large TBA regions are not in such dire need of water: the massive Guarani in South America, for example, though important to the people living above it, lies under an area that receives substantial rainfall. The lack of surface water above the NSAS makes the need for a reliable, binding treaty even clearer.

C. Political Vulnerabilities

One cannot overstate the political volatility of the NSAS region. After eighteen days of largely peaceful protests in early 2011, Egyptians forced the end of president Hosni Mubarak's thirty-year reign, signaling the end of "the Arab world's original secular dictatorship." Less than a week later, challenges to the "mercurial" forty-one- year reign of Libyan leader Muammar al-Gaddafi were in full swing. The upheaval may prove to be the most decisive moment in the Middle East since the Six Day War in 1967. Commentators tracking the revolutionary upheaval in the Arab world have begun speculating on the future impact of the regional upheaval on water sources. With constant political instability, water scarcity issues become even more important. For example, the current fighting in Darfur is largely attributable to water access issues. Armed conflict threatens the rest of Sudan as well. The war may begin in any time for NSAS.

D. Economic Vulnerabilities

One of the many catalysts of conflict in the NSAS region is the disparity in economic power between the four nations. For example, the gross domestic product (GDP) per capita of Chad is 13% of the GDP per capita of Libya.65 Though wealthier than Chad, Sudan is quite poor as well: its GDP per capita is 16% of Libya's.66 This wealth disparity has the potential to directly influence the stability of the NSAS. Economic disparities between the four Nubian states, when considered alongside deep-seated political instability and disadvantageous natural attributes of the NSAS, demonstrate the pressing need for a multilateral treaty. Usage will only increase, and until the Nubian states have an agreement in place, the likelihood of conflict will increase as well.

Conclusion

Some experts believe that if managed properly, the NSAS will last for centuries. Scientific research suggests a minimal Transboundary impact from current and future Nubian extraction. Based on this, some argue that international management of the NSAS is unnecessary. This view is short-sighted, since the longevity of a non-recharging aquifer is not determined simply by its overall volume and flow. If the water table decreases so far that poorer countries cannot afford the technology necessary to reach the aquifer, the overall volume of the aquifer becomes irrelevant. If unregulated future usage causes different sub-basins within the NSAS to become disconnected, leaving certain overlying areas with no access to water whatsoever, the overall volume of the aquifer becomes irrelevant. If the water is polluted by agriculture or wastewater, or if saline intrusion occurs, the overall volume of the aquifer becomes irrelevant. Finally, no matter how well-intentioned and scientifically sound the usage of a Transboundary Aquifer may initially seem, there is a significant time lag before the impact of that usage can be fully understood.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration

to write. Also I would like to thank my friends for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Rock: A Major Geological Component

Sasmit Adhikari
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: sasmitadhikari@live.com

Background:

No doubt rock when analyzed surfacially seems to be, a very common and simple thing or let's say geological component. But it won't be wrong if we say there is no geology without rock. Different people may have different views and definitions. As a student of geology we may define rocks as the consolidated naturally occurring solid aggregate of minerals.

Objectives:

1. To gain knowledge on basic importance of rocks and their properties.

Rock is the naturally occurring solid aggregate of minerals. On the basis of their modes of formation and their respective properties rocks are classified or divided into three types as igneous, sedimentary and metamorphic.

Igneous rocks

Igneous rocks are the rocks formed when magma i.e. the molten rocks cool down and solidify. The temperature below the earth crust is very high which cause the rocks to melt, thus this molten surface is known as magma. Magma is the molten material that erupts when pressure is excessive as in the form of volcano. Thus this substance cools down slowly and causes mineralization to take place. Gradually, the size of the minerals increases until they are large enough to be visible to the naked eye. . Igneous rocks are mostly formed beneath the Earth's surface.

The texture of Igneous rocks can be referred to as Phaneritic, Aphaneritic, Glassy (or vitreous), Pyroclastic or Pegmatitic. Examples of Igneous Rocks include granite, basalt and diorite.

Fig: pegmatite [www.google.com]

Sedimentary Rocks

Sedimentary rocks are usually formed by sedimentation of the Earth's material, and this normally occurs inside water bodies. The Earth's material is constantly exposed to erosion and weathering, and the resulting accumulated loose particles eventually settle, and form Sedimentary rocks. Therefore, one can say, that these types of rocks are formed slowly from the sediments,

dust and dirt of other rocks. Erosion takes place due to windand water. After thousands of years, the eroded pieces of sand and rocksettle, and become compacted to form a rock of their own.

\Sedimentary rocks range from small clay-size rocks to huge boulder-size rocks. The textures of Sedimentary rocks are mainly dependent on the parameters of the clast, or the fragments of the original rock. These parameters can be of various types, such as surface texture, round, spherical or in the form of grain. The most common type of Sedimentary rock is the Conglomerate, which is caused by the accumulation of small pebbles and cobbles. Other types include shale, sandstone and limestone,

which is formed from clastic rocks and the deposition of fossils and minerals.

Fig: limestone [wikipedia.rocks.org]

Metamorphic Rocks

Metamorphic rocks are the result of the transformation of other rocks. Rocks that are subjected to intense heat and pressure change their original shape and form, and become metamorphic rocks. This change in shape is referred to as metamorphism. These rocks are commonly formed by the partial melting of minerals, and re-crystallization. Gneiss is a commonly found metamorphic rock, and it is formed by high pressure, and the partial melting of the minerals contained in the original rock.

Metamorphic rocks have textures like slaty, schistose, gneissose, granoblastic or hornfelsic. Examples of these types of rocks include slate, gneiss, marble, and quartzite, which occur when re-crystallization changes

the shape and form of an original rock formation.

Fig: quartzite [wikipedia.rocks.org]

Conclusion

Igneous rocks are formed when magma (or molten rocks) has cooled down and solidified. Sedimentary rocks are formed by the accumulation of other eroded substances, while metamorphic rocks are formed when rocks change their original shape and form due to intense heat or pressure.

Igneous rocks can be an important source of minerals, and Sedimentary rocks, or their bedding structure, is mostly used in civil engineering; for the construction of housing, roads, tunnels, canals etc. Geologists study the geological properties of metamorphic rocks, as their crystalline nature provides

valuable information about the temperatures and pressures within the Earth's crust. Examples of Igneous rocks include granite and basalt, while examples of Sedimentary rocks include shale, limestone and sandstone. Common examples of metamorphic rocks are marble, slate and quartzite.

Acknowledgement

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friends and also all other friends of editorial board for their valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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Abrupt Climate Change

Sharmila Neupane
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: proespicuous.sharu1@gmail.com

Background

It is often said that the one certainty in life are death and taxes, but "change" could also be called to this short list. We are all interested in 'changes' that will affect us, our families, our society and the whole world. The sorts of changes we might encounter are many varying from gradual to accelerating, abrupt, chaotic and surprising. Some changes will affect out local, regional or global environment. One change that affect all of us is global climate change.

Climate refers to the annual profile of a given location in terms of temperature and precipitation. Climate determines a number of ecologically important patterns. It has direct link with the landform processes such as weathering and erosion. It has crucial role in formation of soils. The life existence in a particular area also depends on the climate of that area. Climate permits the different types of plant growth and interact with the other physical environments. Climate also forms cyclic relation between water, energy and nutrients through the food chain for a particular region.

Abrupt climate change is defined as a large-scale change in the global climate system that takes place over a few decades or less. Such change is anticipated to persist for at least a few decades and will cause substantial disruptions to both human and natural systems. Several types of abrupt climate change can cause serious risk to humans and the natural environment in terms of our ability to adopt, including

- A rapid change of sea level is a result of changes in glaciers and ice sheets.
- Droughts and floods are the results of widespread rapid changes to hydrologic cycles.
- A rapid release in methane gas (strong greenhouse gas) to the atmosphere is the result of both thawing permafrost and oceans sediments.

One of the major questions is whether there will be abrupt change in sea? We know that even small changes in the sea-level rise may have significant repercussions for society, with serious economic impacts, including coastal erosion, as well as increase in coastal flooding and a loss of coastal wetlands. The present climate models do not adequately capture all aspects of sea level resulting from melting glacial ice. However given this there is concern projections for sea level rise in future which probably underestimate the amount of sea level rise during the 21st century.

A second question involving the potential for abrupt changes of hydrologic cycle of particular concern is changes that affect water supply particularly through long, protracted droughts of particular significance is the fact that droughts can develop faster than people and society are able to adopt them. Thus droughts that last from several years to a decade or more have serious consequences to the society. It has been pointed out that long droughts occurred in the past and are still likely to occur in

future even in absence of global warming, as a result of increased greenhouse-gas forcing.

A final question concerning abrupt change is whether there will be rapid change in atmospheric methane. This is significant question because methane is strong greenhouse gas that if greatly increased in concentration in the atmosphere, would accelerate global warming. It is generally concluded that a very rapid change in the release of methane during next 100 years is or so is very unlikely. However there is ongoing warming with emission of methane from both ocean sediments and wetlands. Wetland in northern high latitudes are particularly more susceptible to releasing additional methane because there is accelerated warming, along with enhanced precipitation, in permafrost areas that contain a lot of stored methane. Thus it appears that, in future decades, methane level will likely increase and cause additional warming.

Conclusion

In conclusion it appears that abrupt climate change during the next century is unlikely and thus we will most likely have time to respond to potential adverse effect of global warming. However it takes time to initiate change in policy and time is growing short, a serious response to global warming from all countries in near future.

A better understanding of past abrupt changes in climate through the collection and analysis of geological data is necessary to fully understand what may cause future change. Geologic data provide the most direct evidence of past change. Geologic data from sediments and glacial ice along with monitoring are assisting in understanding the causes of long term changes in glacial condition and near ocean and how these are linked to atmospheric response. With this, we may be better able to forecast both long and short term droughts that have serious consequences to human and the natural environments.

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Bagmati River Pollution

Sima Humagain
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal

Background

The Bagmati River is an important tributary of the Ganges and has a catchments area of 3710km.sq. in Nepal. The river starts primarily from the Baghdwar, Sundarijal Dhaap then enters into Kathmandu valley then runs as different tributaries which comprises 15 percent of the area of the Bagmati basin in Nepal. The Bagmati River is the Bagmati river is the major river in Kathmandu valley and is closely related with the daily life of the habitation. Since generation it has been server as a source of water for drinking, washing, and agriculture purposes in the valley. The river plays a important role in Hindu mythology. But currently the sharp increase in population, unplanned and rapid urbanization, lack of proper planning implementation and poor legislative regulations have led to the serious degradation to the environment quality and is clearly seen in the Bagmati River.

Objective:

1. To identify the present environmental condition and major causes of the river pollution.

2. To study the effects on Bagmati pollution due to the squatters living around it.

Methodology:

This article was prepared with joint effort on reading articles, journals produced by different Medias and also from the voice of the victimized people living around the river area.

More than 24 settlements are located along the banks of the Bagmati river and its major tributaries Bishnumati, Hanumante, Dhobikhola, and Tukucha. Very prone to periodical floods and exposed to extreme water pollution. There are 11 squatters settlement comprising 863 households along the Bagmati River alone.

According to the Lumanti {an institution that works closely with squatters and various government bodies to rehabilitate such communities onsite or facilitate their relocation to other sites in the valley)84% of squatter households have toilets ,other defecate to the open often by the river banks .Also the half of these with latrines drain their waste directly into the river. In all 58 % of the squatter households directly or indirectly pollute the river. Even those squatters' settlements located away from the river use the nearest store water drain to dispose their waste, which finds the way to the river. Much of the pollution load in the river seems to be the city's garbage. The city generates 600 million tones daily is dumped directly into the river. A 2003 study by the non-profitable organization found Chemical Oxygen Demand (COD) in excess of 4000 mg within the city and immediate downstream s water areas – 10 times higher than considered safe. Bio-chemical Oxygen Demand (BOD) levels were as high as 100mg in the heart of Kathmandu.

The problem is that it is difficult to estimate that the total sewage generated when close to 60 % of the city drinking water as sourced from ground water .As groundwater is unregulated no one can accurately estimate the amount of waste water.

Besides septic tanks are the norms in the city. In the absence of a master plans and

due to funds crunch, sewages coverage has expanded incrementally and in a haphazard manner due to a funds crunch. In many parts of the city, residents have on their own, connected their domestic sewages, home pipes to the city sewages network. Leakages are common drainage are not big, the natural slopes of the valley carry domestic sewage straight to the river. Over the dozens of plans for sewages coverage were prepared.

Currently, The Bagmati River is in the worst phase in the context of its natural beauty and purity. There is water in the river but not as pure and drinkable as it used to be in the past decades. The quantity and quality of the river water seems to be completely damageddue to the unwanted mixed up of various pollutants. Since last some years, some NGOs and other social organizations and clubs of the Kathmandu valley are jointly participating in" Safe Bagmati Campaign". Besides it, proper and effective laws should be formulated and implemented from the side of government at rapid speed to control the Bagmati River Pollution and save the natural beauty andthe holy river of the Nepal.

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I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattarai (Head of the Department) for the inspiration to write. Also I would like to thank my friend as well as the editor Navin Thapa and Durga Khatiwoda for his valuable comments and inspiration to write this article. I would like to thank my all other teachers and my colleagues for the support and hope to get it again and again.

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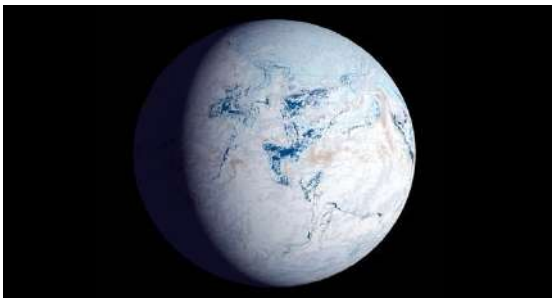
Snowball Earth:
The Super-Glaciations in Earth's History

Vikram shrestha
B.sc 3rd year (Geology), Trichandra Campus, Tribhuvan University
Ghantaghar, Kathmandu, Nepal
Email: vikram_shrestha16@yahoo.com

Introduction

As the Sun evolving naturally, it made progressively more luminous during the Precambrian age then before. As a result, the Earth began to receive more heat from the Sun. However, the Earth did not get warmer. Instead, the geological record seems to suggest it cooled dramatically during the early Proterozoic. The paleomagnetic evidence suggests that glacial deposits, found in South Africa date back to 2.2 billion years ago, were deposited near the equator. If equator was covered by glacier, then it indicates that this glaciation may have been global. These global super-ice ages were so great that the planet was totally frozen over from the poles to the equator, a hypothesis called ***Snowball Earth***. So, Snowball Earth describes a theory that for millions of years the Earth was entirely smothered in freezing ice, stretching from the poles to the equators. Some scientists suggest that there may have been more than one of these global glaciations had happened.

Figure 1: A hypothetical and artistic



picture of the Earth during super-glaciations.

Objective

This article is focused on three such super-glaciations, well before the vertebrate life ever existed on the planet. It defines and explains the cause and effects of those global super-glaciations in the Earth's history thoroughly. The main objective of this article is to visualize the conditions during the snowball earth. It also enhances and reveals the fact related to the super-continent as well as super-glaciations. After completing this article, the readers will able:

- To understand the tectonic activities on Earth's history.
- To know the reasons why and how the glaciation may occurred in the Earth.
- To generalize the idea of evidence of glaciation in simple way.
- To assume whether the glaciation or such events will happen further or not in future's day.

Methodology

Available secondary sources such as books, documentary, articles etc. and published secondary data of different researches and experiments were used for the analysis within the topic. The data were also collected through various other means as through variety of websites, questionnaires and interviews and so on. For the format of this article, the materials provided from the Department of Geology, Trichandra Campus, are used. Finally, all the collected

materials were presented systematically in the form of an article.

What is Snowball Earth?

Planet Earth covered by ice from pole to pole for long periods in the geological past.

Snowball Earth describes the coldest global climate of the Earth's history, about -50°C (-74°F), when a planet covered by glacial ice from pole to pole. The average equatorial temperature would be about -20°C (-10°F), roughly similar to present Antarctica. Because of its solid surface, the climate on a snowball earth would have much in common with present Mars. Despite the cold and dry climate, the atmosphere would still transport some water vapor. Glacial flowage results in sedimentary deposits like glacial erratics, tills, moraines, eskers, ice-rafted debris, etc. are the evidences of the glacial activity, long after the ice has disappeared.

Figure 2: Global ice sheets may have covered the entire Earth and global temperature fell so low that the equator was as cold as modern-day Antarctica.

When did the snowball earths occur?

Near the beginning and end of the Proterozoic Eon, circa 2220 Ma ("Makganyene"), circa 710 Ma ("Sturtian") and circa 640 Ma ("Marinoan").

The last snowball earth ended 635 million years ago (Ma), near the end of the Precambrian Era. This snowball earth is often called as "Marinoan". The sedimentary deposits from this glaciation are found on all continents. It has been estimated in different ways that the Marinoan snowball earth lasted for 6-12 million years, but none of the estimates is highly reliable.

The another snowball earth occurred around 710 Ma and like the Marinoan its sedimentary deposits are found on virtually every continent. It is commonly referred to as "Sturtian". Neither the initiation nor termination of the Sturtian snowball earth has been directly dated, although some evidence suggests that it lasted for millions of years. Its initiation was definitely later than 746 Ma.

The oldest snowball earth goes further back to ~2200 Ma, which is nearly half the age of the Earth. This last snowball earth is commonly referred to as "Makganyene". They are believed to represent a snowball earth because paleomagnetic evidence (of Earth's past magnetic field "fossilized" in rock) suggests they were deposited close to the equator. There is also little evidence for even regional-scale glaciation in the 1.3 billion years between the Makganyene and Sturtian snowball earths.

What caused the snowball earths?

Possibly by a lowering of atmospheric greenhouse gases to near-present levels through tectonically-mediated rock weathering, when the Sun was considerably dimmer than present.

The oldest snowball earth could have been directly caused by the increased oxygen

concentration in the atmosphere, which caused the decrease of methane (CH_4) in the atmosphere. Methane is a strong greenhouse gas, but with oxygen it reacts to form CO_2, a less effective greenhouse gas. When free oxygen became available in the atmosphere, the concentration of methane could have decreased dramatically, enough to counter the effect of the increasing heat flow from the Sun.

Two additional phenomena are known to have occurred, which further contributed to high silicate weathering rates and therefore a cold climate. The first was the breakup of a pre-Pangean supercontinent named *Rodinia*, which began ~830 Ma and continued for nearly 200 million years. A supercontinent is the assembly of almost all continents into a single mass. Silicate weathering rates are low when a supercontinent exists, because most land area is far from the ocean and therefore very dry. When a supercontinent breaks up into small fragments, formerly arid regions become wetter and weathering rates increase accordingly. The second phenomenon was the massive eruption of basalt lava ("flood" basalt) at 723 million years ago in Arctic Canada, which was then very close to the equator. Basalt lava weathers rapidly and is a rich source of Ca_{2+}ions. The combined effects of tropical continents, supercontinent breakup, and equatorial flood basalt emplacement are sufficient to cause a snowball earth.

Figure 3: Volcanoes may have had a role in replenishing CO_2, possibly ending the global ice age that was the snowball Earth during the Cryogenian Period

How did the snowball earths end?

Under extreme CO_2 radiative forcing (greenhouse effect), built up over millions of years because CO_2 consumption by silicate weathering is slowed by the cold, while volcanic and metamorphic CO_2 emissions continue unabated.

The carbon dioxide levels necessary to unfreeze the Earth have been estimated as being 350 times what they are today, about 13% of the atmosphere. Since the Earth was almost completely covered with ice, carbon dioxide could not be withdrawn from the atmosphere by release of alkaline metal ions weathering out of siliceous rocks. Over 4 to 30 million years, enough CO_2 and methane, mainly emitted by volcanoes, would accumulate to finally cause enough greenhouse effect to make surface ice melt in the tropics until a band of permanently ice-free land and water developed; this would be darker than the ice, and thus absorb more energy from the sun.

Could a snowball earth occur again?

The steadily increasing Solar luminosity and the present continental configuration conspire against it, but a large asteroidal or cometary impact could possibly trigger a snowball earth giventhe present cold ocean.

This is a fair question given that the global climate has cooled dramatically over the last 50 million years and 20 thousand years ago (the Last Glacial Maximum) the ice extent was as great as at any time since the last snowball earth. On the other hand, the Sun is nearly 6% more luminous now than during the Marinoan snowball earth, when lowering

greeenhouse gases to present levels triggers a snowball earth in most climate models. As Solar luminosity will only rise in future, a snowball earth becomes a progressively less likely outcome.

On the other hand, a climate model predicted that if the 10-km-diameter asteroid that hit the Earth 65 million years ago extinguishing the dinosaurs and many marine lineages hit instead today, a snowball earth would result. This is because the present cold ocean is more susceptible to surface freezing than the warm Cretaceous ocean (when a snowball earth did not occur) during the decade of reduced Solar forcing due to dust thrown up by the impact.

How did life survive the snowball earths?

A tremendous glaciation would curtail photosynthetic life on Earth, thus letting the atmospheric oxygen be drastically depleted and perhaps even disappear, and thus allow non-oxidized iron-rich rocks to form.

Detractors argue that this kind of glaciation would have made life extinct entirely. However, microfossils such as stromatolites and oncolites prove that in shallow marine environments at least life did not suffer any perturbation. Instead life developed a trophic complexity and survived the cold period unscathed.

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“मैले देखेको कागबेनि”

दुर्गा खतिवाडा

नेपाल आफैंमा सौन्दर्य र विविधताले भरिएको देश हो । नेपालीहरु आफ्नै देश घुम्न र बुझ्न बिरलै निस्किने गर्छन । अझ पढ्न त निस्किने चलन नै छैन भने पनि हुन्छ । थुप्रै विदेशीहरु यहां आएर नेपाल अनि नेपालीको सौन्दर्य र गरिमाको भरपुर बयान गरेको थुप्रै आन्तराष्टिय लेखहरुमा पाऊँछौं । अध्ययनको क्रममा नेपालको कुना काप्चा घुम्न पाउनु अनि यसको बारेमा बुझ्न पाउनु आफैमा गौरवको कुरा हो । असार २ गते देखी साउन २ गते सम्मको एक महिने (SIT) सँग सम्बन्धित भएर दश अमेरिकन विधार्थी र म लगायत चार नेपाली विधार्थी नेपालको भुर्गर्भ अध्ययनका लागि नेपालको प्रसिद्द नदी काली गण्डकीको किनारमा रहेका ती हजारौ पुराणा हाम्रा चट्टान अध्यनका लागि अगाडी बढ्यौ। हामी चौध विधार्थीहरु हाम्रा एक नेपाली शिक्षक डा. विशाल नाथ उप्रेती र एक अमेरिकन शिक्षीका डा.बेथ प्राट सिटौला गरी सोह्र जानाको टोलि मिलेर कालीगण्डकी विगतदेखी वर्तमनसम्ममा ती चट्टान निर्माणमा पुर्याएको भूमिका अध्यन गर्दै हिड्यौ ।

म नेपाली छोरीको लागि घरबाट एक महिना लामो भ्रमण निस्कनु त्यो ज्यादै आत्मनिर्भर्तको कुरो थियो र त्यसमा पनि आफ्नै उमेरर्को अमेरिकन सहपाठिसँगै अध्ययन गर्दै हिंड्न पाउदा मलाई मेरो त्री चन्द्र क्याम्पसको भुर्गर्भ बिभागप्रती हार्दिक आभर प्रकट गर्न मन

लाग्यो कि मलाई यस बिभागले यो सुनौलो अबसर प्रदान गर्यो । विश्वमै विकसित राष्ट्र अमेरिकाका विधार्थी हामी भन्दा ज्यादै स्पुर्थ , विद्वान र भिन्न आचरणका होलान् जसकारण हामी नेपाली विधार्थीहरुलाई बेवास्ता गर्छन भन्ने हाम्रो सोच गलत सबित भयो किनकी विश्वको जुनै कुनाको भए पनि वास्तवमा मनिस, मनिस नै हुदो रहेछ । ति आज हाम्रा घनिस्ट मित्र भएका छन । सुरुमा बोलचालमा असहज भए पनि एक महिनाको लामो समयमा त्यो समस्या मुल समस्या बनेन । नेपालको भौगोलिक बनोट, हिमशृंखलाको अध्यन, हिमनदीको सभावना र चट्टानका अध्यनका लागि निर्मित हाम्रो यो भुर्गर्भसास्त्रीको समुहले काठमाडौंबाट सुरुवात गरेको यात्रा पोखरा, बेनि, तातोपानि, दाना, घासा, टिटर्, लार्जुन्, टुकुचे, मार्फा, जोम्सोम्, कागबेनी हुँदै मुक्तिनाथ सम्मको यत्रा गर्यो । बाटैभरिको त्यो प्रकितिको सौन्दर्यले मलाई सोध्न बाध्य पुयार्यो कि के नेपाल सानो छ ? यहाँ त जीवन सम्भब मरुभुमी पनि रहेछ जब मैले थाहा पाए जोमसोम-मुक्तिनाथखण्ड नेपालको मरुभुमी हो । अध्यनको सिलसिलामा भगवान मुक्तिनाथको दर्शन पछी फर्कदा बाटोमा हामी नेपालीले घरघर्मा बिष्णुको अवतार ठानी पुजा गर्न शालीग्राम भेट्यौ ।

हिन्दू परिवारकी छोरी भएकाले देवताप्रतिको आस्था राखी मैले पनि त्यो शालीग्राम सुटुक्क आफ्नो झोलामा राखे । नेपालि भुमिमा मैले प्रथम पटक देखेको अचम्म के भने हिन्दू मन्दिर मुक्तिनाथमा महिला पुजारी रहेछीन र हिन्दू मन्दिर मुक्तिनाथको समग्र रेखदख र सरसफाई भने बौद्ध धर्मालम्बीको सकृएता रहेछ । यो उदाहरणले मलाई छर्लंग बनाएदियो कि नेपाल धर्मनिर्पेक्ष राज्य पक्कै हो । त्यसैगरी महिला पुजारीको उपस्तिथिले मलाई के भान भयो भने हो नारी महान छे । उसलाई केवल चुलोचौकोमा मात्र बन्देज गराउनु हुदैन , महिला आधिकर माग्नु जाहेज छ ।
मुक्तिनाथको दर्शन पछि फर्कदा हामी पैदल आयौं । .बाटोमा अर्को गाऊं लोमाङथाङ जाने चाह हुँदाहुँदै भबिष्यमा आउने सोच बनायर फर्कियौ । जब म फर्कदै थिऐं जतातै सुक्खापन , हवाहुरी मात्र चलिरहेको कतै बोट बिरुवा नभएको ठाउंमा मैले

एक्कासी त्यहां तल गहिराइमा हरियाली देखें , मानवस्ती भएको पाएं, ती सहरका जस्ता अग्ला अग्ला घरहरु देख्दा अचमैं परे , लग्यो कि मानौं त्यो बस्तीलाई बिश्वको कुनै कुनाबाट ल्याएर थपक्क रार्खिदिएको छ तर पछि हिड्दै जाँदा त थाहा भयो , त्यो त नेपालकै प्रसिद्द ठाउँ कागबेनी पो रहेछ ।

पॅदल भ्रमणमा निस्कको बेलामा सबै मनिस आफ्नो जस्तो लाग्दो रहेछ । व्यापार ब्यवोसाय गर्नेहरु ज्यादै मृदुभासी र सेवाभाबी थिए। सेवा नै धर्म हो भन्ने मानसिक्ता भएका उनिहरुले आतीथी देबो भव; को राम्रो सदुप्रयोग गरको पाए । हाम्रो यात्रामा हामीले मुलत; थकाली मनिस , तीनीहरुको रहनसहन र थकाली खानामा नै रमायौ ।

दिनहुको हिडाइको क्रममा मैले कालीगण्डकी नदी कतै फराकिला त कतै साघुरिएको पाऐं, अचम्म लाग्यो आफ्नो गुरुलाई सोद्धा थाहा पाए कि यो त ठुला ठुला चट्टान एक आपसमा ठोक्किदा ठुला ठुला चीराहरु बन्छन् र यी चिरा परेका ठाउँमा नदी बगेको हुनाले यस्तो दखिएको हो भन्नुभयो । भ्रमणको प्रत्येक दिन मेरो लागि अलिक पृथक र आनन्ददायी हुने गर्थ्यो किनकी म दिनहुँ नयाँ ठाउँ देख्दै र नयाँ कुरा सिक्दै थिए ।जब मैले विश्वको प्रसिद्द खोच देखे, मेरो खुशीको सिमा रहेन त्यस खोच माथिको पुलमा निकै समय बसें । कालीगण्डकी नदीको त्यो उग्र रुप पनि देख । साँच्चैं नै कालीगण्डकी क्रोधित भएको झै लाग्यो त्यो अवोस्थामा। जब हामी जोमसोमबाट माथि लाग्दै गयौ हामीले हाम्रा ती सुन्दर हिमालहरुलाई नजिकैबाट स्पर्स गर्ने पायौ । ती सुन्दर हिमालको अवोलोकन गर्न म साथी भन्दा चांडै उठी आफ्न कोठाको खोल्थें । म सोच्थें कालीगण्डकी नदिको अन्त्य बिन्दु अझ कती टाढा होला तर समयको पावन्दिका कारण त्यहाँ सम्म पुग्न सकिएन तर यती थाहा भयो कि यो नदी ती हिमाल भन्दा पुरानो नदी हो ।

नेपाली परम्परा , रहनसहन र सँस्कृतिमा त हामी नेपाली अनविज्ञ थियनौ तर यी मठ, मन्दिर, गुम्बा ती अमेरिकन मित्रहरुका लागी निकै फरक पृष्टभुमी थियो । नेपाली खाना सधै दालभातले ती मेरा बिदेशी मित्रहरु वाक्क भएका थिय तर "दालभात सक्ति, चोउबिसै घण्टा स्फुर्ति" भन्ने उखन बनाएर प्रोत्सहन गरेपछी हिमालि भूमी नेपालमा आएका तिनिहरु पिज्जा र बर्गर माग्नु सट्टा त्यही नेपाली खान दालभातमा रमाउन थाले । नेपाली

संस्क्रिति बारेमा जान्न निस्किएका उत्सुक सहपाठिहरु हामी नेपालीहरुलाई धरै उत्सुकाता साथ प्रश्न सोध्ने गर्थे । हाम्रो नेपाली भुमिमा बिदेशी हामीसगै पढ्न आएको देख्दा मनमा कतै हामी कम्जोर त छैनौं भन्ने प्रश्न उठेको थियो तर त्यो वास्तविक्ता रहेनछ । नेपाली विधार्थी विवेक र दक्षतामा अमेरिकन सरह निपुण छन् तर अमेरिकन विधार्थीले प्रयोग गर्ने सरह श्रोत र साधनको आभवकै कारण मात्र हामी नेपाली विधार्थी आज पछी परेका राहेछौं ।पढाइको सिल्सिलामा हामीलाई घुल्मिल गराउन र साथीबिचको भाइचारा बढोस् भन्ने हेतुले डा. उप्रेती अमेरिकन शिक्षीका डा.बेथ बारम्बार हामीहरुलाई नेपाली र अमेरिकन बिचको समुह बनाएदिनु हुन्थियो ताकी हामी दिनभरिको अध्ययनमा अकअर्कोसँग परिचित होऊँ । अध्ययनका क्रममा हामीले नेपालको मुग्लिन सडक खन्डमा बिगतमा गएका थुप्रै साना ठुला पहिरोहरुको अध्ययन गर्यौं । निकट भबिष्यमा पुन नजाओस भनेर हाम्रा पौरखी ईन्जिनियरहरुले गरेको साबधानीका उपायहरू पनि हेरियो ।बर्षमा कारीब ३-४ चोटीसम्म हिडेको त्यो राजमार्गको अवस्था बल्ल अहिले थाहा पाउदैछु । त्यसै गरी विश्वमै प्रसिद्द नेपालको कृष्ण भिर चड्दा मलाइ लाग्यो कि पक्कै मैले मेरो देशको यो सुन्दरता जोगाउन केही गर्नै पर्छ । त्यस कृष्ण भिर एक ठुलो पहिरो रहेछ र हाल यस्को अवस्था पुनः नाजुक बन्दै गएको हुनाले तुरुन्त केही उपायबाट यस्को रोकथाम कार्यक्रम सकृय नभएमा पुन यसले भबिष्यमा अष्निट निम्त्याउने कुरा डा. रन्जन कुमार दाहालको मुखबाट सुन्दा म छक्क परें । डा. बेथले नेपाल भुगर्भशास्त्रको अध्ययनको लागि एक खुल्ला प्रयोगषाला रहेको बताउनुभयो ।

यस एक महिने भुगर्भशास्त्रीय शैक्षिक भ्रमणले मलाई नेपालको भुगर्भको ज्ञान मात्र दिएन, बिदेशीसँगको घनिष्टता र आन्तराष्ट्रिय मित्रताको अवसर प्रदान गराएको छ जसले ममा द्रिढविश्वाश र आत्मनिर्भताको नयाँ खुड्किलोमा पाइला टेक्न पनि सिकाएको छ ।

Personal Experiences and Profile of Each Student During Three Years of Bachelor in Department of Geology

(Batch: 067-070)

Year of admission: 2067
Name: Amit Shrestha
Roll no: 353/067
Subject Combination: Geology, Physics and Mathematics
E-mail: shrestha.amit99@gmail.com

I was born in Dhangadhi Municipality, ward no. 1, Kailali district. I have passed my S.L.C from Siddhartha Shishu Sadan Higher Secondary School and +2 from National Academy of Science and Technology (NAST).

I heard about geology from my very close friend and reading about an article in newspaper which was related about geologist and their work fascinated me a lot. So the journey of my bachelor level begun at Ghantaghar, Tri-Chandra Multiple Campus.

The book I have gone through is "***A Thousand Splendid Suns***" by Khaled Hosseini. The book focuses on mothers and daughters, and friendship between women. The book follows the lives of two Afghani women, as they move from children to adult. The book is a moving story about the power of love, the bonds of friendship, the love of country, and the struggle to survive.

Since Geology was a new subject to us, I was excited to take classes on it. The fascinating fact of first year was meeting new friends, studying under the historical roof of Ghantaghar. One thing that I love during those days was that I was taking my classes from almost all PhD. degree holder teachers. I felt so proud at that time.

Second year was more interesting than first year. It was because of the field work. Field work was important because it was very helpful to know about the Himalayan rocks that we study on classes. Working in group was very fruitful. This one thing that I learned from the field work is 'Never give up, Be optimistic.'

Studying geology in third year was very interesting. The classes were very interesting and so was the practical. The theory as well as practical classes of Engineering Geology fascinated me a lot.

Considering the facts mentioned above and based on my own wisdom, I would except to be a good geologist in 10 year from now.

Year of Admission: 2067

Name: Anil Ghimire
Roll no : 340
Subject Combination: Geology, Physics and Mathematics

I was born in Dhungkharka V.D.C. ward no- 1,Thulchaur, Kavre.I completed my S.L.C. from Chaitanya Secondary School from Banepa and +2 from Chaitanya Multiple Campus, which is near my school. After finishing +2 exams, I haven't decided anything about my future. While the result is published out, then I am little bit worry about my future aim. Before giving the S.L.C. exam of last class ,when I was in grade ten, one of my teacher called Harisharan Thapa asked all of my classmates to tell about their future aim after the finishing the S.L.C. exam or school level. In that time, I replied my future aim in the following sentences "I will study the hotel management and contribute my country by developing the hotel and Tourism sector in Nepal. Finally the result is also published then my parents especially my maternal uncle name Baburam Dahal, who is the best guide for my study too, he suggested me to join the science college. What can I do? I think a lot because I am in big controversy as well as my family member also gave the suggestion. Finally I studied +2 sciences without thinking my past feelings. After finishing the +2 in sciences, I decided to be an engineer, so I gave the entrance exam in Phulchoke. But I am not success there. So, I am completely blank after the entrance result.

After that, some days going on, my senior brother suggest me to study the physics in Trichandra Campus. So, I decided to study in that college because I don't want to lose my time for studying engineering preparation for next year. While visiting the Trichandra Campus, I am real being surprised, which I never seen before there. It looks like a big historical university, so many students with different type. Politically involved brothers and sisters make in strange. In my school and high school, there are not any influences of such political violence and affection. So I really felt surprised and sucked too by looking them .Without talking and introducing with me before them hand-checked me, really it's different for me. Because without knowing clearly I never talk and handshake with other. But their character fascinated me.

The first day of geology of mine in that time Dr. Tara Sir taught about geology scopes and little about weathering on rocks (mechanical and chemical). In the initial classes, I was so happy and really interesting for me, because it was totally a different subject of mine. In the first, we went two days field where know to determine the attitude of bed, identification of minerals, rocks of different types; Sedimentary, metamorphic and igneous rocks. It is quite interesting. Due to the less time; it's little bit different for us expert on it. After the 16 days field on BSC 2nd Year it's really very knowledgeable and memorable of my life. I never forget that moment in Malekhu, where we studied the compass and its usages in details, the geo-morphological features on that area and easily being able to know the topographical map and concept mapping of geological unknown area. This is totally practical for our future life for doing research in this specific field. So it totally attracted me to do something on future on this country. Till now, in this 3rs year, I choose the subject to give contribution on this complex geological field in Nepal.

Year of Admission: 2067
Name: Anuma Shrestha
Roll No: 942
Subject Combinaion: Geology, Botany and Zology

Sindhupalchowk Chautara, Purano Bazzar, Ward no. 3, is the place where I spent my whole childhood. I passed my SLC from Ekta Boarding High School, Chautara and completed +2 from Everest International College, Soltimode, Kalimati, and Kathmandu. Knowing information about the Geology from a friend's brother I admitted in Bachelor at Tri-Chandra College. The first thing that stroke on my mind was the classroom, mass of students, system of teaching, which was totally amazing for me.

Apart from the course book the only book that I have gone through is "**Pagal Basti**" written by Sarubhakta and Published by Sajha Prakashan, Lalitpur. The book conveys many message in many aspect just like "love doesn't keep a record of wrongs." Likewise, "let people not confuse their confusion" and so on.

"Change yourself, if you wish to change the world", this is the knowledge and wisdom that I gained during my school life.

During my first year course I was not sure that I would go for geology but after attending few lectures, I was keenly interested in the subject. It is the subject which deals about the things that used to form from the time of our birth and entire life period.

The most interesting thing during my first year study was the geology class by Tara Nidhi sir, I was totally fascinated by his teaching methodology. Learning new things in a new class in a new environment, with new friends, in a new way was really memorable.

During the second year course, I was so excited to learn the things that we go theoretically in a practical way. Really, those 17 days taught us how to work in the field as a geologist. And this is the reason which encouraged me to select geology as a major subject in my third year.

Having geology as a major subject in third year was really interesting. The subject matter including Engineering Geology, Environmental Geology, and Paleontology are very helpful. Having knowledge of these things we understand that various infrastructure developments works can go parallel with the nature and its system.

I am expecting that I would be a successful geologist in my future.

Year of Admission: 2067
Name: Arjun Bhandari
Roll.no: 1060
Subject combination: Geology, Botany & Zoology
E-mail: vandari.arzun@gmail.com

I was born in Bastu VDC, ward no-2, Dhurkot, Gulmi. I have passed my slc from New Horizon Higher Secondary School, Kalikanagar-13, Butwal and completed my +2 level from National Integrated College (NIC), Dillibazar Kathmandu. After completion of intermediate level I went to NIMS institute for preparation of MBBs. I could not get success in that field so I went to get admission at Rampur, Chitwan for Agriculture where I failed to get success. Then my interest was IT (information technology) it was too late to apply for admission so I applied admission at Tri-chandra college.

I knew about geology form my friend. He explained how interesting it was to study geology so i applied admission at Tri-chandra College in Geology Department. After I got admission at geology I was still interested towards IT so I was also applying for IT admission form but when I got admission at IT College then I was attracted towards geology because it was interesting, scientific, researchable field.

The two days fields at Dasinkali and Kakani, similarly seventeen days field at Malakhu are the unforgettable special movement where we learned in field. Third year class is more interesting than first and second year, especially GIS and Engineering Geology which are applicable in fields The first book read by me is “Urgan Ko Ghoda” and the best book I have read is “Mother” by maxim Gorky(1868-1936). I am interested to new advance technology.

Considering the above mentioned facts I would expect to be a skilled and try to be renowned Geologist all over the world in 10 years.

Year of Admission: 2067
Name: Arjun Kumar pandey
Roll No: 527
Subject Combination: Geology, Physics and mathematics

I was born in Raghunathpur VDC ward no.03, Inerwal village situated at Bara district. I attended Shree 3-Chandra Secondary School, kalaiya andcompletedSchool Leaving Certificate Level and completed +2 from Birjung commerce Campus, Birjung. Knowing information about geology from my uncle, I admitted in Bachelor Level for B.Sc at Tri-Chandra Multiple Campus, Ghantaghar. When I first entered and look after Tri-Chandra Multiple Campus, it attracted me a lot because there was the thing that I have studied in historical book but have never seen yet.

The best book I have gone through until that time was “Muna Madan” by Laxmi Prashad Devkota and Published by “Sajha prakashan, Kathmandu”.

I admit and attempted the geology classes during first year course in 2067 B.S. then I started concentrating in my study seriously. Although I have learned many geological knowledge, I was much to take great pleasure to know that a topic of “Glacier”. And while coming at the second year, I start to like “Historical Geology and Geology of Nepal” the most. It tells us all about the history of earth, types of climate prevailed, types of rock classification in different area and their role in giving a present day development. It helps to courage me to select Geology as a major subject in my third year study.

Year of Admission: 2067 BS
Name: Arjun Parsad Neupane
Roll No: 50
Subject Combination: Geology, Physics, Mathematics

My name is Arjun Parsad Neupane . I was born in the Eastern state of India, at a small village Medizephema, Kohima district of Nagaland. I joint my primary level scooling at St. Francies Cathedral High School. I got transferred to Model Higher Secondary School A.G Colony, Kohima and completed my Higher School Level and Secondary school level education from that school. I have never thought to coming Nepal or Trichandra College for my bachelor level education and study Geologu as a major subject. But I had lot of thoughts for my country Nepal, which has bought me here. As one of my brother was studwas studing in trichandra College and he had a friend who came from the same place Kohima and was studing Geology. My brothers friend was the man behind who inspired me to take geology as a subject, as he himself had done lot of research and took up that subject. A view of Rani Pokhari from Trichandra college.

I like doing many thing and learning new things . My hobbies include playing drumstick, playing circket, reading books, visiting new places, and gardening. Till date I have read lots of books that includes biographies, novels and inspiring and informative books among all the books that I like the most is The Alchemist by Paulo Coelho which is inspiring book and inspired me a lot. It is the story about Shepherd boy who wants to be a traveler. It tells us to follow ourown dream never give up in the middle whatever diffulties you get in ur path to persue it and never leave the path or even through you got satisfied before reaching your goal belive in yourself and your dream. The knowledge and wisdom that I have gained from my parents and teachers has helped me a lot (to carry on in my life) in my study and in my outside world. The most important lesion that I have learned in my life till today is (dedicating oneself to the happiness of others in what make) the most important things that I have realized that without discipline, respect and hard working you will never get success in anything. Serving others is what makes me happy the most.

It was not my first option to study Bsc or geology as my major subject. I always wanted to be computer engineering. At first while coming to Tri Chandra College I thought of taking environment as a major subject along with physic and mathematics. The most important things that incorage me to take geology was fieldwork and disclipine of students taking geology compaired to other subjects and the other thing is that as geology is the applied subject and have to work in the field which also interested me a lot. I have learned many things in geology like about landslide, earthquake, volcano platetetonics etc. in the first year. As an outsider, I found many difficulties to adjust in the new environment and I could not speak Nepali properly as well, a friend of mine helped me a lot both in my studies and outside. The field work of Malekhu in the second year and Palpa during third year has helped me a lot in understanding the rock typed and different geological strectures, geological mapping, field work also has bought me close to many friends and even lectures.

In the end I would like to thank Tri Chandra College for giving me all the facilities and also for giving me all the facilities and also to the department of geology and my lectures and professer for giving me the knowledge, which will play an importment role to fulfill my dream of becaming geologist and help in nation building.

Year of admission: 2067
Name: Arya Kumari Thakur
Roll No.: 322
Subject combination: Geology, Statistics , Mathematics
Email: **arya_thakur62@yahoo.com**

I was born in Janakpur, ward no. 16, Dhanusha. I completed my high school from Thilla, Sabaila and +2 from Model Campus, Janakpur. I got to know about geology from my elders and was admitted in Bachelor level for BSc at Tri-Chandra Campus. It was my first visit at Tri-Chandra Campus. Geology was more interesting to study because it gave me an opportunity to know 'The Earth'.

The knowledge and wisdom that I have gained during my school life is "think positive, do positive". This sentence always made me strong.

I got admission but I could not attend regular classes during my first year courses because I was trying to get admission in engineering course but fortunately I was not successful. After few months I concentrated on the study. At the end of the first year, I felt the importance of classes of geology.

In the first year I found physical and structural geology interesting while in second year metamorphic petrology attracted me. All the field work of first year and second year encouraged me to select geology in the third year. The field work provided me geological information and also gave a chance to make good relationship with our friends and respected teachers. In this third year, I am interested in engineering geology which is applicable in civil engineering and GIS.

In upcoming 10 years, hope I must be a popular engineering geologist and also do many researches on engineering geology.

Year of Admission: 2067
Name: Ashish K.C
Roll No: 602
Subject combination: Geology, Physics, Mathematics

I was born in Gankhel-14, Kathanmandu. I completed my school studies from PurbaPaschim School, Balkhu-14, Kathmandu and completed +2 from Nepal Praharii Higher Secondary School, Sanga, Kavre. After completion of +2, I didn't try other fields of applied sciences like engineering, medicine, agriculture etc because I was fully confident and dedicated with myself that I will study the pure science either Physics or Biology. However early i tried to get admit in Nepal Army but didn't success. When I attend the lectures of Geology in Ghantaghar, the first thing that stroke on my mind was the classroom, mass of students, system of teaching, which was totally amazing for me.

I have gone through some literature as well as some spiritual books too. I specially loved the novels of Paulo choelo. I love the books and articles and documentaries which are related to the facts of Physics and Geological History and information's.
The mystery of origin of Earth, land, sea, plates, position of plates in different times, formations of mountains, Geological study of evolution, about minerals, rocks, geological structures and the other geo-related information, I m getting the ideas one by one in progression by different means of Lecture's book, documentaries, research papers, field excursions etc. I want to thank all the teachers of geo-department for being so dedicated and so caring and co-operative

After studying nearly about 3 years, I am interested in the engineering as well as environmental geology. It helps in proper construction works, like construction of tunnels, dams, roads, bridges etc. And the environmental geology gives the knowledge and relationship between the two very closely interconnected geology and environment.

With the reference and mentioned facts above and on the basis of wisdom on myself, I would expect to be a competent geologist in 10 years from now.

Year of admission: 2067 B.S.
Name: Basant Bhandari
Roll No: 1063
Subject combination: Geology, Botany and Zoology
Email: basanta_j4u@hotmail.com

I have born in Simpani V.D.C., ward no. 4, Segle, Lamjung. I attended Shree Laxmi Primary School for my primary level education. It is situated at my village near my home. After class three, I joined Shree Ganesh Secondary School for further study, which is only one secondary school of our V.D.C. I passed S.L.C. from there and came to Kathmandu for higher education. I got admitted in REHDON Higher Secondary School, Samakhusi, Kathmandu for plus 2 in science. After completing plus 2 level from REHDON H.S.S. I didn't try for any applied field because of my interest on core science.

I heard about the 'Admission Open Notice' on Tri-Chandra Multiple Campus from a senior brother from my village who was studying at Tri-Chandra Campus at that time. I filled up for Microbiology initially as suggested by that brother. But later I got information about Geology from senior brother, who was studying Geology. So I got interest to attend a class for trail and I did the same. That was my turning point of life. I really inspired by the lecture, close circle of lecturer and students, disciplined and friendly environment, and international style of teaching. My dram to be a Microbiologist had been changed into Geologist.

The best books I have gone through till now is **'Pagal Basti'** by Sarubhakta and **'Sumnima'** by B.P. Koirala. 'Pagal Basti' has incredible conflict between love and idealism. And 'Sumnima' opens the controversy of naturalism and spiritualism. The best book I have ever read, of foreign writer is **'The Alchemist'**, which is written by Paulo Coelho. "*And, when you want something, all the universe conspires in helping you to achieve it"*, an inspirational statement of this book always motivates me to give continuity to dream and to look forward to fulfill it.

The unforgettable moment during the days on Tri-Chandra is that 1st lecture I attended, which had changed my life. From these three years of bachelor I learned a lot about the earth. I solved many my childhood questions. I am glad to get opportunity to study in this historic Campus, which is itself an Educational Museum. I have a dream to be a reputed Geologist in future and I have commitment to fulfill my dream.

Year of Admission: 2067
Name: Basanta Rayamajhi
Roll no: 39
Combination: Geology, Physics, Maths
Email: raya.basanta@gmail.com

I was born in Topgachi-6, Jhapa,Nepal. And I completed my school level from Novadaya Madhyamik Vidyamandir, which is situated in my village. After completing my school, I joint my +2 science in Dharan Higher secondary school, Dharan, Sunsari. Then for higher study I came here Kathmandu. Then I finally came Tri-Chandra College for my B.sc class. Firstly I attend the class of Physics, Maths. I was determined to study physics because I have never heard about the subject Geology,that was taught in this college. Then I finally decided to study Geology so from that day I am here in Tri-Chandra college , Geology Department.

First, in the starting days of my class I was alone then slowly I made few friends. Then it was easier to study in class. Lately I had so many friends that my college became so exciting. Most of my friends are of Geology combination.The best book I have ever gone through is "Shirish Ko Phool" by Parijat. In my first year of my course we had opportunity to go field work with our teachers. So I was more attached with my friends and teachers.

I was regular and attended almost all the classes my first year. I enjoyed my practical classes very much. Structural Geology was my favorite part in my first year. In second year I loved Petrology. And also knew the importance of Petrology for a successful geologist. The second year, Malekhu field work was my best 17 days in my life. I will never forget those days that I spend with my friends and teachers. The knowledge that I gained from that field work is very important in my future because that was my first field work ever in my life. I learned the importance of friends.

In third year, I loved all the subjects but mostly engineering geology because it is applied geology. I always like those subjects. I hope my third year also be very well and I m also excited about third year field work in Tansen.I hope I will become a better Geologist in my near future.

Year of Admission: 2067
Roll No. 1143
Name: Bijaya Thapa
Subject Combination: Geology, Botany, Zoology

I was born on September 22, 1991 on the occasion of Dashain Festival in Thapathali Hospital, Kathmandu. I completed my lower level school from Indra Dhanush Higher Secondary School and the Joined Child Nature Boarding School (now Mathribhumi Boarding School) , Bhaktapur and Passed my SLC from Same School. Then I enrolled to Triton Higher Secondary College for my Intermediate. I really don't about Geology till then as I was very keen to Medical Science. But when I came to Tri-Chandra College I was very fascinated by Geology Subject and admitted. I was confused at first but very happy now for choosing this subject.

My hobbies are according to mood. I love to watch sic-fictional and different kind of movies based on real stories. I also like to read biography of great people. I love and care rare things and devoted to music too. I am interested in Photography too. In free times I love to watch Discovery and National Geography Channel.

The Book that I liked most is "***The Old Man and the Sea"*** , a novel written by the American author Ernest Hemingway in 1951 in Cuba and published in 1952.*The Old Man and the Sea* is the story of a battle between an old, experienced fisherman and a large marlin.

Talking about my first years' experience, I was very fascinated by the topics and teaching style. I wasn't very familiar with anyone and I used to attend college very often as my mind was diverted to Medical Science. During the time of first year, I tried Nepal Army also. I put my hands and mind to many other fields also which were very hard times for me. However I managed to cover up my studies with practical class. I got the opportunities to know my classmate on practical classes. Geological tour to Chovar, Dakshinkali and Kakani was very memorable and helpful.

In Second year, Geology became more interesting and appealing as we came to learn about the Earth in historical Geology along with the knowledge of different geological structures and processes through different subjects like petrology, Sedimentary, Igneous, metamorphic, Paleontology and Geology of Nepal. The Geological tour of 17 days was very memorable where we were able to visualize and implement our learning to the task along with knowing new things and getting diverse knowledge. It was a wonderful time where we all shared our happiness, sadness and every ups and down together. We got a chance to know each other very nicely and deeply. Malekhu had been a place where we all friend, share a great moment of life. We got a golden chance to be with our teachers completely full time. Our Professors were monitoring our every movement and were very supportive. Meeting with Dr. B.N Upreti and T.N Bhattarai sir was very honorable. They are man of the Icon and respectable. Their every lecture was very precious. They are my Icon and real Heroes.

In final year, Geology became more intresting and faboules subject to me. It made me to think that now Earth was taking with me. Then I realiesed that why we worship Stones. I was very proud to read Geology and to be a part of Geology Department, Ghantaghar. In third year it was really very important to know about the role of engineering geological investigations to the various constructions and the importance of rock mass classificarion and

soil classifivation todesigh the various kinds of infrastructures like road , tunenel, building etc. The 17 days field work to Butwol-Tansen was very memorable; we not only get the idea about our coaurse but also helped us to develop our moral and professional characters and qualities also.

We are very excited and glad that we are now getting to read master in engineering geology in Tri-chandra College Ghantaghar. This subject is completely new and intresting. Based on my Intestest and oppurtinities I would except to be engineering geologist in futures.

Name: Bikash Phuyal
Year of admission: 2067
Roll No:341
Subject combination: Geology, Physics & Mathematics
E-mail: neosamip@gmail.com

I was born in Chetrapur, Bharatpur Municipality, Ward No.9, Chitwan; I completed my School Leaving Certificate from Shree Chandrodaya Secondary School, Benighat, Dhanding and completed my Intermediate from Birendra Multiple Campus, Birendranagar, Chitwan

Knowing information about geology course in Nepal from friend's uncle I had a pioneer interest in geology. I admitted in Tri-Chandra College which is one and only college having Bachelor degree in Geolgoy. The main funny and interesting part at that time was I didn't have any idea about Ghantaghar attached with my college. When I visited Tri-Chandra College I came to know that Ghantaghar is part of my college for the first time and I shared photo of Ghantaghar in my facebook wall.

The best book I have gone through until that time was **Jeevan Phul Ki Kanda** by **Jhamak Kumari Ghimire**, kathmandu. The book convey a message that the life is full of thorn, hindrances however, we can get through it by own grace, positive thought, steady struggle and fateful timing. Similarly, the best book I have gone through, published by Rupa Publication, Delhi by and Indian author Chetan Bhagat is, **Revolution 2020.** It gives us message of struggling life for achieving a goal. It evokes us to see one open door behind hundred closed doors of opportunity.

I admit that I could not paid good attention to geology classes during my first year courses. I was trying to get admission in Bachelor in Fine Arts and I started concentrating my study in geology course seriously. However I am recently doing Bachelor in Fine Arts.

The most unforgettable moment during my first year study was field work in Dakshinkali and Kakani for two days for the first time. It helped me to get introduce with some friends. My friends help me in sharing notes.

While coming at the end of the second year course, I started liking paleontology which teaches us about the life and creature in the geological past. And in third year I got interested in engineering geology which enables us to reduce disastrous consequences in construction. I'm expecting that I would be a successful and competent geologist in my future.

Year of Admission: 2067
Name: Bimal Bohara
Roll No: 80
Email: bimalbohara07@gmail.com
Subject Combination: Geology, Physics and Mathematics

I was born in Chabahil, Kathmandu. I completed my schooling from Shree Himalaya Higher Secondary English Boarding School, Chitwan, Taadi and completed my +2 from Reliance International Academy, Chabahil, Kathmandu. I wanted to join engineering but wasn't successful and by the help of some of my friends I came to know about geology and I found it really interesting as a result I got admitted in this historical college i.e. Tri-Chandra Multiple Campus.

During 1st year I had gain lot of confidence to co-operate with friends and introduced with new subject geology and I started concentrating on my study in geology. The best book I have gone through is Basain because it *is* a story of poor villagers who undergo suffering due to theexploitation of the feudal and so-called upper class of the society.

All moments in the college was really memorable for me. Discussion with friends on different subject matters and the international standard lectures of the professors are really unforgettable. Also the field works were awesome with perfect coordination of teachers and my collegues.

I hope to become a competent Geologist within coming 10 years.

Year of admission: 2067
Name: Bimal Ghimire
Roll No: 1422
Subject combination: Geology, Botany, Zoology

Born in Gulmi district, Musikot ward no3.My family migrated to Butwal and my permanent resident house is in Karahiya-8 VDC, Rupandehi. I attended my schooling up to class seven in Shree Nawa Jyoti English Boarding School in Butwal. And I completed SLC from Kunwarti Boarding School near to my house. I attended plus two from Glorious College, Butwal. For further bachelor education my zoology teacher of plus two level advised me to study Geology and also I knew the value of studying Geology when I came first time in Kathmandu and meet Dr.Prakash Das Ulak. He told me the scope of the subject and I was inspired. I heartly choose Geology subject for my future career to study.

I have read many novels, poems, stories, books in my life. But the best book I have ever read till now is ‘’MUNA MADAN’’ by Laxmi Prasad Devkota. I found there a true devotee towards both characters in themselves and a true love between Muna and Madan. Likewise I have read’’ **Sirisko phool’’** written by Parijat. There is hope and energy in the words of the novel and the writer herself is able to touch the heart of readers by the heart touching and emotional feelings and inspirational thoughts for the life and has written about a life of a woman, her imagination and dreams.

The B.Sc. first year study of mine was not good because it was the year I was trying for Engineering Entrance and also I was doing job so my first year result was not so good. I learned many things about the earth and what really Geology means? After I had my field visits of 1st and 2nd year. Then I came to know the importance of studying geology and the need of geologist in Nepal.

At the end of 2nd year I was enjoying studying the petrology and historical geology but the detail study of paleontology on 3rd year fascinated me a lot to have deep knowledge on fossils; their evolution development and relation with the geological events. Also the field works on Malekhu and Palpa encouraged me a lot to be focused on Geology.

Considering the above facts and area of my interest and on my own wisdom ,I would expect to be a successful geologist and can do something new work for my country in coming 10 years.

Year of admission: 2067
Name: Binod Karki
Roll No: 311
Subject combination: Geology, Physics and Mathematics

I had born in Pounthak V.D.C., Tehrathum. I passed my secondary level from Janapriya Higher Secondary School and completed my intermediate level from Dhankuta Multiple Campus. I was introduced with geology from my friends and I admitted Tri-Chandra college for B.Sc. in geology.

During 1st year I had gain lot of confidence to co-operate with friends and introduced with new subject geology and I started concentrating on my study in geology. The best book I have gone through is 'Muna Madan' by laxmi Prasad Devkota. This book provides message that a man should be respected by his works not by the cast.

The most unforgettable moment in Tri-Chandra is during my 2nd year geological fieldwork along Malekhu, Dhading. Where I gained knowledge about fundamental geological aspects like different rock types, lithology and many more practically. I would expect to be a good geologist in future.

Year of Admission: 2067
Name: Chhabilal Pokharel
Roll No: 514
Subject combination: Geology, Physics & Mathematics

Born in Mareng 7 V.D.C Ward No 7, Kuvindada Villege, Arghakhanchi , I attended Shree Saraswati HSS Suryathum , Arghakhanchi & completed PCL from Tri-Chandara Multiple College Ghantaghar Kathmandu. During PCL studied in Tri- Chandra Campus, we know about geology Department of Ghantaghar & Geology study process, field work etc. I admitted in Bachelor level for B.sc at Tri-chandar campus from by elder geologist /brother suggest me about geology & it's scope, Geological application in Nepal Context.

The best book I have gone through until that time was ," You Can win" written by Shiva Kheda publication by international best seller Kathmandu. The message of that book was "Winner's do not extra work than other but they do work in extra way", Similarly the best book I have gone though was "The secrete" written by Rhoda byne, trans cafion published by peach pokhari prakashan ktm. The best message of that book was "Everything Lost by someone, how they received that it is depended up on his/her present work.

During first year, I stated Concentration in my study Geological course. I had learned many fascinating knowledge of Geology, Physical in geology dealt with physical or Science i.e.Glacial River Wind water in structural geology, I lean about fold fault, rapture etc & mineralogy we studied about different minerals. We observed Two days Dakshidkali & Kakani area.

While coming at the end of the 2nd course, I started learning about historical geology it studied about history of earth. How mountain formed how rock formed etc were most important to me. In second year field work we went to Malekhu in 17 days the level of interest of studying geology got increase than, I decided to study in B.sc Third year as a major subject. During third year was even more interesting because of studying engineering Geology, Exploration & Environmental Geology were more interesting.

Supposing the fact mentioned above & also on my best wisdom, I would expect to be a university professor in ten years time from now.

Year of admission: 2067
Name: Dharma Raj Pandey
Roll No: 234
Subject Combination: Geology, Physics and Mathematics
Email: dharmarajpandey08@gmail.com

I was born in Basantapur, Kathmandu. I completed my schooling from Shree Mahadev Higher Secondary School and I joined ISc from the very historical college Tri-Chandra Multiple College, Ghantaghar, Kathmandu. So as I had done my Isc from the same college I had idea about geology from the campus and friends itself. As a result I selected geology for my bachelor level.

The best book I have gone through is Bhalaadmi by laxmi Prasad Devkota. The most important part that I liked in this book is that we pretend to be good among others but we don't look ourselves what we actually are.

The time spent during our field work in Malekhu with our respected teachers and friends is unforgettable. To gain knowledge practically in front of the eyes and to analyze their importance was really a great achievement for me. The field works like map preparation, stratigraphy and the methods of working and the objectives of work was very much interesting. Besides to know friends and teachers remaining there as a same unit, was also a great experience.

After studying nearly about 3 years I am interested in the engineering geology. Also to work in the construction works and to put my knowledge there would be just a pride for me. As a whole every topics in geology is very interesting and somehow interrelated to each other so we must have sufficient knowledge and preciseness in every topics of geology.

In the upcoming 10 years, hope I must be a good engineering geologist and serve for the betterment of society, nation as well as the whole world.

Year of admission: 2067
Name: Dipendra Thoklihang
Roll No: 1405
Subject combination: Geology, Botany,Zoology
Email: nisum_hene4@yahoo.com

I am from Eaktin V.D.C. , ward no. 4, Panchthar. I started my primary level at Shree Motiram School, which is situated near from my village. After finishing my class five, I joined Shree Sidhheswori School. I came to Kathmandu after completing my D.L.E (class-8). I joined at class-8 in Padmodaya Higher Secondary School, which is well known government school. After completing my S.L.C. from there, I joined plus 2 at Sagarmatha Multiple College, Dillibazr, Kathmandu. I tried for M.B.B.S but couldn't get success at that field so after gapping one year, I joined at Tri-Chandra Campus. I heard about the scope of the geology from my friend so I joined geology. I was curious about the first class of geology which I was going to attend. In first class of geology I was very much inspired by the lecture provided by the lecturer, which changed my dream of life. I started to dreaming to be a good geologist in future.

The best book I have read is 'Seto Dharti' written by Diamond Shamsher. The unforgettable moment on Tri-Chandra Multiple Campus is that 1st year and first lecture of geology. That lecture inspired me to continue my dream for geology. From three years of bachelor in geology, I learned many things mainly about earth. Im proud to be a student of this college. I have a dream to be a specialized geologist in future and I will work hard to achieve it. At last, when you want something from your inner heart, god will help you to achieve it.

Year of Admission: 2067
Name: Drona Adhikari
Roll No: 832
Subject combination: Geology, Physics, Mathematics
Email: dronaadhikari92@gmail.com

I was born on 2049/07/22 in Dulari-2, Morang. I completed my school studies from Shree Sajilal Higher Secondary school, Sunderpur-9, Morang and completed +2 from Ambition Academy Higher Secondary School and College, Kathmandu. After completion of +2, I didn't try other fields of applied sciences like engineering, medicine, agriculture etc because I was fully confident and dedicated with myself that I will study the pure science either Physics or Biology. My brother Mr. Ramesh Adhikari, ex. student of Trichandra college, physics department, council led me about the subject geology, its coverage, its scope and other information that interested me towards the subject. When I attend the lectures of Geology in Ghantaghar, the first thing that stroke on my mind was the classroom, mass of students, system of teaching, which was totally amazing for me.

I have gone through some literature as well as some spiritual books too. I specially loved the novels of Paulo choelo. I love the books and articles and documentaries which are related to the facts of Physics and Geological History and information's.
The mystery of origin of Earth, land, sea, plates, position of plates in different times, formations of mountains, Geological study of evolution, about minerals, rocks, geological structures and the other geo-related informations, I m getting the ideas one by one in progression by different means of Lecture's book, documentaries, research papers, field excursions etc. I want to thank all the teachers of geo-department for being so dedicated and so caring and co-operative

After studying nearly about 3 years, I am interested in the engineering as well as environmental geology. It helps in proper construction works, like construction of tunnels, dams, roads, bridges etc. And the environmental geology gives the knowledge and relationship between the two very closely interconnected geology and environment.

With the reference and mentioned facts above and on the basis of wisdom on myself, I would expect to be a competent geologist in 10 years from now.

Year of admission: 2067
Name: Durga Khatiwada
Roll no: 994
Subject combination: Geology, Botany, Zoology
Email: mailatdurga@gmail.com

I was born in Khotang, Simpani but I spend my childhood in Gothatar, Kathmandu. I completed my S.L.C from Greenwich Academy and passed plus two from Columbus H.S.S. New Baneshwor, Kathmandu. After passing my plus two level, I was wandering the right door for my future opening so as of other students I also gave medical examination of national level where I could not get my name in scholarship list but I got scholarship only in international level but the time and situation of that time did not favoured me to go to abroad and today I think the department of geology was seeking my need so I lost that and got admitted in Tri Chandra Multiple Campus to be the student of geology.

The first day when I came to the college, I was all alone ,had no idea about Bachelor study but when I heard about Geology Department and its practice of teaching it made me able to think once because it was the study of earth and finally I involved in this subject matter as future study of my career. I was much more fascinated by the fact that geology can tell us everything about the formation of the earth to the evolution of the life in earth.
About the best book I have gone through till this date is ''The Positive Way To Change Your Life'' by Norman Vincent Peale which tells about what we think and while a positive attitude of mind can literally change our life ,a negative frame will ultimately destroy us and the Nepali book is "Jeewan Kanda Ki Phool'' by Jhamak Ghimire who has inspired me to work and dedicate on the motto of the life till the end of life as obstacles, pain are the ladders of success for a devotee to reach its destination.

The most unforgettable event during my Bsc.1 year was the 1st leacture of Dr.Tara Nidi Bhattarai on Physical Geology which clarifies to me why geology is studied? So, with much patience and enthuthiasm I studied my 1st year .About the field excursion along Chobhar and Kakani during 1st year and along Malekhu on 2nd year made me practically think about the field knowledge and its implementation on theory knowledge. Hence, these became the most unforgettable moments of my Bachelor level study.

Besides the academic knowledge, the study of Geology has encouraged me to be self-dependent, punctual and alert for every phases and assignment of my study as well as life. I got the knowledge of team work and group study. Among the topics I learned in Geology the most interested topic for me was Physical Geology as it gives the detailed study of geomorphology, glacier, rivers, terraces, hills and the factors of environment. The topic of Engineering Geology in 3rd year has much more attracted me on this subject as it deals with the construction of various infrastructure of development which was topic of mine interest. The study of Exploration Geology, Paleontology, Stratigraphy, and Sedimentology has helped me a lot to enlarge my area of interest. Hence, I like every topics of Geology as it gives information of the past, present, and helps to predict the future. Being the sincere student as I have attended almost all lectures and practical classes and considering the factmentioned above and also based on my ability to explore and implement my own wisdom,I would expect to be a proficient geologist in 10 years from now.

Year of admission: 2067
Name: Govind Joshi
Roll no. : 435
Subject combination:-Geology, Physics and Mathematics
E-mail:- zoc.govinda@gmail.com

I was born in Amargarhi Municipality, ward no: 02, Dadeldhura. After few years we moved to Bhimduttanagar Municipality, ward no: 18, Kanchanpur. I completed my schooling from Adarsh Vidhya Niketan Higher Secondary School, Mahendranagar, Kanchanpur and +2 from Radiant higher Secondary School, Mahendranagar, Kanchanpur.

After completing my +2, i moved to Kathmandu for my further study. I tried for engineering course but I didn't succeed. To give continuity to my study I got admitted to Tri-Chandra College. I have no idea which subject to study, one of my brothers suggests me to study Geology, so do I do. After attending few clasess, I got realized that this is the subject meant for me and I find geology a fascinating subject.

The best book I have read yet "Revolution 20-20" written by Chetan Bhagat.

During first year I have attended very few classes as I was trying for abroad study. But classes attended during that time were very great because I got many new friends. It was also new experience for me because I have never study in such a huge mass.

During second year, I got real chance to know our world more closely, because we had field trip to Malekhu for 17 days, and during field work we had many good and bad memories.

Third year was very much for me I think, because I got an opportunity to attend a 24 days field work with American students in Muglin-Pokhara-Mustang-Muktinath area. I am very thankful to Department for providing that golden opportunity. Third year was more practical than other year I think. Rock engineering is the most fascinating subject in 3Rd year I found.

I hope, I will be Geologist with 3 P's.

Year of Admission: 2067
Name: Gunanidhi Pokhrel
Roll No: 908
Subject Combination: Geology, Physics, Mathematics

I was born in Karnal, India but after 6-7 months of my birth our family returns to our village Khana VDC ward no.-2, Lutipokhari, Arghakhanchi. When I was at 7, I came to Lalitpur with my father to further study. I attended other two schools, before completion of SLC board from government school named Bal Vinod Madhyamik Vidhyalaya located in Nah:Tole Lalitpur. I had completed HSEB (10+2) board from CPS College, Kumaripati.

After finishing 12th grade, I had tried for Bachelor in Engineering in Pulchowk Engineering Campus but I can't get success to enter there. Then I got information about Trichandra Multiple Campus where we can choose different subject. Among the different combination, GPM I liked most. Then I admitted to Trichandra Campus for the course of 3rd year B.Sc. Nobody told me before that Geology can be studied in Bachelor level in Nepal. This subject attracts me since Childhood. We went to educational field trip in Malekhu for 17days in B.Sc 2nd year and in 3rd we are going to Tansen-Butwal field trip for 21 days which are also contents of our syllabus in Geology. I admit that I could not paid good attention to geology classes during 1st year course. When slowly I got more and exciting knowledge about geology then only started to concentrate in geology subject matter seriously. Although I have learned many fascinating knowledge of geology, I was much delighted to know that a grain of sand can tells us a long history starting how rock was formed in a deep sea, exposed to atmospheric environment and subsequent erosion.

The best book I have gone through until that time was '**Palpasa Cafe'** Written by Narayan Wagle in 2005 and Published by Nepa-Laya, Kalikasthan. Writer Wagle was awarded by prestigious Madan Prize for the same book. The best book published by foreign author is '**2 States: The Story of My Marriage**' Novel by Chetan Bhagat in 2009 and published by Rupa Publication. It is the story about a couple coming from two different states in India, who face hardships in convincing their parents to approve of their marriage.

In my life, till this point, life encourage me to commitment that there is nothing important than support and raise voice for any positive aspect, how far you go in life depends on your being tender with the young, compassionate with the aged, sympathetic with the striving and tolerant of the weak and strong. Because someday in your life you will have been all of these.I got to know that Geologists study the earth in order to perform tasks like predicting natural disasters, finding natural resources and finding solutions for changes in climate. These scientists have extensive knowledge about the earth's materials, their structure and how they are formed. Geologists also understand the earth's processes and how they affect the environment. Geology students start by learning the basics of earth science. They study how natural occurrences like floods and earthquakes affect life and how people can plan and prepare for them. Students learn about the raw materials (like oil and water) that make up the planet and how they can be used in everyday life. Finally, students learn to examine the layers of the Earth to understand how it has changed.

Those who are interested in pursuing a bachelor's degree in geology have a strong background in science and math, since these are knowledge areas geologists will likely use in their everyday work. Though a bachelor's degree is enough to obtain entry-level employment in the field, many individuals choose to earn advanced degrees. At the master's and doctorate level, students are able to specialize in a particular field of interest, for eg. hydrology (water studies) or volcanology (study of volcanoes) and focus their career in that area.

Year of admission-2067
Name-Harish Dangi
Roll no-670
Subject combination-Geology, Statistics, Mathematics

My birthplace is bardiya which lies in Midwestern development region of Nepal. I studied in GGN Boarding school up to class 5 in my birth place. For the better education I was transferred in Nepalgung. I did my slc in Jayabageswari Higher Secondary School and did my +2 in Modern Public higher secondary school of Nepalgunj.

I always loved adventure. Travelling in new places and enjoying with nature (evaluating unique structures, rocks, cliffs etc) always made me fascinated and resulted into my deep interest. slowly it became my hobby and I started to search both my prefect future and hobby in a single career which dragged me here in department of geology , trichandra college which was one and only the college having this department. Besides this when I entered in the class room I saw the way of studying , interaction with student and sir, management of department etc pulled me toward the administration to get me admitted in the combination (GSM)

I want to share my little experience which I got from day of my admission to till now. First of all I got a opportunity to become more social. Me and most of my fried never lived for academic purpose ie field study away from home for nearly 20 days. This gave us to know us, know our way of living, studying, etc. and projected the real future of Geologist. Beside this I noticed that this subject have full of suspense material which is compacted and cant be evaluated by a normal personalities. I got each chapter and each knowledge interesting and interesting day by day. This subject gave me so much potentiality and excitement in study that I never blamed my self choosing this subject. it made me feel glad because this subject is directly related to nature , whole earth, even we can say whole explored universe and plays an important role in the life each living creature in this earth.

At last I want to thank the Department of Geology and Geo club which gave me this opportunity to express my own words. I wish this will be helpful for new generations to get some knowledge of geology and can know about the department of geology.

Year of admission: 2067
Name: Ishwar Adhikari
Roll No. : 436
Subject combination: Geology, Physics, Mathamatics

I was born in Syangja diostrict, Malunga V.D.C., Ward No. 1, Bhedabari village. I completed my secondary level education from Shree Sarbajanik Higher Secondary school, Syangja and complited higher level education from Hill-Town International Higher Secondary School, Kathmandu. After completing +2 I was planning to study engineering but all dreams never comes to be true. So I chose Tri-Chandra College for my further study. Knowing from friends and other sineor brothers, I decided to study Geology and admitted in Tri-Chandra College.

I was interested in singing song in my childhood but later my hubies changed into writing poem, 'Gajal', reading novel and articles. I love visiting new place most. This also forced to resd me geology in 3rd year.

In 1st and 2nd year, I have many friend but in 3rd year, most of them study physics. So only few Known friends remains in Geology class so that I am introduced with many friends in 3rd year. They all are kind, helpful and also intelligent. Chhabilal, Purushottam, Sameer, Madhav, Narayan, Sujan are my best and close friend who I never can forget.

Geology is on of the field oriented subject. This open eart is the laboratory for geology. Knowledge of geology is utilized to change this world through development. These things attracted me to study geology in 3rd year.

Besides my personal events and accident, the most unforgotteble moment during my second year study was a fieldwork at Malekhu. I learnt many basic knowledge about geology there. I am thankful to my friends for their kind help and I am impressed to our teacher for their valuable suggestion, guidence and friendly co-operation.

I am very very thankful to my parents for their support in my study. They are real alive god for me. I want to serve this country after the compliction of Study. If my wishes come true, I would serve this country as an officer of Government of Nepal.

Year of Admission: 2067
Name: Ishwor Gyawali
Roll No: 79
Subject Combination: Geology, Physics and Mathematics
Email: ishwor.gr8@gmail.com

I was born inKapan-3 Akashedhara, Kathmandu. I completed my schooling from Sun Shine English Boarding School Bhairahawa and Reliance International Academy, Chabahil Kathmandu and I joined +2 in the same Reliance International Academy, Chabahil, Kathmandu. And finally with the help of some of my friends I joined the historical Tri-Chandra College taking geology as my majors.

The best book I have gone through is **'Jay Bhundhi'** by Bhairav Aryal. The most important part that I liked in this book is that we pile up our works in a lazy way to do it tomorrow which never comes.

Every time in the college was memorable. The inspiring lectures of the professors and the supportive friends made my journey full of memories. The time spent during our field work in Malekhu with our respected teachers and friends is unforgettable. To gain knowledge practically in front of the eyes and to analyze their importance was really a great achievement for me. The field works like map preparation, stratigraphy and the methods of working and the objectives of work was very much interesting. Besides to know friends and teachers remaining there as a same unit, was also a great experience.

After studying nearly about 3 years I am interested in the engineering geology. Also to work in the construction works and to put my knowledge there would be just a pride for me. As a whole every topics in geology is very interesting and somehow interrelated to each other so we must have sufficient knowledge and preciseness in every topics of geology.

In the upcoming 10 years, hope I must be a good engineering geologist and serve for the betterment of society, nation as well as the whole world.

Year of admission: 2067
Name: Jeevan K.C.
Roll.no: 1463
Subject combination: Geology, Botany, Zoology

I was born in Arghakanchi district, Khidim V.D.C, ward no-5. During my childhood, my family migrated to Dang and currently my temporary resident is in Dang, Tulsipur. I attended my early schooling in Saraswati Medium Sohool up to class seven and I passed my SLC from Adarsha Academy School, Tulsipur. I attended plus two educations from Sagarmatha Multiple College, Dillibazar, and Kathmandu. For my Bachelor education I joined the historical college of Nepal, Tri-Chandra Multiple Campus, Ghantagar, Kathmandu.

Really, I have not read any novels completely till the date but I love watching movies and dramas rather than reading books and novels .Watching the national and international novels in the form of movies attracts me a lot.

The B.Sc. 1st year study of mine was not good because of my diversion of study towards medical entrance preparation so I couldn't secure good result in the 1st year. With much depression and hopeless thoughts for the life, I was entered in to the Tri-Chandra College but when one of my friend suggest me to study Geology and informed about its scope in future and its working area I was attracted towards the subject matter. The teaching style of the teachers and the friendly environment within the Department of Geology between the teachers and students encouraged me further to be the student of Geology.

During the field work in Chovar and Kakani on my 1st year and in Malekhu in 2nd year, I got chance to visualize the theoretical knowledge practically in the field. Besides it, I learnt the basic ways of life i.e. time management, group works, alertness, punctuality and the way of living independently in life after being the student of geology.

I got knowledge about the Engineering Geology, Paleontology, Sedimentology, Economic Geology and GIS during my 3rd year study. These helped me a lot to know about the various geological evidences, facts, formation of the earth and various geological phenomenons. Hence, today I have keen interest in the subject matter and feel proud to be the student of geology.

Considering all the above facts mentioned, based on my own wisdom and my dedication on the subject matter I would expect to be a competent geologist on coming 10 years' time from now and would be able to contribute something new as a geologist for my country, Nepal.

Year of admission: 2067
Name: Jharendra K.C.
Roll No:10
Subject combination: Geology, Chemistry and Mathematics
E-mail: jharendra_kc@hotmail.com

I was born in Ashwora, Tulshipur, Ward no: 11, Dang. I have completed my primary schooling form the local school and received secondary education along SLC from Janajagriti Gyan Reshmi secondary school in Baljutar, Kathmandu. I did my +2 level educations from Sigma College in Shorakhutta, Kathmandu. Then I joined Tri-Chandra Campus aiming to study Bachelor level education in geology. Everything that encountered with Tri-Chandra Campus amazed me very much and I shared my feeling with my parents.

When I started my classes I came to know that our teacher are such a qualified personality to whom I always admired. Initially, I tried for engineering but could not make it out for 100% scholarship. For such replacement of my own passion of engineering, I found geology as a better source which can be affordable for me.

Basically I am very much decent and laborious person I do not talk that much and can not open with friends that easily. Sometimes such nature cannot withstand with my goal. I have to work on it.

I am very much fond of literature and I also write sorts of poems, gajal and stories. I love reading books, listening music and watching movies.

Teaching students fascinates me so I used to take some classes in a school. I've joined youth oriented organization, Nepalese Youth for Climate Action (NYCA). It upgrades my external knowledge of networking and build up my confidence.

The days I came across in my first and second years totally blessed me with knowledge and self motivation learning about origin of earth, groundwater, rocks and structures made me feel great and I could easily choose geology as my major subject in third year.

Finally I like to thank my teacher and friends who are in the editorial board for giving me such an opportunity of writing some words from my side for the marvelous work of publishing the bulletin.

Year of admission-2067
Name-Jyoti Karki
Roll no-1364
Subject combination-Geology, Botany, Zoology
Email-karkijyoti@gmail.com

I was born in February 22, 1992 in Indrayani, VDC .ward no-1, Sankhu, Kathmandu. I attended Dhrubatara Boarding High School, Buddhanikantha and passed my SLC from there. After that I attended Mahendra Bhandaari Memorable College and completed plus two from there. After that I decided to read Environment Science. I visit so many colleges for that but Tri-Chandra College attracts me a lot because of affordable fees and the historical building which I used to look surprisly in my childhood ,the Ghantaghar. I took some classes of environment science and one day in my botany class I met a friend of geology. She told me a lot about the geological field works and the lectures. And the most attractive part is there is the combination of GBZ, no chemistry. So I finally I decided to read Geology.

The best book that I have read is "**Shrisko phool** "written by Parijat, Bishnu Kumari Waiva. Reading the book I got the message that ''A simple thing can affects the human life seriously'' .The writer has compared the life of the main character with the flower of Blue mimosa. She has beautifully explained the psychology of different aged people.

The time which I have spend with my friend is the most memorable and unforgettable moment. I have got many friends who helped me and gained so many happiness as well as knowledge from my friends. I heartly thanks to all of them.

During the field works of Malekhu, I realized that choosing Geology was my best decision I have ever made. Geology is the subject in which we can read with the fieldworks. The field works helps a lot to understand the geology so I choose Geology as my major subject in 3rd year. Now I am excited to get more knowledge of geology as well as the field works of 3rd year.

Year of Admission: 2067
Name: Kamal Kafle
Roll no: 1049
Subject Combination: Geology, Botany, Zoology

I was born in thumki village ward no.5 Rapakot VDC,Syanga.I did my slc from tarun seceondary school which is in my village .After completing SLC I came to Kathmandu for my further studies.I did my high school or+2 from NIC(National Integrated collage).After my +2 I directly joined Tri-Chandra Collage.I took the class of Botany,zoology,Geology. Then I decided to take GBZ combination.

I was inspired to read geology because the classes were run by using computers and projectors .In first year I liked physical geology most because its seems intresting to me.I was intrested to know the land forms made by various geological agents. In my second year I enjoyed geology of Nepal Himalaya most because I could know about the geology of various places of my country. Then in our second year malekhu field work I learned a lot about geological field techniques. I learned about geology of central Nepal, route mapping, geological mapping. In third year course I liked palentology most because I was always curious about plants and animals that existed millions of years ago. In third year palpa-tansen field work I learned about geology of western Nepal, siwalik,kali gandaki super group,tansen group rocks.

I hope to be a good geologist in next five years.

Year of admission: 2067
Name: Karishma Khadka
Roll no: 1267
Subject Combination: Geology, Botany, Zoology
Email: kari.khdkn@gmail.com

Today I feel proud to be a student of geology and happy that my decision to study geology was the best decision of my life.

My home town is Melamchi, Sindhupalchowk. I grew up in Kathmandu. I attended Gyankung Higher Secondary School situated at Ravibhawan and completed my +2 from the same college. I have gone through several books of national and foreign writers. Some of my favorite are 'Palpasa Café' by Narayan Wagle, 'Sirish Ko Phool' by Parijat, 'Sumnima' by B.P. Koirala, 'Munamadan' by Laxmi Prasad Devkota, 'The Notebook' by Nicholas Spark, 'Harry Potter' by J.K. Rowling, etc.

After completing my +2, initially I was in dilemma about further study. The first lecture of geology attracted me and encouraged me to study geology. I heard that Geology Department has a disciplined environment with regular classes. So the search for the option after my +2 is finally over. Finally I joined Tri-Chandra Campus to study geology. My childhood Friend also encouraged to study geology with me.

Because of a new environment, I couldn't pay good attention during the first year. The field works at Dakshinkali and Kakani during the first year motivate me to continue geology as bachelor study. While coming in second year, I was interested in the Geology of Nepal Himalaya. Field work in Malekhu encouraged me a lot to select geology as a major subject in 3rd year. The field work in Palpa-Tansen area helped me to gather knowledge in the field of geology. Besides, it taught me aout time management and team work also. The memory of field work will be embedded in my heart forever. Today, I am at the end of 3rd year, I am learning and there id much more to learn. I love geology and respect it. I would expect to be a good geologist in future.

Year of admission: 2067
Name: Keshav Shrestha
Roll No: 075
Subject combination: Geology, Statistics, Mathematics
Email:keshavshrestha7@gmail.com

Hello it's me keshav shrestha all the way from Balkot, Bhaktapur. I am fun loving guy. Playing football, reading book, and cooking is my best hobbies. I have done my schooling from Madhyapur Model English School located at Ghathaghar, Thimi. At that time I liked math and science books, it's very interesting to me. I joined +2 in Premier College New Baneshwor, Kathmandu. Then i tried for IOE but i can't get scholarship in Pulchwok Engineering College. Then I don't want to join private Engineering College although forced by parent. At that time I heard about Tri-Chandra College by friend. After that I and my friend visited college and luckily I found geology subject.

It is very interesting subject. Now a day I don't regret for not joining engineering. Geology is such subject which makes students capable in working in unity and build up attitude. Due to geology class I know about history of earth by only a piece of rock. Those days i use to throw a piece of stone in river but now a time i am busy in identify minerals present in that rock.I know about process of earthquake, tsunami, etc. I teach these things to my brother and friends. Another interest of being student of geology is field visit. I can know about compass handling and mapping. Route mapping, geological mapping is most important in field work. Actually I think as geologist in field work. I also want to be engineering geologist like my respected teachers. My teachers are also a good and mapping friendly.

Lastly, thanks to all of my lovely friend and my respected teachers and also a many thankful to geo club.

Year of admission: 2067
Name: Khagendra Dahal
Roll No: 790
Subject Combination: Geology, Statistics and Mathematics

I was born in Budhabare VDC, Ward no 9, Jhapa. I completed my school level education from Mahananda Shiksha Sadan, Budhabare then I passed my I.Sc. level education from Mahendra Morang Adarsha Multiple Campus, Biratnagar. Then I came to Kathmandu to join Bachelor level education, I was first admitted in Tri-Chandra Campus in the combination of Physics, Statistics and Mathematics. After two months of regular study in the same combination I met a friend Saroj at KIC tuition centre where I was taking tuition classes of Mathematics. I was excited to know about Geological studies and it scope in near future. Then I changed my combination and admitted as a student of Geology. I was late to take my regular classes so I took help of the same friend to meet my left studies. As I am from a family of poor background so I was involved in a job at day so was unable to take lectures but attended the practical classes.

The best book I have gone through until that time was "PALPASA CAFE" which was written by Narayan Pd. Wagle. The best thing about this book is that, it includes the situation of Nepal and worries and fear of Nepalese during the Home war of government and Maoist. Similarly, the best book I have gone through published by foreign author is Adolf Hitler, named "Mein KAMPF (My struggle)" which is about his self confidence and leading power of an ordinary person.

I knowledge and wisdom that I have gained during my school life has encouraged me to be self reliant and hard working. I have learned many fascinating knowledge of Geology; I was much delighted to know about sea level change and its influence on making different types of structures. While coming at the end of second year. I was interested in Structural geology the most. It tells all about the geological structures formed because of tectonic activities. It encouraged me to choose Geology as my major subject in my 3rd year study.

Studying Geology in 3rd year was more fascinating because of field work, occasional lectures by renowned geoscientists, workshop on "Underground Excavation, organized by the department. During third year study, geological mapping attracted me a lot. It was an indispensible tool to know how rock types and geological structures are changing horizontally and vertically in an area. This information plays an important role not only to understand natural process that occurred in the past and presently prevailing now but also helps us to design various infrastructures in an environmental friendly manner.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be an expert of Lesser Himalaya.

Year of admission: 2067
Name: Kiran Pandey
Roll no. : 330
Subject combination: Geology, Physics and Mathematics
E-mail: pandeykiran80@gmail.com

I was born in Dhangadhi municipality, ward no. 13. I completed my schooling from Siddhartha Shishu Sadan Higher Secondary School, Dhangadhi, Kailali and completed +2 from National Academy of Science and Technology (NAST), Dhangadhi.

I was interested in geology from my school days. When I first visited Ghantaghar, I saw Department of Geology and get admitted.

The best book I have read until this time is "The Alchemist" written by Paulo Coelho. The book conveys "there is only one thing that makes a dream impossible to achieve: the fear of failure". The best book I have gone through by a Nepali author is "Seto Bagh" by Diamond Sumsher Rana.

The unforgettable moment during my first year study was meeting new friends, studying in a huge class, get interacted with seniors involved in politics. Seniors were very helpful during admission, in library stuffs and they suggest us not to miss any opportunity to utilize the facility available at the collage.

During my second year, I was very much interested in Nepal Himalaya. Studying this subject I got to know the process of Himalaya formation and other aspects of Nepal Himalaya. Field work in second year was very fruitful. We were in a real laboratory where we made geological map, identified rock type in the field, saw many geological features like fault, fold, we learned how to work in group.

Studying Geology in third year is even more fascinating. Third year course is an application of knowledge we earned in first and second year. Practical in third year is very interesting.

My days, studying geology in Ghantaghar is going very well. Based on my own wisdom, I would except to be a good geologist and will be fruitful to the country.

Year of Admission: 2067
Name: Madhav Paudel
Roll No: 605
Subject Combination: Geology, Physics and Mathematics

I was born in Basauti V.D.C Ward No 5, Kailali, I attended National secondary school, Kailali& Completed +2 from Carribean College, Manbhavan. I admitted in Bachelor level for B.sc at Tri-chandra campus from by elder geologist /brother suggest me about geology & it's scope, Geological application in Nepal Context.

The best book I have gone through until that time was ," You Can win" written by Shiva Kheda publication by international best seller Kathmandu. The message of that book was "Winner's do not extra work than other but they do work in extra way", similarly the best book I have gone though was "The Secrete" written by Rhoda byne, Trans cafion published by peach pokhari prakashan ktm. The best message of that book was "Everything Lost by someone, how they received that it is depended up on his/her present work.

During first year, I stated Concentration in my study Geological course. I had learned many fascinating knowledge of Geology, Physical in geology dealt with physical or Science i.e.Glacial River Wind water in structural geology, I lean about fold fault, rapture etc & mineralogy we studied about different minerals. We observed Two days Dakshinkali & Kakani area.

Supposing the fact mentioned above & also on my best wisdom, I would expect to be a university professor in ten years time from now.

Year of Admission: 2067
Name: Madhavi Regmi
Roll No: 399
Subject combination: Geology, Physics, Mathematics
Email: regmi_madhavi@yahoo.com

I was born in the capital city Kathmandu, addressing permanently in Kumarigal -07, Kathmandu, Nepal. I spent my childhood attending as well as changing many schools, some inside Kathmandu some outside valley i.e. in Pokhara. I completed my school studies from Arunima Higher Secondary school, Kathmandu and completed +2 from Kathmandu Donbosco Higher Secondary School and College, Kathmandu. From my early childhood may be when I was in 5th standard, we used to have very basic knowledge on geology in the course, and I would become very interested while studying the various rock types i.e. igneous, sedimentary and metamorphic. During the passage of time my interest was overcome by different tuff course further. But after +2 when I came to know that geology can be taken as a major subject in higher studies too my exciteness knew no bound. So from the dilemma either to go towards engineering or geology, I selected geology. And finally I became the part of this historical Tri-Chandra college, Ghantaghar, Kathmandu.

Either by some external pressure or by my own interest I have gone through some literature as well as some spiritual books too. The holy book 'Gita', 'Nitislokas', 'lalitya'- a poem collection book by Kabi Siromani Lekh Nath Poudyal, 'Prasnottar' by Lekh Nath Poudyal etc. The most touching thing throughout study of these books was a sloka of a poem by Lekh Nath Poudyal…….

Mero jiwana puspako jagatale paaos meetho basana
Aaos saurava bishwako pani ma..ma. bhanne vaye chahana
Aafuma timi dosh khoja gunako garbipana dur hos
Arkaka guna khoja dosh haruko charcha chiyo kyai naa hos…

Though I was interested in geology, I admit I didn't pay attention during my first year because of some environmental factors or I may say due to my weakness. Every moment in Tri-Chandra especially in our own Geology Department is unforgettable. Each and every time new knowledge gain either by listening to teachers or by discussion with friends was always fascinating and wonderful experience. The field works and presentations made the moments more special and unforgettable. Also to study about geology from the smallest unit to the whole world is a mystery.

After studying nearly about 3 years, I am interested in the engineering as well as environmental geology. It helps in proper construction works, like construction of tunnels, dams, roads, bridges etc. And the environmental geology gives the knowledge and relationship between the two very closely interconnected geology and environment.

With the reference and mentioned facts above and on the basis of wisdom on myself, I would expect to be a competent geologist in 10 years from now.

Year of admission: 2067
Name:-Mahendra Maharjan
Roll no. :-508/067
Subject combination:-Geology, Statistics and Mathematics
E-mail:- mahen.m10@gmail.com

I was born in Kirtipur Municipality, ward no: 11, Panga. I completed my schooling from Panga Secondary Boarding School, Kirtipur-9, Kathmandu and +2 from Gauri Shankar Higher Secondary School, Kalimati, Kathmandu.

After completing my +2, I got admitted to Tri-Chandra College. I have no idea which subject to study, one of my friends suggests me to study Geology, so do we join together. After attending few classes, I got realized that this is the subject meant for me and I find geology a fascinating subject.

The book I have read couple of year back is "**Leaving Microsoft to change the world**" by John Wood and translated in Nepali by Khagendra Sangraula.

During first year I have attended very few classes enjoying with old high school friends. But classes attended during that time were very great because I got many new friends. It was also new experience for me because I have never study in such a huge mass.

During second year, I got real chance to know our world closely, because we had field trip to Malekhu for 17 days, and during field work we had learnt more about Geology and also had some good and bad memories.

Third year was more interesting than other year because I choose Geology as major subject.

I hope, I will be Geologist with 3 P's.

Year of admission: 2067
Name: Manish Shrestha
Roll No: 536
Subject combination: Geology, Statistics & Mathematics

I was born in Sitapaila, Ward No. 1, Kathmandu; I completed my School Leaving Certificate from Dallu Awasiya Vidhyalaya, Kathmandu and completed my +2 from Sirius College, Bafal, and Kathmandu. I admitted for Bachelor of Science for my bachelor level at Tri Chandra College.

The crowd of students in a large hall on first day made me confused about how I am going to complete my study; in a sense I was scared. I still remember days when I and my friends used to have discussions for seat with other students but as the day passed I got used to with these situations. First I was confused to choose my subjects which to choose and which to leave and one of my friend told me about Geology, just after I listened the word geology I was interested because it was new for me and chose this subject along with Statistics and Mathematics.

I had a busy schedule from the beginning, I had to attend my college in morning and then I had to take periods in a school where I taught Computer science and still I am teaching. This job made me difficult to attend the class of second year but however managed to self study. I would thank to all my friends who helped for covering my classes knowing my problem.

Being bored with theoretical subjects geology boost up my studying habit geology didn't only made me study but each day I study I could learn new things along being a practical subject I was much more interested in this subject. After geological field visit to Malekhu, Dhading I got opportunity to know how the geological study is carried practically along with this I got opportunity to make many new friends also.

Coming to third year I was very happy because Professor from Central Department and the top teachers taught us they didn't only taught us but also inspired us to study more and be familiar to the field of geology practically. Every day, every teacher and every subject of geology fascinated me.

Not only geology I am interested in many other field computer programming, web page designing, cooking and travelling. I recently visited the Safrubesi, Rasuwa I got the opportunity to visit Chilime hydro power project, the tunneling of the project made me no words to describe about how the engineering geology help to create such a world inside that hill and not only that it made me think how important the geology is in every field and even very important for developing countries like Nepal. This made me more interested in studying geology seriously.

Still there is a long way to go in the future I will further continue my study of geology and become a good geologist.

Year of admission: 2067 B.S.
Name: Maria Maharjan
Roll No.: 1185
Subject combination: Geology, Botany, Zoology
Email: mariya.maharjan@gmail.com

A few minute bus-rides from the heart of capital, there is a beautiful place, Chobhar, my birth place lies in the Kritipur Muncipality. I passed my S.L.C. from Gyankunj Higher Secondary School, Ravibhawan, Kathmandu and completed my plus 2 from the same school. After plus 2, I started preparing for MBBS and when I failed to appear in the merit list, I joined the very known government college i.e. our Tri-Chandra .

I joined this college for studying Micro-Biology but I was inspired by my childhood friend to study 'Geology'. The subject combination 'GBZ' where one doesn't have to study Chemistry, the field trips to different places during bachelor level's study attracted me a lot. I heartly want to thank my friend for inspiring me to choose this subject where we can get the information of the past, present and even can predict the future events of the earth.

The best book I had gone through till the date is 'Muna Madan', written by Laxmi Prasad Devkota and published by Sajha Prakashan, Kathmandu; which conveys a message that a man is considered to be respectable by his deeds, not by his cast.

Most of the days spent at Tri- Chandra, as a student of Geology are memorable but the most unforgettable moments were those 17 days that we spent at Malekhu for fieldwork during our second year. The fieldwork at Malekhu Area has encouraged me a lot to select Geology as the major subject in 3rd year. Fieldwork not only provided geological information, but also gave a golden opportunity to make closest relationship between teachers and studentsas well as taught the importance of team work. Similarly the 19 days field trip to Tansen Area also halped us to gain more knowledge and know many more interesting facts on Geology.

Year of admission: 2067
Name: Navin Thapa
Roll No: 518
Subject combination: Geology, Physics & Mathematics
E-mail: ecall2nbn@gmail.com

I was born in Basali, Barhmatola V.D.C, Ward No. 2, Bajura; I completed my School Leaving Certificate from Shree Panchodaya Higher Secondary School, Dhangadhi, Kailali and completed my +2 from National Academy Of Science and Technology(NAST), Dhangadhi.

Knowing information about geology course in Nepal from friend's uncle I had a pioneer interest in geology. I admitted in Tri-Chandra College which is one and only college having Bachelor degree in Geolgoy. The main funny and interesting part at that time was I didn't have any idea about Ghantaghar attached with my college. When I visited Tri-Chandra College I came to know that Ghantaghar is part of my college for the first time and I shared photo of Ghantaghar in my facebook wall.

The best book I have gone through until that time was **Jeevan Phul Ki Kanda** by **Jhamak Kumari Ghimire**, Kathmandu. The book convey a message that the life is full of thorn, hindrances however, we can get through it by own grace, positive thought, steady struggle and fateful timing. Similarly, the best book I have gone through, published by Rupa Publication, Delhi by and Indian author Chetan Bhagat is, **Revolution 2020.** It gives us message of struggling life for achieving a goal. It evokes us to see one open door behind hundred closed doors of opportunity.

I admit that I could not paid good attention to geology classes during my first year courses. I was trying to get admission in B.Sc in Animation and Film making but I miss my admission session due to Passport problem and my mind change and I started concentrating my study in geology course seriously.

The most unforgettable moment during my first year study was field work in Dakshinkali and Kakani for two days for the first time. It helped me to get introduce with some friends. My friends help me in sharing notes.

While coming at the end of the second year course, I started liking paleontology which teaches us about the life and creature in the geological past. And in third year I got interested in engineering geology which enables us to reduce disastrous consequences in construction. I'm expecting that I would be a successful and competent geologist in my future.

Year of Admission: 2067
Name: Nawraj Sapkota
Roll.no: 1058
Subject combination: Geology, Botany & Zoology
E-mail:sapkotanawraj8@gmail.com

I was born in Malika V.D.C, Ward No. 3,Chautara, Baglung. I have passed my S.L.C from "Shree Malika Higher secondary school", and completed +2 level from National Integrated College (NIC), Dillibazar Kathmandu. After completion of intermediate level from NIC, I went NIMS institute for MBBS entrance preparation. But, I was not appeared in entrance exam, because I was attracted towards Vetnary science. So I went to Rampur, Chitwan for the entrance of Vetnary doctor in "IAAS" (Institute of Agriculture and Animal Husbandry). However, I could not get succeeded. Then I came to Tri-Chandra college to get admission in environmental science because one of my senior brother suggested me.

When I was came Tri-Chandra First time I heard about the geology department and went to visit it. I heard lots of things about geology from others students in Tri-Chandra. Rest of that the low no of students and projector taught method forced me to get admit in geology rather than environment science. The best book I have gone through until today by Nepali writer is "Jhola ''by Krishna Dharabasi .This book reflects the traditional male dominated Nepalese Society where woman were bound to burn alive with their husbands dead body after the death of their husband. This tradition was named as ''SATI PARTHA". The book I have gone through until today by foreign writer is "One night at call center" by Chetan Bhagat.

After get admitted in geology, I was concentrated in geology because it was interesting and new subject for me. I have learned many fascinating knowledge of geology. I was grateful to know single fossil can tell the history of ancient time. The most unforgettable moment was the geological excursion on Kakani during first year, organize by geology department. Similarly, the 17 days field excursion in Malekhu in second year was the never unforgettable, which make me to choose geology as a major subject in third year. The physical geology attracted to me because it deals with the physical elements of earth. I liked very much the study of rivers, glaciers, winds and oceans from my childhood.

Studying geology in third year was also interesting because here I found the subject of my interest. During third year, I came to liked engineering geology. It deals with Tunneling, Mining and underground excavation etc. Study of economic minerals and gem stone was also interesting. Third year study was also fascinating because of field works mapping etc.

Considering the fact mentioned above and also based on my own wisdom, I would except to be a skilled and renowned geologist in 10years time from now.

Year of admission: 2067
Name: Niraj Regmi
Roll no.:1270
Subject Combination: Geology, Zoology and Botany
Email: nirazzregmi@gmail.com

I was born in Laxmipur, 9 Dang. I attend my school life from Araniko English School, Sunpur Dang and completed my S.L.C. from Mount View Higher Secondary School, Ghorai. Also, I have passed my +2 from Padmodaya Public Model Higher Secondary School Bharatpur, Dang. For the Bachelor level study, I have searched most of the subjects of different colleges but couldn't satisfy. So, I decided to go to India for BMLT course. But due to some problems, I couldn't complete the BMLT course and returned to Kathmandu. Then, my brother suggested me to join Geology at Tri-Chandra College. At first when I saw the Department of Geology, I was attracted because the building of Department is historical and joined with Ghantaghar (The Clock Tower). So, I decided to join Geology.

The best book, I have gone through till the date is **Summer Love** written by Subin Bhattarai and published by Ratna Pustak Bhandar, Bhotahity Kathmandu. The novel is about the love story of university students. Similarly the best book I have gone through, published by foreign authors is **Five Point Someone** by Chetan Bhagat. This book mainly suggests "Practical knowledge is better than Theoretical".

The knowledge and wisdom that I have gained during my school life is that, there is no one greater than Parents and Teachers. So, we should respect them.

After being interested in the Geology, I started concentrating on the study. It was a new subject to me and took long time to understand. Though, I just passed in 1st year exam. I gave more emphasis in knowledge rather than number or marks in exam. I have learned many fascinating knowledge of Geology. I was much delighted to know the internal and external structures of the earth.

The most unforgettable moment during 1st year study was the field excursion on Dakshinkali, Chovar and Kakani area. This field work was the turning point of my study. I have gained geological practical knowledge from the field.

At the end of 2nd year, I was interested on "Geology of Nepal Himalaya". It gives the more geological knowledge of Nepal Himalaya and its adjoining region. I also gained geological knowledge from 17 days field work of Malekhu.

Studying Geology in 3rd year was more fascinating because of Engineering Geology. I knew the real importance of geologist in Civil Engineering projects. Without Geologist perfect engineering projects cannot run. Now days, I think one of the best decisions of my life is choosing Geology for Higher study. I am fully satisfied from my subjects.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a qualified geologist in the future.

Year of Admission: 2067
Name: Prabin Pramod Khatiwada
Roll No:869
Subject Combination: Geology, Statistics, Mathematics
Email: prabinpkhatiwada@gmail.com

I was born in Kumpur-5, Dhading on March 1991; I completed my primary school level from Shree Jalpa Lower Secondary School located near my house. My S.L.C was completed from Satyawati Higher Secondary School and after that I came to Kathmandu for my higher studies. Amrit Science Campus and Tri-Chandra College were my institution of choice for intermediate level in science and Bachelor level in Geology respectively.

While continuing my studies I also took up a job in various renewable energy sectors for the last five years. In this period I have met many people related to environment science as well as those related to renewable energy sector and the talks about eco friendly, environment friendly, renewable, recyclable, nature's gift etc has inspired me in contributing towards the environment sector. Geology for me happened as I was searching for an alternate to environment science (morning shift) in Tri Chandra campus and my plan for the future is to further my studies environment geology.During my three years in Tri Chandra Campus I have learned a lot and I consider the Department of Geology very unique than other department when it comes to the teaching methodology. Teachers in this department are highly qualified in their respective fields. Even though this geology department is part of the Tri Chandra campus it has stayed away and been independent from the political scene that has affected other departments. It has been my honor to become a part of Department of Geology.

I enjoy reading books, watching movies, listening to music and travelling. The last book I read was "Steve Jobs" which is a biographyabout Steve Jobs written by Walter Isaacson. I consider Steve Jobs commencement speech at Stanford University an inspirational speech I've heard till now.

Year of admission: 2067
Name: Prakash Rawat
Roll No.: 1388
Subject Combination: Geology, Botany, Zoology

I had born in Dang, Ghorai. I attended Alpha English Boarding School and completed plus 2 degree from Padmodaya Public Higher Secondary School. Knowing about geology from my brother, I admitted in Department of geology, Tri-Chandra Multiple Campus for B.Sc. in geology. When I attended the class of geology for the first time, I realized that I was at right place to develop my career. Then I saw my future in the different aspects of the Earth's science.

The best book I have gone through is 'Sirish Ko Phool' by Parijat. The book conveys a message about the effect of love and affection of normal life. Similarly the best book I have gone through, published by foreign author is 'Five Point Someone' by Chetan Bhagat. Is suggests practical education is better than theoretical one.

The knowledge and wisdom that I have gained during my school life has encouraged me to involve in the field of research. After being interested in the geology, I started concentrating on my study in geology seriously. Although my results of first and second year are not good enough, I have learned many fascinating knowledge of geology. While coming at the end of 3rd year I started to like the exploration geology and engineering geology. The interpretation of the geological facts in terms of civil engineering aspects is one of the interesting and challenging job.

Studying geology in the 3rd year was even more fascinating because of the field work at Butwal-Tansen area. Practically applicable subjects such as engineering geology, economic geology, exploration geology, environmental geology along with the 19 days field work attracted me a lot towards geology. Because of my interest and wisdom I expect to be a good geologist with in some years from now.

Year of Admission: 2067
Name: Pranav Raj Bakhrel
Roll no: 413
Sub. Combination: Geology, Physics, Maths

I was born in Baseshwor VDC ward no. 4 Chhihira Sindhuli. I completed my lower secondary education from Sishu Pragya Sadan English School and secondary education from Gyan Jyoti Awasiya Madhyamik Vidhyalaya. I completed my +2 education from The Times International College. I knew about 'Geology' from school. As I mentioned that I was born in 'Chhihira' means 'waterfalls' i.e. near to my home. Also the structure of Ramechhap danda seen from my home attracted a lot and I was curious about its structure, that curiosity led me to Ghanta ghar Trichandra for my B.Sc education.

I love reading different books of stories and novels. The best Nepali book I read was "Naaso" written by Guru Prasad Mainali & published by Sajha prakasan. It reflects Nepali cultures, socials norms and values. I like to read books of Anton pavlovich Chekhov, a Russian writer who writes stories on psychology and love.

I agree that I couldn't perform better on 1st year exams due to some reasons. But now I got curious about my studies and I've started studying hard. Teachers are helpful and friendly. I would like to say geology department is the best department in entire Trichandra College. Also geology studying friends are friendly and helpful. We make discussion over different topics and problems regarding our studies.

The best part on Geology is practical classes. We have got well equipped lab. The fieldwork at "Malekhu" helped me to explore more about geology. I was clear about how can we work on field and apply the knowledge we acquired on theory classes in practical life. Now I am interested in applied geology which is Engineering Geology.

Year of Admission: 2067
Name: Purushottam Adhikari
Roll no: 314
Subject Combination: Geology, Physics and Mathematics
Email:puru11adhikari@gmail.com

I was born in Manpur Tapara VDC ward no.02, Mahadeuli village situated at Bardiya district. I attended Manpur Secondary School, Manpur Tapara and completed School Leaving Certificate Level and completed I.Sc from Amrit Science College (ASCOL), Kathmandu. Knowing information about geology from my uncle, I admitted in Bachelor Level for B.Sc at Tri-Chandra Multiple Campus, Ghantaghar. When I first entered and look after Tri-Chandra Multiple Campus, it attracted me a lot because there was the thing that I have Studied in historical book but have never seen yet.

The best book I have gone through until that time was "Karnali Blues" by Buddhi Sagar and Published by "Fine Print Books, Kathmandu". The book conveys a message that a son Recognize the struggle of his father, whom he thought that his father was the bravest and well- Knowned man of the world for him.

I admitted and attempted the geology classes during first year course in 2067 B.S. then I started concentrating in my study seriously. Although I have learned many geological knowledge, I was much to take great pleasure to know that a topic of "Glacier". And while coming at the second year, I start to like "Historical Geology and Geology of Nepal" the most. It tells us all about the history of earth, types of climate prevailed, types of rock classification in different area and their role in giving a present day development. It helps to courage me to select Geology as a major subject in my third year study.

During this third year period, another two subjects "Paleontology" and "Economic Mineral Deposit" attracted me. It was broad information to understand geological processes of earth, types of climatic condition, live ramble and extinct, most importantly human evolution. Again ore-mineral, tenor morphology and texture of ore bodies, processes of formation of economic deposits. This information plays vital role not only to understand natural processes that occurred in the past and present prevailing now, but also to design various infra-structures in an environment friendly manner.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be university professor in 10 years time from now.

Year of admission: 2067
Name: Rabi Dhungana
Roll No: 690
Subject combination: Geology, physics and Mathematics
E-mail: rockrabi@yahoo.com

I was born in margha, Nuwakot, Ward no: 09, Kumari. I have completed my primary schooling form the English school and received secondary education along SLC from Gorakhkali English Boarding school in Balaju, Kathmandu. I did my +2 level educations from Intensive College in Kalimati, Kathmandu. Then I joined Tri-Chandra Campus aiming to study Bachelor level education in geology.

Everything that encountered with Tri-Chandra Campus amazed me very much and I shared my feeling with my parents. When I started my classes I came to know that our teachers are such a qualified personality to whom I always admired. Initially, I tried for engineering but could not make it out for 100% scholarship. For such replacement of my own passion of engineering, I found geology as a better source which can be affordable for me.

Basically I am very much decent and laborious person I do not talk that much and cannot open with friends that easily. Sometimes such nature cannot withstand with my goal. I have to work on it. I am very much fond of Fine art and I also draw different art of nature and environment. I love reading books, listening music and watching movies. Teaching students fascinates me so I used to take some classes in a school. I've joined in volunteer in institute of COCAP, (Collective of Campaigns and Peace). It upgrades my external knowledge and build up my confidence.

The days I came across in my first and second years totally blessed me with knowledge and self motivation learning about origin of earth, groundwater, rocks and structures made me feel great and I could easily choose geology as my major subject in third year. Finally I like to thank my teacher and friends who are in the editorial board for giving me such a great opportunity of writing some words from my side for the marvelous work of publishing the bulletin.

Year of admission: 2067
Name: Rabina Hada
Roll no: 540
Subject combination: Geology, Statistics and Mathematics

I was born in the historical place Bhaktapur. I completed my school level from shree padma higher secondary school and +2 from khwopa higher secondary school, Bhaktapur. From my secondary level, I was not so good at science and math but I chosed these subjects as challenge in +2.after completing +2, my interest in science increased. So I decided to join B.sc in a historical college Tri Chandra Multiple Campus. I was not sure to study geology as my major subject but after joining and having some knowledge in it I was gradually interested in it.

Even though I was not so interested in literature, I have gone through some literatic topics like "shirish ko phool" , Munamadan and likewise some other books. The main inspiring book I had gone through is "Pransnottar" by Lekh Nath Paudyal. I liked it the most because it motivates about the responsibility and aim of an individual.

The days in the college during these three years were really memorable. However in the 1st year I was not that familiar with my colleagues and teachers but gradually I became comfortable in the environment. A keen interest developed inside me towards geology. Also the field works made this journey more memorable and I came closer to geology. The interesting as field works and interactive lectures from teachers made me more curious in the related subject matters.

However while raising my feet towards 3rd year I am being interested in engineering geology and paleontology. With the wisdom on my own I hope to become a renowned geologist within 10 years.

Year of admission: 2067
Name: Rabindra Timilsina
Roll No: 596
Subject: Geology, Statistics and Mathematics

I was born in Kawasoti V.D.C ward No. 7, Magarkort village, Nawalparasi. I completed my school level education from Saint Josephs School, Nawalparasi then I passed my +2 level educations from Chetana Vidhyashram, Lalitpur. Then I came to Kathmandu to join Bachelor level education, I got information about geology from my father. Then I admitted in Bachelor level for B. Sc at Tri-Chandra Campus. When I first visited Tri-Chandra Campus, Ghantaghar attracted me a lot because it was something in a history book.

The best book I have gone through until that time was "KARNALI BLUES" which was written by Buddhi Sagar Basyal. The best thing about this book is that, how a life turns according to age of a person. Similarly, the best book I have gone through published by foreign author is Adolf Hitler, named "Mein KAMPF (My struggle)" which is about his strategy for re-building his country.

My knowledge and wisdom that I have gained during my school life has encouraged me to commitment to help others. I have learned many fascinating knowledge of Geology; I was much delighted to know that development of Himalayas.

While coming at the end of second year. I got my interest in Structural geology the most. It tells all about the geological structures formed because of tectonic activities. It encouraged me to choose Geology as my major subject in my 3rd year study.

Studying Geology in 3rd year was more fascinating because of field work, occasional lectures by renowned geoscientists, workshop on "underground Excavation, organized by the department. During third year study, geological mapping attracted me a lot. It was an indispensible tool to know how rock types and geological structures are changing horizontally and vertically in an area. This information plays an important role not only to understand natural process that occurred in the past and presently prevailing now but also helps us to design various infrastructures in an environmental friendly manner.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a University professor in 10years. I am proud to be a Student of this historic Campus and Department Of Geology and want to thanks my entire teacher who shows me the way to be a good geologist.

Year of admission: 2067
Name: Rahul Poudel
Roll no: 1421
Subject combination: Geology, Botany, Zoology
Email: rahulpoudel5972@gmail.com

I was born in Parbat district, Ranipani V.D.C. ward no-4. I completed my schooling in Butwal, Canon Higher Secondary School and +2 from Glorious College, Butwal. Knowing the information about the geology from one of my +2 teacher, I joined Tri-Chandra Multiple Campus and admitted in Department of Geology.

The best book I have gone through till now is the 'Alchemist' by Paulo Coelho. This book is inspiring for any one, who is seeking path in life. The book 'The Master and Disciples Relationship' published by Osho Topoban is also my favorite book. This book made my heart full of respect for all the teachers, who are teaching me geology in Ghantaghar.

I learned many interesting facts of geology from 1st year. I was always curious about the earth, its origin, its processes and many more from my childhood. I fulfilled my curiosity by learning geology. The most interesting part of geology in 2nd year was petrology for me. Malekhu fieldwork during 2nd year was one of the memorable moments in Tri-Chandra. Studying geology in 3rd year is more fascinating due to fieldwork, seminars, lectures and many other educational activities. Considering the facts mentioned above I would expect to be a good geologist in near future.

Year of Admission: 2067 BS
Name: Rajan Sigdel
Roll No: 121
Subject Combination: Geology, Chemistry, Mathematics
Email: rink.sig@gmail.com

I was born in Darchha V.D.C, ward No. 1, palpa. I attended Shree Jana Vikash Higher Sec. School Gorkha and completed +2 from Kathmandu Bernhardt College, Kathmandu. Knowing the information about Geology from my friend, I admitted in Bachelor Level for B.Sc at Tri Chandra Campus.

The best book I have gone through till the date is JHOLA by Krishna Dharabashi. The book contains sati partha (in ancent time women had to go with their dead husband in burning chitas) Similarly, the best book I have read so far published by foreign writer is The Good Earth by pearls s. buck which describes the village old man in china about his struggle in his life and its gives us knowledge about the important of our land. Every hard problem faced in your life doesn't be so scared but faced it with open heart. In final whatever the causes it made but if you had your land then nothing can do worse to you.

The knowledge and wisdom that I have gained during my school life has encourage me to make a full commitment as I study as well as it helps me to understand life in the better way.

I admitted at Tri Chandra but could not paid good attention on study because of poultices during first year but in second year I fully leave poultices from my mind and concentrate on my study.

The most unforgettable moment during my first year was a field study in Dakshinkali and Kakani. Student life is all about learning so every opportunity to learn is a fair treat for us. One should be thankful for the facilities provided by Tri Chandra Campus.

At second year each and every topic dragged my whole attention and I was very pleased. The subject matter includes such a diverse aspect of geology that I was eagerly finding out the causes behind it. Without any hesitation I was convinced to choose geology as a major subject in third year and my aim was also to study geology.

Third year was also even more excited because of field work, occasional lectures by renowned professor and other academic activities organized by department. Considering the fact mentioned above and also based on my own wisdom, I would except to be a good geologist within ten years' time from now.

Year of Admission: 2067
Name: Rasila Koirala
Roll No: 729
Subject combination: Geology, Physics and Mathematics
Email: - black1slirva@gmail.com

I was born in Kumarigal, Chabahil, Kathmandu. I completed my school studies from Arunima Higher Secondary School and college, Kathmandu and +2 from the same college. I came to Tri-Chandra Campus, Ghantaghar, Kathmandu for further studies. I got admission for Physics, Chemistry and Mathematics at first but my friends discussion on the interesting topics of geology leaded me to change my combination into Physics, Mathematics and Geology. I was very much happy to join geology as felt as if my search was fulfilled.

I was very much excited to attain geology classes. I listened the terms attentively. Geology became one of my favorites. As a result I was inspired to work hard. I felt happy collecting information on different topics from library especially on structural portion during my first year.

The latest and best book, I have read is “China harayeko Manche” by Haribansha Acharya. It encouraged me that one can make their aim oneself, the luck favour in ones hand for which one has to labour himself. These things impressed me a lot.

The most unforgettable moment during my first year study was to choose a new subject. Not only that I got new and good friends. Also the sports hall and table tennis are the major things to be remembered. When I recall those moments, even now I feel really good and it makes me smile.

Before coming to third year, I was interested towards physical geology structures of oceans, rock etc. Finally I choose geology as a major subject in the third year. In future also I am thinking of selecting engineering geology as a major subject because it gives knowledge related to the changes in structures with respect to the environmental change which will change the people’s life style.

Year of Admission: 2067
Name: Rishi Dev Chudal
Roll no: 305
Combination: Geology, Physics, Mathematics

It was almost dawn in Dharan-16, 1990; when I first opened my eyes and with a cry began my journey. I hopped between schools in my early years of schooling before I found Universal Collage Preparatory School, Kathmandu and followed the same establishment into Universal Collage for my high school education. After my high school graduation in 2009, I took an unplanned break from institutionalized education system and found that pause to be most beneficial for my personal growth.

I wished to become a geologist, even before I learned its deep meanings. My fascination towards geology and minerals from an early age is attributed towards my family's mining background. I grew up playing with garnets, tourmaline, quartz and such. A free wanderer by sprite, I choose to study the art of earth science for my undergraduate study mostly because it provided me with a dynamic field where my unquenchable lust for nature could co-exist with the world.

So, being the only university with geology undergraduate program in Nepal; initially my choice to enrol in Tri-Chandra Campus was based on this fact. But, my misgivings were soon put to rest as I found the Geology Department to be most knowledge oriented, disciplined and practical-based department in the facility. In the past two and a half year, I have been introducing to many facets of geology; and knowledge on each of these faces is essential to imagine, with vivacity, the rise and fall of earth surface across the eons. And, if I have to be particular, I am much inclined towards structural geology, mineralogy and exploration geology. My first year was amalgam of interesting incidents and characters. Malekhu Field trip was a definite highlight of my brief years in this department.

I have a passion for books like many others and as I have loved hundreds of books since my childhood, I feel it unfair to choose a few as favourite. Still I regard Muna Madan by Laxmi Prasad Devkota and Harry Potter Series by J.K.Rowling as important literature for me; Muna Madam because the tragic prose of this epic poem still hunt me like a phantom whispers in a dark well. I grew up with Harry potter and there are no words in me to describe his influence as I grow up. And, The Story of Philosophy by Will Durant, is a majestic piece of philosophy in itself!

Year of Admission: 2067
Name: Ronash Adhikari
Roll no: 11
Combination: Geology, Physics and Mathematics
Email: ronash1990@hotmail.com

I was born in Bhadrapur-15, Jhapa,Nepal. But when I was 5 years old I moved to Sanothimi Bhaktapur and spent my childhood there. I completed by schooling and higher school from SOS Hermann Gmeiner School, Sanothimi Bhaktapur. I joined Tri-Chandra College as I was interested to study the science subjects. Before joining the college, I didn't had idea about Geology subject was also taught in Tri-Chandra College. I was attracted to study this subject because I saw fewer numbers of students and the teaching method was up to date with the technology.

I quickly made lots of friends and started enjoying my college life.

The best book I have ever read is "The Lamp is Lit" by Ruskin Bond. Bond is an Anglo-Indian writer whose stories are plotted in a rural or suburban background with children being central character. In my first year I enjoyed physical Geology most. In first year we had one day field work in Kakani and Dhachinkali. In second year I enjoyed Geology of Nepal the most. In the same second year we went to Malekhu for 17days field work. In the beginning of the third year I had an opportunity to attend a 24 days field work with American students in Muglin-Pokhara-Mustang-Muktinath area. I want to thank the department for providing this opportunity to work with the foreign students. In my third year course I liked Exploration Geology the most. I am sure that our third year field work will be very fruitful as well.

I hope i will become a competent geologist in next five years.

Year of Admission : 2067
Name: Rupak Gyawali
Roll No: 807
Subject combination: Geology, Physics, Mathematics

I was born in Lalmateya-2, Dang. I completed my school studies from Shree Moonlight Secondary school, Lalmateya-9, Dang and completed +2 from Ambition Academy Higher Secondary School and College, Kathmandu. After completion of +2, I didn't try other fields of applied sciences like engineering, medicine, agriculture etc because I was fully confident and dedicated with myself that I will study the pure science either Physics or Biology. My brother Mr. Ramesh Adhikari, ex. student of Trichandra college, physics department, council led me about the subject geology, its coverage, its scope and other information that interested me towards the subject. When I attend the lectures of Geology in Ghantaghar, the first thing that stroke on my mind was the classroom, mass of students, system of teaching, which was totally amazing for me.

I have gone through some literature as well as some spiritual books too. I specially loved the novels of Paulo choelo. I love the books and articles and documentaries which are related to the facts of Physics and Geological History and information's.

The mystery of origin of Earth, land, sea, plates, position of plates in different times, formations of mountains, Geological study of evolution, about minerals, rocks, geological structures and the other geo-related informations, I m getting the ideas one by one in progression by different means of Lecture's book, documentaries, research papers, field excursions etc. I want to thank all the teachers of geo-department for being so dedicated and so caring and co-operative

After studying nearly about 3 years, I am interested in the engineering as well as environmental geology. It helps in proper construction works, like construction of tunnels, dams, roads, bridges etc. And the environmental geology gives the knowledge and relationship between the two very closely interconnected geology and environment.

With the reference and mentioned facts above and on the basis of wisdom on myself, I would expect to be a competent geologist in 10 years from now.

Year of Admission:
Year of Admission: 2067
Name: Rythm Rai
Roll No:
Subject Combination: Geology, Physics and mathematics

I was born in Bhojpur district, Koshi zone,Nepaledada -02. I completed my school level in Suryodaya Jyoti Secondary English Boarding School in Ghattekulo,Kathmandu and +2 from the Campion Academy of Kumaripati, Lalitpur.I was suggested by the elders to be admit on this tri Chandra College in department of geology.

The book I have gone through till now is "Siris Ko Phul" by Parijat, the book is about the love story between a retired army officer and woman. The love story is in depression theme.

In first year I like Physical geology most because I was interested to find out the erosional and depositional features formed by various geological agents like wind, river, glacier, sea, ocean etc.

In second year I started to like Geology of Nepal most because I could learn about the rocks formations (lithological units) across the whole country and their natures. In second year I attended the sixteen days Malekhu field work. There I learn about geology of Central Nepal, Lesser and Higher Himalaya. I also learn geological mapping and route mapping and some fossils.

In third year course I enjoyed paleontology most because I am always curious about the plant and animals that existed millions of years ago. In third year Butwal-Tansen Field work I learned geology of western Nepal, Siwaliks and Lesser Himalaya and engineering Geological Field Techniques.

I hope I will be a compentent geologist in next five years.

Year of admission: 2067
Name: Sameer Poudel
Roll no.: 408
Subject Combination: Geology, Physics, Mathematics
Email: poudelsameer@gmail.com

I don’t know where I was born, but I spent my childhood, a golden era in the lap of Pharping located on southern part of Kathmandu. In my past memories, sometimes on distant past, I remember someone calling me,"sameer", Later on I learned that it is my name. Then I learned to use surname and thus "sameer" became "sameer poudel". This is how I got identity.

I learned first letter, learned to transform letters into words and words into sentence from cardinal international boarding high school and from the same school, I passed S.L.C. I spent some of the part of my late teen age on Kathmandu Bernhardt collage, where I had some wonderful memories and lessons that I learned during my higher schooling. At this stage I am on Trichandra multiple campuse, where I am being transformed into a capable man from a teenager.

Being inspired from "you can win" by Shiva khera and "Master your mind, Design your destiny" by Adam khoo, I believe in doing things in a different way than doing different thing. Apart from these books, I am also inspired from "The Alchemist" by Paulo Coelho which inspires us to dream, and to work hard to fulfill your dreams and desire since everything is created twice, once in dreams/ imaginations and once in reality.

I am an energetic, ambitious person. I posses a clear, logical mind with a practical approach to problem solving and an impetus to see things through to completion. I am excellent in working with others to achieve a certain objective in time and with excellence. I have a great eye for detail and design. I am eager to learn, I enjoy overcoming challenges, and I have a genuine interest in Geological practices. My greatest strengths are my research, communication and writing skill. I have ever thought to become a successful Geologist in my dreams and always striving to make my dream into reality. And, now geology is my destiny and I have feeling that I will do my best in this field.

Year of Admission: 2067
Name: Sanjeeb Bhujel
Roll No. : 920
Subject combination: Geology, Botany, Zoology
Email: sanjeew.bhujel@gmail.com

I was born in Tekanpur – 4, Sindhupalchowk. I have complicated my S.L.C. from Shree Kalika Secondary School, Tekanpur – 5, Sindhupalchowk and had done my +2 from New Millennium College, Sukedhara. After completion of +2 I was preparing for British Army. However I could not be success. Then I came to Tri-chandra Campus; at that time I was in confusion about the subject combination. However, one of the senior brothers told me to join Geology, then I got admitted in Tri-Chandra Multiple Campus for geology.

My hobbies are reading nobels, playing football, swimming, drawing, watching various programs of Discovery, Animal Planet, Sports channel, and Filmy channel, internet surfing etc. I have gone through several books of national and foreign writers. The best book I have read is 'Bashain' written by Lila Bdr. Chhetri and published by Sajha Prakashan, Kathmandu. The book conveys a message that in a society we should always help peoples who have problems and shouldn't dominate poor people. Similarly, the best book I have gone through, published by foreign author is "Five Point Someone" by Chetan Bhagat. It suggests practical knowledge is better than theoretical.

During my 1st year of B.Sc., I had been fascinated by every topic we studied. The subject geology gave me an opportunity to know the earth, nature and its processes we usually used to hear or see and admire closely. After the completion of first year, Geology became much more appealing as we came to learn about history of earth in Historical Geology along with the knowledge of the different geological structure and processes through different subject like Petrology, Sedimentary, Igneous and Metamorphic, Paleontology and Geology of Nepal. The 17 days long field work d been held during our second year at Malekhu; where we visualized the implements our theoretical learning practically. Malekhu had been a place where all of us shared many moment of life, happiness, sadness, and we became able to understand each other.

In third year, we gained knowledge releted with geology through various seminars, lectures, field works and many more. 19 days field work at Tansen is really unforgettable moment of my life. Each and every day of my third year was very much memorable for me. Because I was almost finishing my journey of the historic Campus like T.C. considering the facts mentioned above and also based on my wisdom. I would expect to be a good geologist and renowned geologist in 10 years from now.

Year of admission: 2067
Name: Samit Regmi
Roll No: 338
Subject combination: Geology, Statistics & Mathematics
Email: timasimger123@gmail.com

Born in Thimure V.D.C, ward no 8, Palpa district. I completed my S.L.C. from Green Peace School, Kohalpur, Banke. Knowing information about geology from my friend, I admitted in Bachelor Level for B.Sc. at Tri-Chandra Campus, Ghantaghar. When I first visited Tri-Chandra Campus I was very excited to be the part of the educational institution which holds the extra ordinary history.

The best book I have gone through till the date is Jivan Kanda Ki Phool by Jhamak Kumari Ghimire published by the Oriental Publication. The book contains the message that problem is the power itself. Life discovers who we are? Similarly, the best book ii have read so far, published by the foreign author is Eleven Minutes by Paulo Choleo which gives message that for every aspects of life we must use positive thoughts and gratitude to every experience, experienced in life.

I could not understand all about geology during first year because it was new subject for me. Although, I learned many fascinating knowledge of geology during first year. I was amazed that the continents are drifting over the surface of earth. The Himalaya was formed due to collision of Indian and Eurasian plates, a small grain of sand can tell us long history starting hoe rocks were formed in deep sea, exposed to the atmospheric environment and subsequent erosion followed by transportation and deposition.

The most unforgettable moment during my first year study was encounter with my friend who not only helped me to cover my classes that i have missed, but also encouraged me to go to the library and study other books of interested. He was in the opinion that student life is for learning and we should not miss any opportunity to utilize available at Tri-Chandra Campus.

While coming at the end of second year, I started liking paleontology the most. It tells about all the history of earth, types of climate, lives roamed and extinct, natural calamities occurred and most importantly human evolution and their role in giving a shape to the present day development me to select geology as major subject in my third year study.

Year of admission: 2067
Name: Santosh Pathak
Roll No: 1082
Subject combination: Geology, BotanyAnd Zoology
Email:pathaksantosh5782@gmail.com

I was born in Lamatar, ward no: 2, Lalitpur. I completed my school level from Dibya Jyoti Secondary School, Lalitpur and completed my plus 2 from NIMS College, Lalitpur. Knowing the information about geology from a syllabus providing by student's union, I admitted at Tri-Chandra Campus for B.Sc. in geology. Some historical background of the college also attracted me a lot to study here.

The first book I have gone through is 'Three Mistakes of My Life' by Chetan Bhagat. The book pictures today are youngster's activities, views and perception. After this book, I was really fascinated by the writing of Chetan Bhagat and gone through all his books by the time.

It was a strange feeling for me during 1st year because geology was completely new subject for me. I used to wonder how it is possible to explain past events as well as to predict future events by analyzing present evident of the earth.

During my 1st year in college, I used to feel funny as well as strange when we had to go from one room to another room after every period. It was really confusing for some days but I adapted with the circumstances gradually. During 1st year classes, I had learned many fascinating knowledge of geology. Im very impressed with the statement of James Hutton, "the present is key to the past".

The most unforgettable memory is during my 2nd year's geological field along Malekhu, Dhading, where I first learned to differentiate rock types practically. I also learned to make geological compass traverse map using brunton compass which was really interesting. This tour encouraged me to choose geology as my subject of interest. After attending practical classes in 1st year and in 2nd year, I realize that knowledge of geology can be applied for the structural and economic development of nation.

While coming at the end of the 3rd year course, I started to like exploration geology. Studying geology in 3rd year was even more interesting because of field works, home assignments and many others academic activities organized by Department of Geology. During 3rd year's study, engineering geological study of rock and soil attracted me a lot towards it. Due to my interest and dedication on geology, I would expect one day I'll be an expert on geology.

Year of admission: 2067
Name: Saroj Chandra Poudel
Roll No: 820
Subject Combination: Geology, Physics and Mathematics

I was born in Sonpur V.D.C ward No. 1, Narti village, Dang. I attended Ma. Vi. Sonpur High School, Dang and completed +2 from Padmodaya Public Model Higher Secondary School, Dang. Then I came to Kathmandu to join Bachelor level education at Patan Multiple Campus in B. Sc 1st year with combination of Physics, Chemistry and Mathematics. After studying almost 7 months there then I got information about geology from my uncle, brother and sister-in-law. Then I admitted in Bachelor level for B. Sc at Tri-Chandra Campus. When I first visited Tri-Chandra Campus, Ghantaghar attracted me a lot because it was something in a history book and partly studied in secondary level classes but have never seen before.

The best book I have gone through until that time was "MUNAMADAN" which was written by Laxmi Prasad Devkota and published by Sajha Prakashan. I have studied this book while I was in class 7. The best thing about this book is that, we need to consider a respectable based on his work not on his cast or anything else. Similarly, the best book I have gone through published by foreign author is Barrack Obama, president of USA named "DREAM FROM MY FATHER" which tells a story of Race and Inheritance, in which a son of black African and white American mother searches for a workable meaning to his life as a black American and he proves that a man can do anything after following own dream with hard labour and will power.

I knowledge and wisdom that I have gained during my school life has encouraged me to commitment that there is nothing important than doing hard work and helping others. I could pay good attention to geology classes during my first year course because I was already late in Geology Department because I was first admitted at Patan Multiple Campus then only I concentrating my study in Geology course seriously. Although I have learned many fascinating knowledge of Geology, I was much delighted to know that once upon a time the earth was in Pangaea Stage, according to which all continents were together and a pebble in conglomerate can tell us long history about river and deposition environment and geological development of earth.

The most unforgettable moment during my first year study was that, when I entered first time in Geology class our teacher announced that all required course are completed from that day and no lecture classes will be held by another day then I was shocked. Then I got a friend name " Samip" who helped me to cover my entire missed classes with the help of note and also encouraged me to go the library and study the other books of interest and he also told me to use all opportunity available at Tri-Chandra College.

While coming at the end of second year after complete field work. I got my interest in Petrology the most. It tells all about the sedimentary deposition during development of the earth and it attracted me because of direct implementation in field geology which will use in our future, while performing geological works. It encouraged me to choose Geology as my major subject in my 3rd year study.

Studying Geology in 3rd year was more fascinating because of field work, occasional lectures by renowned geoscientists, workshop on "underground Excavation" and many other activities like mapping, compass traverse etc organized by the department. During third year study, geological mapping attracted me a lot. It was an indispensible tool to know how rock types and geological structures are changing horizontally and vertically in an area and also how interestingly a depositional environment change to deposit different types of sediments to form different types of rock. This information plays an important role not only to understand natural process that occurred in the past and presently prevailing now but also tells us how does it developed in future days, which helps us to design various infrastructures in an environmental friendly manner.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a renowned and extra-ordinary field based geologist and also expect to be a University professor in 10 years to spread my geological knowledge to my juniors.

At last, I am proud to be a student of this historic department of historic campus and want to thank all my highly decorated teachers, who show me to a way for my great future travelling with geology and also want to thank for my colleague friends for their great support.

Year of Admission: 2067
Name: Sasmit Adhikari
Roll No.: 804
Email: sasmitadhikari@live.com
Subject Combination: Geology, Statistics and Mathematics

Born in Kewalpur, Dhading Ward No.01. I completed my school studies from Daffodil Public School, kathmandu and +2 from Capital College and Research Center, Kathmandu. I was very much interested to join army but was not able then I decided to continue BSC and got admitted in Tri-Chandra Multiple Campus, Ghantaghar, Kathmandu. From some of my friends I came to know about geology and felt that it was the right subject for me.

During my first year I was not able to give full time to my studies because I was diverted to some other courses too but from the second year I started to pay attention and was also interested to know the vastness of our subject. Every moment every time to be with teachers and the interesting lectures of my subject of interest was just awesome. Except my course books I surf the books related to military and their life styles.

The time spent during our field work in Malekhu with our respected teachers and friends is unforgettable. To gain knowledge practically in front of the eyes and to analyze their importance was really a great achievement for me. The field works like map preparation, stratigraphy and the methods of working and the objectives of work was very much interesting. Besides to know friends and teachers remaining there as a same unit, was also a great experience.

After studying nearly about 3 years I am interested in the engineering geology. Also to work in the construction works and to put my knowledge there would be just a pride for me. As a whole every topics in geology is very interesting and somehow interrelated to each other so we must have sufficient knowledge and preciseness in every topics of geology.

In the upcoming 10 years, hope I must be a good engineering geologist and serve for the betterment of society, nation as well as the whole world.

Year of admission: 2067
Name: Selina Niroula
Subject combination: Geology, Botany and Zoology
Email: Selina_niroula@yahoo.com

I was born in Damak, Goltar, Jhapa. I completed my schooling from Shree Dhukurpani High School, Jhapa and completed +2 from Damak Multipe Campus, Damak, and Jhapa. I have knee interest in geology from school level, because we have basic knowledge of geology in school level. When I came to know that Geology is taught in Tri-Chandra College, I got admitted at Tri-Chandra College. I am also amazed by the fact that I am going to study in Historic college of Nepal.

The best book I have gone through till date is Muna Madan, written by Laxmi Prasad Devkota. Message conveyed by the book is, Man is known by his work not by his cast.

During my childhood I learnt to respect each other and help each other.I admit that I couldn't pay good attention to Geology classes during my 1St year course as I was trying to get admission in MBBS course, but didn't succeed. After that I have given my full attention to Geology. Geology is fascinating subject because we study long history starting, how rock was formed in a deep sea, exposed to atmospheric environment and subsequent erosion.

The most unforgettable moment during my study was field work to Malekhu during 2nd year, because I learnt many things from that field.During 3rd year we have gone to Butwal-Tansen for field and there I learnt many new things. During field work we have good and bad memories.

Considering the facts above and also based on my experience, I think I will be successful Geologist in 10 years' time from now.

Year of Admission: 2067
Name : Sharmila Neupane
Roll No: 400
Subject Combination: Geology, Physics, Mathematics
Email :sharu_neupane@yahoo.com

I was born in Goldhunga V.D.C ward no. 7, Balaju, Kathmandu. Had completed the high school from Pragati Higher Secondary Boarding School, Balaju, Kathmandu. The journey of my higher education was initiated from Tri-Chandra Multiple Campus, Ghantaghar, Kathmandu. I was admitted at Tri-Chandra Campus for intermediate level in science (ISc).

When I was in grade 9 I had visited Tri-Chandra Campus to become the part of geological exhibition as a viewer from my school. The historical building and Ranipokhari infront of the campus attracted me a lot previously while travelling in vehicles. When I stepped into Tri-Chandra Campus being a student, I got my first lecture in the building which attracted me before the tranquil water of Ranipokhari, which made me feel so peaceful even now it happens so. So I always believe in:

The best book is life.
The best lesson is patience.
The best teacher is experience.
The best student is attempt.

During my school life mostly I was encouraged from two proverbs "the journey of thousand miles start from a single step" and "the failure is the pillar of success". Also "The Greatness Guy" written by Robin Sharma taught me to live the life in a different way.

Again I joined B.Sc. level at Tri-Chandra combining geology, physics and mathematics as the suggestion of my brother. In 1st year some terms of geology were new, some were heard before but didn't knew the history and detail in depth about those terms and subjects. So geology was quite difficult. Talking about the second year, I could attach with geology more. The 15 days geological excursion along Malekhu area was the most memorable days ever in my life. From that excursion, it was like a habit that picking up stones/rock from road and trying to interpret it in the correct way.

As geology reflects the historical background of all the constituents of our dynamic earth, shows the status in present and can predict the condition in future. It encouraged me to choose geology as a major subject in my third year.Studying geology in third year was even more fascinating. Engineering geology and GIS were the more interesting and applicable subjects which are related to excavation and mapping system.Geology is the better way to be in touched with our earth and environment. All subjects under geology have their own value and importance for the sustainable use and application. All subjects teach us the meaning and significances of our surrounding and lead us to interpret our planet broadly.

Year of admission: 2067
Name: Shree Krishna Karki
Roll no: 828
Combination: Geology, Statistics and Mathematics

I was born in Bhimeshwor municipality ward no 8 Mati Dolakha. I have completed my schooling from The Rising Star School, Charikot Dolakha and +2 from St.Lawrence Higher secondary school Chabahil Kathmandu. As I was mentally prepared to join the Bsc after +2, I inter into the Tri Chandra Multiple College.Then I went to the Department of Geology and found that I am in the right place. The place of knowledge, cooperation, friendly and other positive things.

'Jhola' by Krishna Dharabase was the book that I've gone through reflects the miserable and difficult life of the women. Married women are forced to burn alive with their dead husband. This unfair and negative tradition was ended by the Rana Prime minister Chandra Shamser.

The knowledge that I got from my school is that, do good and be good. This will finally help to find the right path and success.

As I was interested in the geology I was regular from the starting of the classes from the first year.I've gathered the geological term and some basic knowledge of geology in this part.

At the end of the second year it started liking paleontology, petrology and sediment logy too. So it's difficult to choose the best of these for me .But it was sure that I will choose Geology as the major subject in the 3rd year.

Studying geology in the 3rd year was more interesting because of the more field works in newer areas under the guidance of renowned geologist, frequent presentation of the achievement in the field with interaction. During the 3rd we've practice geological mapping, individual route mapping, lithology, structures, and so on. These tools and factors are absolutely necessary to determine how rock types are changing tectonically. All these information will give ideas about the past natural process and the future. These ideas can be important for the friendly infrastructure of country that leads the country towards development.

Year of admission: 2067
Name: Sima Humagain
Roll no: 929
Subject combination: Geology, Botany, Zoology

I was born in Gothatar VDC; ward no -3 in Kathmandu .I completed my study up to class three at Gothatar English Secondary School. Gothatar, Kathmandu. Then I attended my SLC from Arun Jyoti Vidhya Mandir, Jorpati, Kathmandu. I completed my plus two from Jya Multiple Campus, Dakchin Dhoka, Kathmandu.

At first, I went in Tri -Chandra College to read Microbiology. I attended some classes of Microbiology but I couldn't understand anything about the subject matter so I did not like to read that subject. My brother who was reading Geology in same college told me about Geology that brought quite interest about the subject matter in me so I went in Geology class with my brother the next day. The first day at Tri-Chandra College is very unforgettable moment in my life. I went alone to visit the college and to search the zoology and Microbiology classes' .One of the elder brother showed me the class. I was quite surprised and nervous after I saw such a huge college, its infrastructure and the maximum no. of students studying here.

The best book I have gone through until that time was "Palpasa Cafe" by Narayan Wagle. The book was about the events of Nepal during Maoist period.IT is a heart touching book. The book I have gone through, published by foreign writer is "A Brief History of Time by Stephen Hawking .It was the book about the inventions of theories about universe, from the Big Bang Theory To Black Holes.

The first class of my geology is unforgettable as I had no any friend and I was all alone and I was very late to join the Geology .I had already missed many lectures. I told my brother to go as mine friend with me in geology class. All students were outside the class I asked "Why the students are staying outside though it's already time to attend the class?'' the brother replied me, it's Tara sir's class and no one is allowed to enter inside till sir manages the projector for the lecture. My brother had told me a lot about the teaching style of the sir so I was quite hurry and interested to attend the class. Finally I attended the class and I was much more impressed by his teaching style from the 1st lecture.

I was not habituated of reading books and searching an answers as Boarding schools and plus two teaching practices had made us to be dependent upon the teachers note. As a result ,in 1st year many problems in my studying habit but slowly it was improved during my 2nd year study as I started going library and start searching and reading books. During my bachelor study in Geology I learnt about Earth, Earth's history, rock and their depositional environment, various structures seen in the rocks, evolution of Himalayas and many more. The most interesting thing about geology is the field study .The practical study in field makes us easy to visualize the truth that we have learnt in the books so it makes our study easier and understand deeply. Due to these all encouraged me to study the Geology in my 3rd year as Bachelors' degree.Studying Geology in third year is more interesting. In this year I learnt about the Palentology, Stratigraphy, and the most interesting topics about Economic Geology and Engineering Geology. Due to my keen interest in geology I hope to be a prone geologist in coming 10 years.

Year of Admission: 2067 BS
Name: SubarnaDhakal
Roll No: 27
Subject Combination: Geology, Chemistry, Mathematics
Email: subarna.dhakal@yahoo.com

I was born in Harmi V.D.C, ward No. 9, Gorkha. I attended Shree Mahendra Lila Higher Sec. SchoolGorkha and completed +2 fromKathmandu Bernhardt College, Kathmandu. Knowing the information about Geology from my brother, I admitted in Bachelor Level for B.Sc at Tri Chandra Campus. When I was at class 8 my brother told me about geology, from that time I was very interested to study geology and that was fulfilled by Tri Chandra College.
The best book I have gone through till the date is **Jivan Kanda Ki Phool** by Jhamak Ghimire published by Oriental publication. The book contains massage that the problem is power itself; life gives us to discover who we are? Similarly, the best book I have read so far published by foreign writer is **Eleven Minutes** by Paulo Coelho which gives massage that for every aspect of life we must use positive thought and attitude to every experience, experienced in life.The knowledge and wisdom that I have gained during my school life has encourage me to make a full commitment as I study as well as it helps me to understand life in the better way.

I admitted at Tri Chandra but could not paid good attention on study because of politics during first year but in second year I fully leave poultices from my mind and concentrate on my study.The most unforgettable moment during my first year was a field study in Dakshinkali and Kakani. Student life is all about learning so every opportunity to learn is a fair treat for us. One should be thankful for the facilities provided by Tri Chandra Campus.

At second year each and every topic dragged my whole attention and I was very pleased. The subject matter includes such a diverse aspect of geology that I was eagerly finding out the causes behind it. Without any hesitation I was convinced to choose geology as a major subject in third year and my aim was also to study geology.

Third year was also even more excited because of field work, occasional lectures by renowned professor and other academic activities organized by department.

Considering the fact mentioned above and also based on my own wisdom, I would except to be a good geologist within ten years' time from now.

Year of Admission: 2067
Name: Suman Maharjan
Roll No.:414
Subject Combination: Geology, Physics and Mathematics

I was born in Kathmandu M. P. C, Ward No. 15, Dallu, Kathmandu. I attended New Arunodaya English High School, Dallu, Bijeshwori, Kathmandu and completed +2 from The Times Higher Secondary School, Dilli Bazaar, Kathmandu. After completing +2 level I joined Tri Chandra Campus to continue my further study. When I first visited Tri Chandra Campus, the buildings and of course Rani Pokhari and Ghantaghar, the historical heritage of our country, attracted me a lot because I had not been able to view these monuments so closely and I am very happy and glad that these ancient monuments are part of my college which I shared with my family members as well.

I am a hard working, decent and obedient student. I am a fun loving person so I like to have fun with my friends. I think this is the reason why I have a lot of friends. I am very passionate in sports as well besides that I like listening music, visit new places, watching movies, reading books etc.

After joining Tri Chandra Campus I was totally unaware about the facilities that are available in the college, because this place was new for me. But with my friends help it become easy for me to understand the environment of the college and to utilize the facilities provided by the college, joining Geology subject is one of that.

When I first entered the Geology class I was amazed by the environment of the classroom. I felt blessed after taking the classes which was conducted by well qualified, renowned lecturers. During my first year course, I felt this subject a little difficult because this subject was new thing to me. But with my friends help and my teacher's guidance I started to like the subject and the willingness to learn more kept on increasing. This subject attracted me because of field works as well in field work we can learn many fascinating things of this dynamic earth. This subject is practical based subject which I like the most and which is the main reason to select Geology as a major subject in my 3rd year study. Studying Geology in 3rd year was even more fruitful and fascinating because of the course design which includes field works. Practically learning subjects like engineering geology attracted me a lot during my third year study.

Year of Admission: 2067
Name: Surendra Kandangwa
Roll no. : 550
Subject combination: Geology, statistics and Mathematics
E-mail: surendra_naren@yahoo.com

I was born in sitapaila, ward no: 04, Kathmandu. I completed my schooling from Shree Jana Uddhar secondary School, Harisiddhi and +2 from Sirius College, Bafal. After completing my +2, I joined NAEE for engineering to fulfill my school dream.

I paid 3 month fee from my own pocket money. No one knew about that even my mom and dad. After two and half month I was totally fade up from engineering. I still don't know why I gave up that. But ofcourse some kind of reason lies behind that moment and the main reason might be competition for pulchowk. I was hopeless by seeing all intelligent student from different and extra concept, so I treated my mind , I won't be succeed, and I have to kick my school dream.

To give continuity to my study I got admitted to Tri-Chandra College. I had no idea which subject to study, one of my friends suggested me to study Geology, so I did the same. After attending few classes, I realize studying geology in trichandra from well qualified lecturer and professor is good enough. This is the subject really meant for me and I find geology everywhere.

Year of admission-2067
Name- Ujjwal Acharya
Roll No: 07
Subject Comination-Geology, Physics, Mathematics

I was born in Damak Municipality- 10 of Jhapa District. I completed my S.L.C. from Shree Saraswoti H.S. School, Damak-14 and +2 in Science from Bernhard H.S. School, Balkhu, Kathmandu. I could not get good marks to apply for scholarship in the IOE examination, so I joined Tri-Chandra Multiple Campus, taking GPM combination as advised by my Uncle, who was also a geologist. I was really inspired by him.

The best novel I have studied till date is "The Alchemist" by Paulo Coelho. This book inspires people to follow their dreams.

When I started taking classes of Geology, I found the subject very interesting. Plate tectonics, Structural geology and Earth's history were very interesting to learn. Study and interpretation of contour maps were also interesting.

After the end of second year, I found geology very interesting and was keen to learn further, so I chose geology in third year. The field work of Malekhu area was the most unforgettable time in my life.

Year of Admission: 2067
Name: Vikram Shrestha
Roll no.: 240
Subject Combination: Geology, Physics and Mathematics
E-mail: vikram_shrestha16@yahoo.com

I was born in Gulariya - 8, districts headquarter of Bardiya and my date of birth is 11th Asard. I changed my school during my student life due to many reasons. So, I have well experiences about the school life. At first, I attended Dinak Boarding School at Khajura Bazaar for my primary school. Then, I move to Gulariya and admitted in Bageshwory Boarding School for secondary school. For class 8, I joint in Small Heaven Secondary School, at Narayanghat. And after that, I again changed school and completed my SLC exam from Paschimanchal Higher Secondary School at Pokhara.

Then after, I spend 2 years in Bernhardt Collage at Balkhu, Kathmandu for higher secondary school (+2) in science. For Bachelor, at first, I joint in same collage, i.e. Trichandra Campus, then I moved to Germany to study Physics. Finally, at present, I am again studying my Bachelor in Trichandra Campus.

I have a quite interesting and surprising story about why I am so enthusiastic to be a student of geology in Trichandra Campuse. My story, to study geology, begins from the time when I was too young, may be at the age of 10-12 years. Since that time, I always used to be curious about 'what might have happened on Earth well before the people existed on this planet?' So, many related questions knocked my mind so frequently like, when and how the Earth was originated? How the atmosphere and ocean etc. were formed for the first time? How the life itself came on exist? Did the prehistoric animals like dinosaurs ever existed on Earth? If so, how they all get extinct? How the Himalaya and other mountains formed in present shape? Even, how the ancient Kathmandu Lake was originated and finally disappeared? and etc. At the beginning, to answer out all of these questions, I did not have any sources, no proper books, no related persons or teachers, no museum and nothing else. I was continued to think about it, however, until and unless I fully satisfied internally.

When I passed SLC exam, all of my relatives including my family members forced me to study SCIENCE; as I had good marks in SLC exam. As they had expected, I joint +2 (HSEB) in science faculty as my further career. But the big question arises in my life just after completing my +2. Though, there is lots of choices after +2, even in science field, I was in big dilemma to select the particular subject in that particular time. My family forced to become an engineer, who I am not interested yet, and on other hand, I have to find out the related subject in science that will be able to answer out my numerous curiosities that know my mind, every moment and every single day. Somewhere, I realized that the PHYSICS is that particular subject that I am searching for and will explain the history of the Earth on the base of science, that is, researches and experiments. I tried my best to convince my family (*especially* my dad) that I want to study physics for further, but he directly rejected me. So, I followed the path that my dad had directed me, as I never want to hurt them.

May be 6-7 months later, I get an idea, to go abroad for my further study and luckily, all may family members agree with this decision. The interesting fact is that, my dad gave me a green signal, no matter which subject I like to choice in abroad. Then I applied and got a Student Visa to study Physics in Germany.

After long time period, may be 2-3 years later, I would not satisfied with Physics, simply because I did not get the answers of my problematic questions still then. One day, I expressed all my feelings to one of my junior Nepalese students in my work place and interestingly and intensely, he suggested me with very beautiful ideas. He explained me, "Physics is not the subject that will solve my problems, in fact, and GEOLOGY is the proper and right subject, which has all the scientific answers that you are seeking for". Furthermore, he elaborated me to go back to Nepal to join the subject Geology in Trichandra Campus (the only place in Nepal). For this, he had mainly two reasons: the first, it is expensive and very hard to study geology in Germany and the second reason is that, it will be far better to study Geology in own country where he/she will spend their entire life. In addition, he added, the Department of Geology in Trichandra Campus is well organized department among all the Government Collage and Campus and the teachers of this department are well trained and almost all are Ph.D. holders.

I was fully satisfied with his suggestions, in fact, all the credits why I am studing Geology goes to him. Soon after that, I decided to go back to my own nation, so then immediately, I wrote a letter to my dad in Nepal and I explained all this matter to him briefly. I do not know how, he offered me to come back to Nepal and study what I want. So, I returned back to my own country to study that is very much important for the country like Nepal. Scientists called Nepal as, "Labotary of Geology". So, this is my and last changes to proved myself that I will clarify all my surprising questions related to the history of the Earth and prehistoric life.

In this way, after spending long academic years in Germany, I am study Geology in Trichandra Campus, Gantaghar, Kathmandu and the academic environment of the Department of Geology is very wonderful and very different that I was expected before. All the teachers and staffs are so co-operative and supportive that I cannot express that in words. All the friends I found in these subjects are so loving and caring individually. To the point, I really proud to be a part of this department and I also want to ensure all the teachers and friends of Department of Geology that I will always and always dedicated to this department and in the field of Geology.