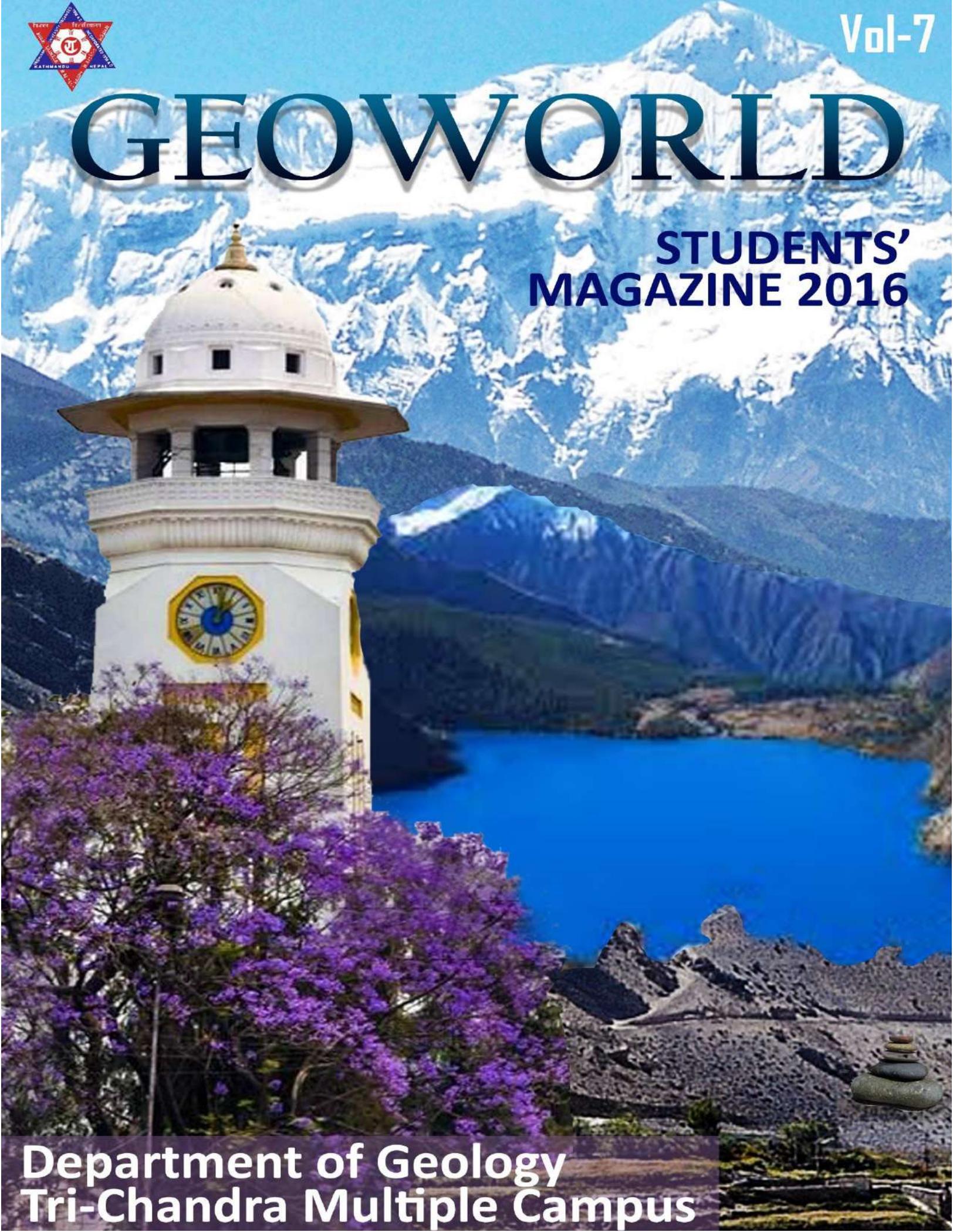




Vol-7

GEO WORLD

**STUDENTS'
MAGAZINE 2016**



**Department of Geology
Tri-Chandra Multiple Campus**

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All knowledge begins as uncommon—unrecognized, undervalued, and sometimes unaccepted. But with the right perspective, the uncommon can become the exceptional. That's why GEO WORLD (VOL 7) is dedicated to making uncommon knowledge, common—through validation, integration, and connection. GEO WORLD (VOL 7) is a magazine that is glorified in academics of geology student. We are immersely happy to publish this academic magazine. This magazine contains articles, some personal introduction and autobiography of the students.

We would like to relay and express our deep gratitude to Dr. Tara Nidi Bhattarai for this continuous support and encouragement to publish this magazine. We would also like to thank the students who have contributed their precious time in writing the articles. And all the faculty members, the administration for enormous support.

We are excited about this magazine, and we hope our readers will find it useful for navigating through all of the information within an article and related material from other locations on the internet.. Though every care has been taken to remove the mistakes, critical comments regarding the magazine is heartly appreciated. We would be grateful for any feedback.

Thank you!!

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त्रिभुवन विश्वविद्यालय
त्रि-चन्द्र बहुमुखी क्याम्पस
(स्थापित १९७५ वि.सं.)

फोन : ४-२४४०४७

क्याम्पस प्रमुखको कार्यालय
सरस्वती सदन, काठमाडौं ।

पत्र संख्या:-

मिति: 2073-06-12.....

शुभकामना



त्रिचन्द्र बहुमुखी क्याम्पस, भुगर्भशास्त्र विभाग, चौथो वर्षमा अध्ययनरत विद्यार्थीहरुद्वारा प्रकाशित "GEOWORLD" नामक मुखपत्रको सातौं संस्करण प्रकाशन गर्न लागेको थाहा पाउँदा अत्यन्त खुशी लागेको छ ।

यस प्रकारको मुखपत्रले भुगर्भशास्त्र अध्ययनरत विद्यार्थी तथा अन्य विद्यार्थीहरुलाई ठुलो टेवा र उर्जा प्रदान गर्छ भन्ने मैले विश्वास राखेको छु । साथै यस कार्यमा सहभागी हुने सबै विद्यार्थीहरुमा मेरो व्यक्तिगत तथा क्याम्पसको तर्फबाट बधाई दिदै यस मुखपत्रको सफल प्रकाशनको लागि हार्दिक शुभकामना व्यक्त गर्दछु ।

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क्याम्पस प्रमुख



त्रिभुवन विश्वविद्यालय
त्रि-चन्द्र बहुमुखी क्याम्पस

फोन : ४-२४४०४७

(स्थापित १९७५ वि.सं.)

विज्ञान तथा प्रविधि अध्ययन संस्था
त्रि-चन्द्र क्याम्पस

क्याम्पस प्रमुखको कार्यालय

सरस्वती सदन, काठमाडौं ।

Date: 2073-06-12

पत्र संख्या:-

GOODWILL MESSAGE

मिति:.....

FROM THE HEAD OF DEPARTMENT,
GEOLOGY, TRI-CHANDRA CAMPUS

It gives me an immense pleasure to express my good wishes to the 'Geoworld, Volume 7', from the Geology Students, BSc. 4th year (batch 2069) of Tri-Chandra Campus.

I would also like to congratulate all the students for their 'Students Magazine', which is published regularly.

The messages and technical know-how mentioned in the articles might be useful and helpful for the nation building process.

May all be benefitted from the students' labor, endeavor and positivity.



(Madan Ratna Manandhar)

Head

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Geology was totally a new subject to me, as I came Tri-Chandra Multiple Campus. So, I decided to study Geology there. I must say that was the best decision I took at that time. I am really enjoying studying Geology rather than other subjects.

Playing cricket is my hobby. Cricket always fascinates me. Besides playing cricket, travelling has always been fun. It feels great travelling to different places and meeting new people.

Possibility of Minerals Extraction and its Utilization in Nepal

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Abstract: This paper article gives the summery of the occurrence of minerals and their sustainable use for economic development and their proper extraction of most of important metals, non-metals and fuel mineral in Nepal. In the geological point of view, the geology of Nepal is very complex because of geodynamic movement of the mountain. Though the complex geology, good amount of different types of minerals have been reported. More than 85 minerals and their varieties have been known in large concentration in Nepal. It is believed that there are areas in Nepal which contain plenty of tantalum, niobium, molybdenum and rare earth metals ores. Nepal may become a major supplier of these metals if their proper execution is made. Alluvial plain of Nepal are known to have placer gold while the middle region contains copper, iron, zinc, nickel, cobalt etc.

Key Words: *extraction of minerals, economic development, metal, non-metal, fuel mineral*

1. BACKGROUND

Nepal is the land locked mountainous country which lies in the central part of the 2500km long Himalayan belt. About one third part of Nepal is covered by mountainous range. Nepal covers the area of 1, 47,181 sq. km and is bounded by the northern latitude 26⁰22' and 30⁰27' and the eastern longitude 80⁰04' and 88⁰12'.

The geology of Nepal is very complex because of continuous geodynamic process in Himalayan region and that resulted many thrusting, faulting, folding, magmatic activities and metamorphic effects. From mineral resources point of view, Nepal Himalayan can be divided into five distinct morpho-geotectonic zones from south to north; the southernmost terai plain is potential for gravel, sand, ground water, petroleum and natural gas. The sub-Himalayan zone (churia/siwalik) is the potential area for construction material, radioactive minerals, petroleum, natural gas and minor amount of coal. Similarly, lesser Himalayan zone (the Mahabharata range and midlands) is potential for metallic minerals mainly iron, copper, lead, zinc, cobalt, nickel, tin, tungsten, molybdenum, gold, uranium etc. Industrial minerals like magnesite, phosphorite, limestone, dolomite, talc, clay etc. gemstones like tourmaline, garnet, kyanite etc. fuel minerals like coal, lignite, methane gas, petroleum and natural gas and radioactive minerals and constructive materials like gravel as well as river boulders, gravel and sand. Similarly, in higher Himalayan are highly promising for precious and semiprecious stones. Marble and metallic minerals like lead, zinc, gold etc. likewise, In the Tibetan Tethys zone mainly limestone; gypsum brine water (salt) and natural gas etc have high potential.

Minerals are the naturally occurring homogenous non-renewable substances having a set of constant physical properties atomic structure and chemical composition (Bangar, 2001). Sustainable development of such resources helps to strengthen the economy of a country. Metallic minerals are very much used in various proposes in day to day life. They are mostly extracted from their respective ore. During five years

Plan period the Government of Nepal has given high priority to explore, evaluate and sustainable development of industrial minerals, high price metals, base metals, fuel, minerals, precious and semi-precious stones. Minerals exploration activities were in peak during 1974-1980 when DMG and UN funded minerals exploration development project were in action. Since then the GON is investors/companies (National and international) to invest in minerals and mining sector and established minerals based industries in Nepal.

1.1 Mineral Extraction

The process of taking out metallic, nonmetallic and fuel minerals from their ores bodies which is buried under the earth is known as mineral extraction. There are several different ways to extract the mineral from the earth; out of these two main methods are surface mining and subsurface mining.

1.1.1 Extracting surface minerals

• Surface mining

It is the process of removing mineral which are near the earth's surface is known as surface mining. In this method mainly shallow deposits are removed. More than one third of the world's yearly mineral production is being extracted by the surface mining. Minerals such as coal, copper, iron, clays, gypsum, phosphate, rock, sand, gravels, stone and other precious minerals like gold, tin, platinum and gems etc are extracted from surface mining. There are various methods for surface mining, which are given below.

Subdividing surface mining method.

Method	Subclass	Method
Mechanical excavation		<ul style="list-style-type: none"> ▪ Open-pit (or Open-cut or Open-cast) mining. ▪ Terrace mining. ▪ Strip (flat terrain) mining. ▪ Contour strip (hilly terrain) mining. ▪ Auger Mining ▪ Glory Holing ▪ Quarrying
Aqueous	Placer	<ul style="list-style-type: none"> ▪ Panning ▪ Sluicing ▪ Dredging ▪ Hydraulic Mining
	Solution	<ul style="list-style-type: none"> ▪ Heap Leaching ▪ In-situ leaching (ISL)

1.1.2 Extracting mineral in deep under ground

• Subsurface mining

Some minerals which are extracted from very deep below earth's surface – sometimes hundreds or thousands of feet deep are known as subsurface mining. To remove these minerals from the ground, a long tunnel is created; horizontal shafts, vertical shafts, sloping shafts that can incline upward or downward or combination of all these depending on the shape of the ore bodies. Under mining involves drilling, grinding, building supported by pillars and shoring, removing ore, reshoring and following the ore face. There are different ways for subsurface mining. They are Long wall mining and solution mining.

2. Minerals found in Nepal

2.1 Metallic minerals

Iron ore occurrences/ prospects/ deposits are reported from 85 localities. It was mined and smelted extensively in different parts of Nepal since 200 years before present but no one is in operation at present. In those days people were fully dependent on indigenous production and Nepal was also exporting iron

And copper to Tibet. It was used in the domestic and agricultural utilities as well as arms and tool making. Phulchoki (Lalitpur), Thoshe (Ramechhap), Labdi Khola (Tanahun) and Jirbang (Chitwan) are the main known iron ore deposits. Iron prospects/ old workings are also known from different parts of Baitadi, Bajhang, Jajarkot, Rolpa, Surkhet, Myagdi, Baglung, Parbat, Chitwan, Ramechhap, Taplejung etc. Phulchoki iron deposit still remained untransformed into commercialization. Those iron deposit was

mined during Rana's time for almost 100 years and it was totally closed after the democracy when finished iron became available in the market. Recently a private company started exploration the works after getting the Prospection License of the iron mining in Nepal for their economic use for country.

Copper occurrences/ prospects are known from 107 localities. Small scale copper mines were operated in Gyazi (Gorkha), Okharbot (Myagdi) and Wapsa (Solukhumbu) till to the last decade. Old workings are known from different parts of Darchula, Bajhang, Bajura, Baglung, Gulmi, Tanahun, Gorkha, Makwanpur, Kavre, Ramechhap, Okhaldunga, Dhankuta, Solukhumbu, Ilam and Taplejung districts. Among them Siddhi Khani (Ilam), Mulkhani (Gulmi) Arkhaule & Ipa (Makwanpur), Khandeshori (Darchula) are the important ones. Other copper prospects like Kalitar (Makwanpur), Dhusa (Dhadhing), Bamangaon (Dadeldhura), Bhut Khola (Tanahun), Pandav Khani (Baglung), Chhirling Khola (Bhojpur) are the major ones.

Zinc and Lead occurrences/ prospects are reported from 49 localities in different parts of Nepal. In most of the cases they are associated in the same deposit like as in Larri (Ganesh Himal, Rasuwa), Labang-Khairang (Makwanpur), Pangum (Solukhumbu), Salimar valley (Mugu/ Humla), Dhuwakot (Parbat), Barghare (Makwanpur), Khola Khani (Taplejung) etc. (Department of mines and geology, 2015)

Gold is a precious metal. Alluvial/ placer gold are frequently mined from the river gravel/ sediments from the major rivers like Mahakali, Chamliya, Jamari Gad, Seti, Karnali, Bheri, Lungri Khola & Phagum Khola (Rolpa), Kaligandaki, Myagdi Khola, Modi, Madi, Trishuli, Budigandaki and Sunkoshi. Primary gold occurrences are known only from Lungri Khola area (Rolpa); Bangabagar, Gorang & Jamari gad (Baitadi); Bamangaon (Dadeldhura) but they are yet to be evaluated by detail exploration. The used of gold are; The greater part of the gold produced is used to manufacture various articles among which jewelry comes first (50%); The 40% of remaining gold is kept by governments as a “gold reserve” in the form of coins and bullion; The other use of gold (10%) is in industries (electronics, precision instruments, chemical, and medicine).

2.2 Nonmetallic minerals

Nonmetallic minerals rocks like limestone, magnesite, dolomite, phosphorite, talc, quartz, mica, clay, silica sand, gemstones, decorative and dimension stones, construction materials etc. are the common nonmetallic minerals.

Limestone and Dolomite: Over 1.25 billion metric tons of cement grade limestone deposits are known from the Lesser Himalayan region only (DMG, 2015). Over 5 billion tons (possible) of **dolomite** occur mainly in the Lesser Himalaya and in some parts of Higher Himalayan region. Most of them are not yet explored in detail and still we do not know their grade and quality to utilize as raw materials for industries.

2.3 Fuel minerals

Coal: Existence of peat, lignite and coal are known in the different parts of the country. Such occurrences are known in four stratigraphic positions e.g. (i) Quaternary lignite in Kathmandu valley (ii) Siwalik coal (iii) Eocene coal and (iv) Gondwana coal. Lignite deposit in Kathmandu valley. Small scale 19 coal mines are in operation in Dang, Salyan, Rolpa and Palpa districts. Gondwana Coal encountered near Barahakshetra and Kampughat areas are not up to the suitable grade. Coal production in Nepal is insignificantly small (100-200ton/day (Department of mines and geology, 2015).

Petroleum and Natural Gas:

A series of Oil and Natural gas seeps are recorded in a stretch of 14km in Padukasthan, Sirsathan and Navisthan area in Dailekh and only gas seep in Muktinath (Mustang). GON/ DMG are giving high

priority to explore and promote petroleum exploration in Nepal since 1982. DMG/ Petroleum Exploration Promotion Project (PEPP) identified 10 prospective blocks in the southern parts of the country. Shell Company of Netherlands conducted exploration in Block no.10 in eastern Nepal. It has drilled a well up to 3520m deep but the hole appeared dry. At present Texana Resources Company of USA and Cairn Energy PLC of UK have initiated the exploration works in Block no 3 & 5; and 1, 2, 4, 6 & 7 respectively. The possibility of finding oil in some of these blocks appears fairly high (Department of mines and geology, 2015).

Methane gas in Kathmandu valley is associated with ground water that exists in the lake sediment of the Kathmandu valley. Initial exploration was carried out with the assistance of Japanese International Co-operation Agency (JICA). DMG explored this gas in 26 sq. km area in Kathmandu valley and proved 316 million cubic meter methane gas deposit. The purpose was to assess the available reserve and the possibility to use it as an alternative energy. The feasibility study was conducted in 1996/97 by a private consultant. The study concludes that the use of methane gas is viable for both domestic and industrial purposes. Based on the above results, DMG had invited proposals 5 times from the potential investors to bid for the development and commercialization of the gas resources for the benefit of society. But so far no one has taken such initiative. It is available for the potential investors to develop and commercialize for the benefit of the people of Kathmandu valley. Recently two companies applied for the promotion of Kathmandu natural gas (Department of mines and geology, 2015).

2. OBJECTIVES

The main objective of this report is based on the minerals extraction and their proper utilization for the economic development of the Nation.

3. METHODOLOGY

All the necessary information of this report article was collected from secondary sources like books, articles, online journals and magazines, etc.

4. CONCLUSION

For the sustainable use and economic development of the country extraction as well as exploitation of mineral resources is very important. Continuous effort are very necessary to find out more mineral deposit, timely exploitation of these known resources and make multiple uses of these mineral commodities for the benefit of the people. Government of Nepal should give high priority of explore, evaluate and sustainable development of industrial minerals, high price metals, base metals, fuel minerals, precious and semi-precious stones as well as nonmetals.

ACKNOWLEDGEMENT

I am very thanking full to Dr.Tara Nidi Bhatrai for giving me the opportunity of writing this article based on "Possibility of minerals extraction and utilization of Nepal". I would like to give my sincerely thank to my friend who helped me directly or indirectly while writing this article.

REFERENCES

Bangar, K. (2001) *Principals of engineering geology*. First ed. Lomus offset press, Delhi.

Kaphle,K.(2011) *Minerals , Mines and Mining activity in Nepal*.

Department of mines and geology, Retrieved 2015, [Available on]
<http://www.dmgnepal.gov.np/component/content/article/71-foreword>



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Born in Bastu VDC, ward no 07 Dhurkot in Gulmi district. I attended Dhurkot Boarding School in primary level. Then attempt secondary level in Shree Kalika Boarding school. The passed my SLC from Shree Himalaya Higher Secondary School in Gulmi. To fulfill aim went to Kathmandu for higher studies and attended Classic College International pinglasthan, gaushala for +2 and completed in 2069. My father's wise to be an engineer. Knowing information about geology from brother I admitted in Bachelor level for B.Sc. at Tri-Chandra Campus. When I visited Tri-Chandra Campus, Ghantaghar I think my future depends on this college, then I see big clock I think success in life depends upon the proper use time.

The first and best book I have gone through was Muna Madhan written by Laxmi Parshad Devkota. This book convey a message that desire of a lot money adds worries rather than happiness and there is only one caste in the world i.e. man. Similarly, another best book I have gone through, published by foreign author is You Can Win by Shiv Khera. it makes evaluation of our self if we are going through life out of inspiration(to win) or desperation (not to lose) give an positive thinking into attitude ambition and action. The knowledge and wisdom that I have gained during my school life has encouraged me to make commitment is must be in discipline, we should do what we can do for the betterment of country.

The unforgettable moment during my first year study was I am such interested in geology classes to know the history of earth. I started liking all subject. On the other hand I got my new friend encouraged to study. During my second year I was really impressed on field visit of geology and also attention on subject my curiosity increases to know the knowledge of geology. Similarly, interest makes to study geology in 3rd year. My attention on the subject and fact information encouraged me to select geology as a major subject in my 4th year study. Studying geology in 4th year was ever more fascinating because of field works, academic activities organized by the department, occasional lecture by geoscientists. During 4th year study attention in engineering geology a subject of application helped me to understand the geology vastly with wide knowledge in practically and theoretically.

Considering the fact mentioned above and also based on my own wisdom. I would except to be a renowned engineering geologist in 10 year time from now.

Natural Resources and Development in Nepal

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Abstract: This paper aim to evaluate how importance Natural Resources for the development of our country Nepal. Natural Resources are the gift of nature to living beings which are used by them for their benefit. Likewise Nepal is also one which is rich in natural resources, in contest of Nepal many peoples' economy depends on it. The important Natural Resources are Mineral, Forest, Water, SOIL/Land, Wildlife etc (nepaldestination, 2010). The prosperity of Natural Resources and proper utilization make the country rich. The improvement of natural resources in Nepal is by developing the technical manpower, infrastructure, adequate research, appropriate government policy, courageous entrepreneurs and so on. The increasing rate of people has higher demand of natural resources for their stander of living. The resources have been fullest extent with scientific and technological skill to people because used of natural resources is important for sustainable development. It's vital role in functioning the modern nation.

Key Words: *natural Resources, demand, Improvement, utilization, sustainable development*

1. BACKGROUND

Man is inseparable from resources Nepal has also been endowed with rich resources. We humans have learned to use the materials of the earth vastly to improve the quality of our lives. In fact our evolving ability to measure of the progress of our civilization from ages to age. The natural resources play an essential role in supporting the livelihoods of the majority of the poor's people improvement in their activities. (Natural resources from the earth) Nepalese are based upon agro-bases economy because of poor economic condition. Due to lack of capital and technology people are not capable to do best and hence destroying the natural resources. So we avoid destruction of environment and natural resources and can establish industrial area by using scientific and modern technology to improve economic development.

2. OBJECTIVES

- How natural resources help in economic development
- Study Location and show available of natural resources in Nepal for development
- To create general awareness among the people on preservation,
- Utilization and sustainable development of natural resources.

3. METHODOLOGY

The information of this article was taken from secondary source like book, article, website and others.

4. FIELD INVESTIGATION AND DATA COLLECTION

Different books and article were investigate the natural resources and help in development in Nepal. At present contest of Nepal earthquake 2072-01-12 destroy a lots which lack behind the development of work. The important research are hydropower, solar energy, fossil fuels, metallic and nonmetallic mineral etc. Appropriate use of this natural resources support the economic development of country.

5. RESULTS AND DISCUSSION

Geology of Nepal is very complex because of continual geodynamic process in the Himalayan region (kpkaphle2011dec3). It is underdeveloped country with vast natural resources such resources are mineral, water, forest, medical herbs, wildlife, agricultural product and so on. Mineral are non-renewable resources in Nepal more than then 85 mineral and their varieties have been known in large concentration. Water resources is also 2nd rich country in world. Similarly, forest and land/soil has huge uses for the development of the country. Let us see some important resources of Nepal for development of country in briefly. Mineral Resources helps in economic development, from mineral resources point of view, the southernmost Terai Plain is potential for ground water, petroleum and natural gas, and the Sub Himalaya for construction materials, radioactive minerals, petroleum, natural gas and minor amount of petrified coal.

Lesser Himalaya for metallic minerals mainly Iron, copper, lead, zinc, cobalt, nickel, tin, tungsten, molybdenum, gold, uranium, rare metals and so on, and industrial minerals like magnesite, phosphorite, limestone, dolomite, talc, clay, kaoline, graphite, mica, silica sand and quartz, and gemstones like, tourmaline, aquamarine/ beryl, garnet, kyanite and quartz crystals, and fuel minerals such as coal, lignite, methane gas, petroleum and natural gas, hot springs and radioactive minerals, and voluminous construction materials. Some of the areas in Higher Himalaya are highly promising for precious and semiprecious stones like ruby, sapphire and emerald, and metallic minerals like lead, zinc, uranium, gold silver etc. Tibetan Tethys zone is prospective for limestone, gypsum, brine water (salt), radioactive minerals and natural gas. (kpkaphle2011dec3)

Water is a basic source of energy which helps in overall development of country. From availability point of view Nepal is second rich country in the word. The development of Nepal's water resources could generate hydroelectric power, furnish water for irrigation and supply water for domestic and industrial uses. It helps in economic development in agriculture, industries, hydroelectric potential, foreign currency and many more.



Fig 1: Hydropower project at Koshi (Photo credit: Mikeldunham)

The forest resources are renewable natural resources. In the context of Nepal which is rich floral and faunal biodiversity, so appropriate scientific management and utilization of these resources can accelerate the pace of economic development of the country. The importance of forest resources in economic development are as follows: source of energy, source of raw material, source of fodder and animal habitat, control of soil erosion and landslides, source of water, tourism development, source of public revenue, ecological balance.

Other many more resources are also found in Nepal like soil/land, wildlife, medicinal herbs, and so on. These all help in development.

From this article on natural resources and development we can know the importance of resources and which helps in the development of the country. For example; mainly water for hydroelectricity, forest for medicinal plants, mineral resources for energy, possibility of tourism. The needs for improvement in natural resources by developing infrastructure, technical main-power, appropriate government policy, and so more. Natural resources are our common and public property free gift by nature for goodness and essential to be alive. In other hand resources create local jobs add value products create more economic opportunities than exporting.

6. CONCLUSION

We can conclude Nepal is potentially rich in Natural Resources with the huge amount of opportunities for development. We have discussed details. Water resources has various opportunities and potential of hydropower is rich at various regions and basins. In present context, electricity supply is insufficient, unreliable, and expensive. The nation brings good programming, technology and financial projects to produce excess electricity as for the nation as well as to export for the development activities. Similarly, mineral resources are lagged behind because of the inadequate research, infrastructure. So technologically and scientifically improve the economic development like energy, industries etc Green forest are Nepal's wealth is famous slogan. Nepal is rich in biodiversity having tremendous potential for development. Natural resources are important source of tourism so proper institutional, arrangement, and management make nation develop.

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REFERENCES

kpkaphle.blogspot.com/2011/12/minerals-mines-and-mining-activities.html>

[10 November 2015]

Nepaldestination.blogspot.com/2010/03/natural-resources.html[15 November 2015]

Naturalresourcesinnepal.blogspot.com/2011/09/present-condition-of-natural-resources.html[11 November 2015]



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Born in Japhe V.D.C, ward no. 7, Dolakha but I spent less time in my village. I completed my S.L.C from Aakash Deep English Secondary School, Dakshindhoka, Kathmandu and +2 from Herald International Collage, Mahrajgunj. Three years ago I admitted in Bachelor Level for B.Sc at Tri-Chandra campus. When I first visited Tri-Chandra campus, Ghantaghar as well as Ranipokhari attracted me the most because I had not seen these two beautiful structures so close. I wanted to know how a monument was built on the middle of a pond. I also wanted to see the machines inside Ghantaghar but unfortunately we are not allowed to go inside.

The best book I have gone through until the time is Summer Love by Subin Bhattra. It is a story of love. It shows how much true a man can love anyone. This book fascinated me the most because when I read the book, I felt like that I am the character of the story and I could feel all that the man in the story felt.

The knowledge and wisdom that I have gained during my school life has encouraged me to make a commitment that I will never be lazy and spent my free time by doing useful works like reading books or playing or helping others but doing nothing is strictly prohibited.

It is the age or the environment of Tri-Chandra campus that I could not focus on my study. Although I started to love geology class, I did not understand some of the terminologies, but I was determined to study Geology and I concentrated to learn it. I wanted to know how the scientist divided the interior of the earth and concluded about their states, composition, temperature and many more.

The most unforgettable moment during my first year study was a day in our collage library. It was second time I visited the library. I was there to make my library card when I met the most beautiful girl of the campus and made friendship with her. While coming at the end of second year course, I started liking Igneous Petrology. It describes about the volcanic as well as plutonic rocks. It also describes about interior composition of mantle. Also the practical works of structural geology were also very interesting. During my third year, my attention was towards the geophysics. It also helped to understand about the interior of the earth. During third year, my unforgettable moment was the 15 days field work. It was fun since I was with my friends. Those 15 days are very special days of my life.

Studying Geology in fourth year is more fascinating because of field works, study about engineering geology, mining geology and many more. Also it is grateful to study in fourth year since my batch is the first fourth year batch of Nepal. Study of groundwater and use of geophysical method to study it could be very useful to most of the people. This year is also important because we will have 30 days field work. I hope that it will be more fun than previous year.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a very good geological scientist in near future.

Water Resources in Kathmandu

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Abstract: This article contain a detailed report of available water resources in Kathmandu valley. People are using water resources rapidly and moreover they are destroying it. I would like that the people who will read this article will not only stop polluting environment but also support for the conservation of these resources. As it is the human who are using these resources, it is their duty to conserve it.

Key Words: *ground water, pollution, rain water, river, water*

1. BACKGROUND

Kathmandu is the capital city of Nepal. It has plenty of water resources. The natural resources are gift of nature. Nepal is second richest country in water resources. Water resources are divided into 3 different categories. They are: Rain water, Surface water and subsurface water. Cloud is the source of rain water. It is formed by the concentration of water vapor of the air. Surface water contain source like rivers, pond and lake. In Kathmandu valley we can see few small ponds, some rivers but no lakes. Subsurface water refers to water beneath the ground. There is huge aquifer on the land of the valley. Aquifer refers to the geological formation like soil, fracture in rocks that store as well as supply the water.

2. OBJECTIVES

Nepal is rich in water resources but the people are facing problem of water. The main objectives of this article are:

- To show the available resources of water in Kathmandu
- To show degradation of these resources
- To aware people about the solution of the problem
- To make the best use of this natural resources

3. METHODOLOGY

The necessary information about the article was collected by field study, and secondary sources like book, article, website etc.

4. RESULT AND DISCUSSION

As stated above there are three types of water resources. They are described below:

4.1 Rain

Kathmandu valley, lying at the coordinate of 27° 42' 14.67" N, 85° 18' 25.5" E is at temperate climatic zone. It has the annual rainfall of 1343 mm. The rainfall periodically occurs in the month of July and August with average rainfall of 380 mm and 345 mm respectively. The rain water irrigates land and recharges the ground as well as surface water.

4.1.1 Degradation and Problems

Due to the smoke of factories and vehicle, dust and volcanic gases the atmosphere is affected and same gas and dust pollute the cloud that makes rain. Similarly the rain makes road muddy and triggers disaster like flood and landslide. When heavy rainfall occurs in central part of city, the roads are filled with water, it also disturb the transportation.

4.1.2 Solutions

The pollution on the air could be stopped by closing the factories that produces harmful gases, using ecofriendly vehicles, planting and many other cleanliness programs. The rain triggers disasters but this is earth process. We can reduce the risk of these disasters by proper developmental work and many safety measures. We can make dams and bars on the bank of rivers to reduce destruction due to flood by heavy rainfall. Landslide could be controlled by planting trees on barren land, filling joints and huge fractures. Roads should be pitched and proper drainage system should be made on the city to ensure good transportation facility.

4.1.3 Use

Rain water in Kathmandu is not as polluted as in other places of the world. Rain water could be used in drinking purpose. If we collect rain water and filter it, then we won't get the problem drinking water in rainy season. Now-a-days the concept of Eco-friendly home has played a vital role in conservation and utilization of rain water in different home of the city.

4.2 Ground Water

The ground water is providing drinking water facility to most of the people in the city. It is charged by rain water. Kathmandu is a big reservoir of underground water. People are using groundwater in almost every home. People are getting enough supply of ground water in some part of the city but on the center of the valley, the supply of ground water is very less. This is due to the geology of the valley. Most of the northern part and some surrounding hills are good aquifer of water which contains sand but the central part is filled with clay which does not form good aquifer (Maharjan, 2014).

4.2.1 Degradation and Problems

Ground water may contain harmful chemicals like arsenic which hampers the health of people and makes water yellow. People are utilizing the ground water in a huge amount but the recharging process is disturbed by unmanaged urbanization. So the level of ground water is decreasing day by day and ultimately vanishing. We can see the stone taps that used to supply water 24 hours before ten years is now dry (Khatiwada, 2014).

4.2.2 Solutions

Harmful chemicals can be treated using proper chemical. The use should be minimized and urbanization should be managed in a proper way. A large area of the valley must be conserved as a land fill area. Land fill area is a separated land any place for the recharge of the ground water. Rainfall occurs mostly in the northern part of the valley so northern part is suitable for landfill area.

4.2.3 Uses

After purifying and filtering the ground water, it can be used for drinking, irrigating lands, washing, cleaning and many more.

4.3 Surface Water

Kathmandu is also irrigated with surface water. Bagmati river, Bishnumati river, Dhobi river, Nakhu river, Tukucha river, Manamati river, Manohara river, Hanumante river and Balkhu river are the major rivers of the valley (Pandey, 2014). Most of the rivers in Nepal are originated from snow but the rivers of Kathmandu valley are originated from ground water (aquifer). These rivers are clean, fresh and drinkable at the origin and to a few distances where it travels but as the river flow downward, it is polluted by human activities. The rivers combine with each other's at different places and flows as a single river Bagmati through the Chobar pass out of the valley.

4.3.1 Degradation and Problems

The rivers of Kathmandu valley is polluted by human activity. The quality of river water is so degraded that it is not used for drinking purpose. Most of the famous religious sites are on the bank of the rivers. The religious activities also pollute the rivers river. Similarly drainage is also mixed on the river. The volume of water is also decreasing day by day. Since the rivers are small, the problems of flood do not occur here (Humagain, 2014).

4.3.2 Solutions

Since it is the people who polluted the rivers, it is the duty of people to clean it. A project for the cleanliness of the river has also been established but its effectiveness will be seen if every people of the city give their time to clean the river do not pollute onward. If the rivers of the valley are made clean then it is sure that these river would supply amount of water enough for drinking even in dry season (Sapkota, 2014). The hard part is religious activities like burning the dead body and throwing it into the river. A new plan and effective policies are to be formed to control the pollution.

4.3.3 Uses

The river water is used for irrigation but not for drinking. Some small rivers like Sundarijal are conserved and supplied to limited area of the city. If all the rivers of the valley will be pollution free then the water could be supplied to every home in the valley.

5. CONCLUSION

We are facing water crisis but if we conserve rain water, purify ground water, purify rivers and make a pollution free environment then we won't face water crisis. It is said that nothing is impossible, conserving and purifying water resource is not a big task. If we people try our best we can make Kathmandu a beautiful and clean city and protect our resources. Melamchi Drinking Water Project was started about 30 years ago and it is about to be completed. But if the demand of water supply goes on increasing then Melamchi River alone cannot fulfill people's need. So we have to conserve water resources of Kathmandu valley.

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REFERENCES

Humagain, S. (2014) 'Bagmati River Pollution' *Geoworld*, vol.5, pp. 103-104

Khatiwada, D. (2014) 'Impact of Urbanization on Groundwater Recharge and Discharge' *Geoworld*, vol.5, pp. 23-26

Maharjan, M. (2014) 'Groundwater Use and Overuse' *Geoworld*, vol.5, pp.53-55

Pandey, K. (2014) 'Bagmati River and Its Attributes' *Geoworld*, vol.5, pp.41-44

Sapkota, N. (2014) 'How to Control Pollution in River' *Geoworld*, vol.5, pp.61-63



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I was born in Isma Dralamchour VDC, ward no. 4 Gulmi. I completed my SLC from Shree Ram Rajya Higher Secondary school, Dohali. After that I moved to Kathmandu to continue my further studies because of lack of good college in my district. I passed +2 from Gyankunj College, Ravibhawan Kathmandu. To choose the proper subject for my future was really difficult for me at that time and according to my uncle advice I decided to join B.Sc geology in Tri-Chandra Campus. The historical Ghantaghar is located in the compound of Tri-Chandra Campus had fascinated me lot.

The best book I had read till that time was Raktakunda written by Krishana Abiral. This book make me aware of how the royal massacre had occurred in the then Narayanhiti Royal Palace in 2058 B.S. The best book I have gone through written by foreign auther is Lu Xun a Biography written by Wang Shiquing published by foreign language press, Beijing. This book tells us how Lu Xun united Chinese people against foreign aggression.

The knowledge I have gained till now makes me conclude that helping others who are in need given me incomparable satisfaction.

In my 1st year course I really enjoy the course of physical geology but, didn't study well. When I couldn't do well in exams of the first year, I made up mind to study sincerely.

Towards the end of 2nd year course structural geology attracted me a lot. It is the study of three dimensional distributions of rock units with respect to their deformational histories. The study of geological structures has been prime importance in economic geology.

In the 3rd year of my course, I started liking Geology of Nepal Himalaya. This gives the real picture of how our hills, mountains, and plains are formed and existed in present condition. I really feel proud to study geology of my country. This is why I decided to major in geology.

My forth year course has just begun; Engineering Geology attracted me so much. Gorkha earthquake of April 2015 made everybody about geo science. Hence I also decided to study this subject as my major subject. I have also made up my mind to study it even in my further studies.

If everything remains the same I will be a geologist with in a decade.

Reckless Construction of Roads in Rural Areas and its Adverse Effects

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Abstract: Road is very essential infrastructure to develop the country. It is cheapest among all transportation and easiest way to connect the rural corner of the nation. Roads should be constructed scientifically keeping into consideration the bearing capacity of earth. But in rural areas of Nepal the road have been constructed recklessly. As a result they have given birth to various serious problems, such as landslide, debris flow etc. Road construction in rural corner of Nepal has been politically motivated. The technical manpower involved in designed the road can't work independently. They are compelled to design the road as per the interest of local politician.

Key Words: road, rural, reckless, environment, unsustainable

1. INTRODUCTION

Transport is the main infrastructure of development .Water transport is unavailable in landlocked country like Nepal. Air transport is very expensive. Hence road transport is very important for countries like Nepal. On the basis of administrative classification roads are classified into four categories, i.e. National Highways, Feeder Roads, District Roads and Urban Roads (Nepal Road Standard 2070). Seasonal roads in rural area are comes under feeders roads in this classification as they serve the communities wide interest and connect district headquarters. Road construction has certain basic and scientific norms which must be followed while designing roads. But in rural areas, roads are beings designed and constructed haphazardly and unscientifically and they are unsustainable. Unsustainable roads are those that have no drainage arrangements, high gradient, no protection structure in critical places, no biological protection etc. Such reckless road construction has very adverse effects in the environment and triggers numerous natural disasters.

2. OBJECTIVES

- To understand the present status of rural roads in Nepal.
- To understand the adverse effect of such recklessly constructed road.
- To point out the ways to construct the environment friendly and scientific road in rural area.

3. METHODOLOGY

Much information in this article are collected via direct observation of such road projects, some other information are compiled from secondary sources like newspaper, journal etc.

4. RESULTS AND DISCUSSION

Present status

The road construction in rural area is really environment unfriendly. In Nepal, there are broadly two main road construction technologies in use for rural road construction, they are labor based and equipment based technologies. Both of these technology involve cut and throws method. Because of various governments process delays occurs in budget releasing process which limits the working season for road projects. This results the introduction of equipment based technology in fragile land during rainy season. In the other hand hardly invested technical manpower can't work independently. They have to work as per the interest of local political leader, who have no knowledge of geological norms and standard of road construction. Local people have little or no knowledge about the possible danger caused by such haphazard construction. They accept whatever proposal their leader put forward. They want road in their village at any cost. They don't take into consideration the adverse effect of road construction in fragile land. "Rural road construction in Nepal is constrained by its topography, geological condition, scarce financial resources and lack of sufficient and technical manpower in rural area"(Shrestha2070)



Fig: small scale landslides in Tamghas-Pyuthan road section, Gulmi. Numerous minor scale landslides occurred in this section because of haphazard construction.

Effect on environment

The conventional method of road construction surely leads to the dangerous effect on the environment and the community. The main effect of such method of construction is the mass wasting. Excavated mass thrown down hill damages and cover the vegetation. It takes many years to reclaim the lands to its original condition. Area damaged by the thrown material is about three times more than the land occupied by the road. When the heavy equipment cuts and throws the soil, the entire mass is eroded away heavily by various geological agents. When the water carries sediment load of newly constructed road during

rainy season, debris flow is resulted. Which directly enters into the fertile land which undoubtedly reduces the production capacity of agricultural field and that debris flow have the capacity to erode away the entire village. Materials throw downhill of road is washed out during monsoon and transported to rivulets and rivers sediment load increased in flood due to the mass wasting by road further adds to the damaging effect of the flood. It also plays a catalytic role to trigger landslide in valley side of road due to added load of excavated mass pulling down the original soil mass of hill slope, which was stable earlier. The main effect of cut and throw method of road construction is landslide. The more the cut height is greater the more the chances of landslides and slope failure. Such process may cause landslides even in a dry season. Shear failure is also common in such roads. During the process of construction no one cares about the condition and type of soil and rock. Rock fall is also common in such rural roads. The roads are constructed for the transportation of goods and people but such recklessly constructed roads can't operate properly. As a result, such roads can make no contribution for the well beings of local people for nearly a year. Such road is really curse for the local people.

5. CONCLUSION

Roads in rural areas have become indispensable parts of local people. Road transport is the only and last means of transport network. This type of road construction should be replaced by sustainable and scientific method. First of all local people should be aware of the carelessly constructed road. They shouldn't compel the engineers to design the road as per vested interest. Bearing capacity of earth should be taken into the consideration, fragile area shouldn't be chosen for the shorter. Road constructed scientifically are eco-friendly. Cut and throw method must be replaced by cut and fill method in rural areas. Minimal uses of heavy equipment in rainy season generally increase the stability of road. Proper drainage of water during rainy season greatly reduces the danger of landslides and debris flow.

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I am thankful to my Tri-Chandra college, department of geology for giving me the opportunity to write an article. I express sincere gratitude to Dr. Tara Nidhi Bhattarai for all kind of encouragement to write this article. I would like to thank all the member of editor board for their valuable comments and advice. Similarly I would like thank all others teachers of Geology Department and my colleagues to encourage me to write the article.

REFERENCE

Shrestha, H.R. (n.d.) *Harmonizing Rural Road Development with Mountain Environment: Green Roads in Nepal*, [Online], Available: <http://lgcdp.gov.np/phase1/home/pdf/RuralRoadReport.pdf> [15 December 2015]

Ministry of Local Development (2011) *Economic Analysis of Local Government Investment in Rural Roads in Nepal 2011* [Online], Available: <http://www.lgcdp.gov.np> [15 December 2015]



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Born in Kirtipur, ward no 2, Tyanglaphant, Kathmandu. I attended Pushpasadan Boarding High School, Kirtipur and completed +2 from Trinity International College, Kathmandu. Geology was known to me as earth science but I was unknown about the great importance of geology and its interaction with me in my day to day life. I first visited Tri-Chandra Campus as the oldest institute of higher learning in Nepal. Ghantaghar attracted me a lot.

The best book I have gone through is 'Muna Madan' written by Laxmi Prasad Devkota,, 'Jhola' written by Krishna Dharabasi, both the novels are heart touching Muna Madan explains importance of work in everyones life that makes people great and respected in society not the cast and race they are born in . Jhola , based on sati pratha and eternal love it explains the love between mother and son and the strong move of women against the sati pratha. Similarly the best book I have gone through, published by foreign author is 'The Plumed Serpent' by D.H Lawrence, it conveys the message that restless wonderings does not impair the creative powers, success is determined by hardship one does.

The wisdom that I have gained during my school life has encouraged me to make a commitment that I will give my best effort to achieve success inspite of several obstacles that comes to hinder my success.

During my first year course I was wandering to get a good friendship and active participation in overall activities. I slowly set up my mind with the determined interest as well as enthuthiasm on geology. The most interesting I found was the principle of uniformitarianism "the present is the key to the past"

(Hutton,1785) and came to know that, the same physical processes that are operating now on earth's surface operated throughout geologic time ,with ups and down in its intensity.

The most unforgettable moment during my first year study was the first day I entered Tri-Chandra campus as a student, me unaccompanied by friends seeing the crowded classrooms and noisy environment felt awful. Fortunately Geology class was not so crowded, the discipline and rules and regulation made me more determined towards my decision of taking Geology for further studies.

At the end of second year, I started liking historical geology the most. It gives information about the historical development of earth, its evolution, the tectonic movement that occurred to make changes in the landform & sea distribution in the geological past. During my 3rd study Educational excursion to Malekhu for 14 days, observing and working up with the instruments, route mapping added more to the theoretical knowledge. Effort by teachers and my hard work made me to take Geology as major subject in fourth year. Studying Geology in fourth year was even more fascinating, Engineering Geology attracted me a lot , it not only gives an idea about use of Geology and its components while working together with the civil engineers but also help in developing practical skills in solving the engineering problems.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a skilled Geologist in coming 5 years from now.

A Day Trekking from Kagbeni to Khinga

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Trekking is one of the most popular activities for both recreational as well as educational purpose. Trekking along the snow covered mountains with the most dramatic close views are breathtaking. The first experience of trekking I had ever had in my life till now is from Kagbeni to Khinga. There are no words to explain how blessed I am to feel the extreme grace of nature, the excitement I had while walking in the snow are immortal. 4th Himalayan Exercise Tour conducted by Gondwana Institute for Geology & Environment (Japan) in collaboration with Department of Geology, Tri-Chandra Multiple Campus gave me the golden opportunity to participate in it. Starting from 8th-17th March the team of 24 members headed by Japanese teacher Prof. M. Yoshida and Nepali teachers Dr Ananta Prasad Gajurel and Mr. Mukunda Raj Poudel we studied a section from Tethys Himalaya to Endo- Gangatic plain. The route was Kathmandu-Pokhara-Beni-Jomsom-Khinga-Beni-Pokhara-Tansen-Lumbini-Muglin-Kathmandu.



Fig 1: A group photo with Nepalese and Japanese students

On 10th March, 2015 early in the morning from Jomsom(2740m) we drove to Kagbeni(2800m) via jeep, surrounding steep hills slowly became less steep, the beautiful view of Kaligandaki valley could be easily perceived by sight, the wide valley made by the flowing kaligandaki,(also known as thakkhola) had low amount of water flowing in early March. My Japanese friends were surprised to see clear water, the same water that was ugly downstream. Kaligandaki River carried huge amount of debris causing the clear water that flowed from the mountains to ruin in look.



Fig2. Wide Thakkhola valley

Kagbeni village located in upper Mustang of Dhawalagiri zone of northern Nepal looked admirable. The village is situated at the confluence of the Kaligandaki River and Jhon Khola,(also known as Kag Khola).Village lies on the lower terrace of Kaligandaki River. Due to bulky snow fall there, the hills covered with snow were eye-catching. For moving forward towards Muktinath was a snowy, challenging narrow trail, between massive Himalayan peaks of Dhaulagiri (8,167) and Annapurna1 (8,091m). The trail goes parallel to the Jhon khola that flows into Kaligandaki River. The trail goes slowly and the Annapurna range reveals itself. During sunset and sun rise over Annapurna 1 (8,091m), 2,3,4 and Annapurna south , Mt Dhaulagiri (8,167m), Mt Manslu (8,176), Mt Nilgiri, Mt Machhapuchhre , Gangapurna & Tukuhe slowly appears . At the base of these mountains we walked. Mustang is the last encave of original Tibetan culture. This area is the part of the Tibetan culture. This area is a part of Tibetan plateau and is elevated dehydrated and gorgeous .I experienced a climate change here, the air that passed was dry and caused cracking of lips. The rain shadow area which had precipitation of only 250mm per year had no vegetation. The sand dunes were beautifully distributed by the action of wind; these were composed of mud, sand& silt. From the snow covered patches of the sand dunes arised the thorny plants as shown in the figure below (fig.3).



Fig 3.View of Mt Dhaulagiri and Tukuhe
From Kagbeni



Fig 4. Sand dunes patches with thorny
Bushes.

At the base terrace of Nilgiri, where Mt Dhaulagiri and Tukuiche could be viewed, gave the several view, towards north was thakkhola valley, Thakkhola garben filled by glaciolacustrine and glaciofluvial sediments. West gave the Appealing view of Sandachhe Himal. Further moving east towards Khinga village we had the wonderful experience with the snow that was reflecting the huge light, My friends were used to with snowy environment but was unexperienced by me before ,so I enjoyed every seconds there. They were enjoying seeing the high peaks, topography with high relief which they had never seen before. On the way we observed thick lake sediments composed of yellowish gray to light yellow sand and silt, as the snow had covered the basement, we were only able to observe it on the trail, which we moved on. On the way we observed moraine deposits, end moraine was clearly observable. Tethys sediment composed of clasts of sandstone and limestones were sparsely distributed.

Forward moving a bit from Khinga we observed the Thoron Peak (6,482m), Khatunkhan (6,484m) and the pass between these two peaks was Thoron la. The Jharkot village below seemed fascinating place. Very few houses could be seen before in the Khinga village and almost no houses before khinga village, Jharkot village was below the peaks. The domestic animal like horse, yak were mostly seen there



Fig 5. View of Thoron Peak, Khatunkhan and Thoron la (pass)

On the same way from forward of Khinga *ammonite* fossils were found, presence of thick ice made observation of fossils difficult. The adverse climate had made the people's life difficult, huge snowfall made cultivation of crops and feeding of domestic animals difficult. Trek from kagbeni only takes about 2 to 3 hours but as our Trekking was Geological as well as non- Geological education oriented it took a lot of time to reach Khinga. It was near dusk, wind was blowing carrying the fine ice particles, gently passed by. This moment made memorable imprint in everyones mind.

Finally it was time to get moving; we had still downhill trekking to reach Kagbeni. Thus we detached ourselves from the beautiful mountains and moved on.



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I am born in Gothatar municipality, ward No.13, Kathmandu, I attended Pritima English Secondary School, Kathmandu, and completed +2 from Universal College, Kathmandu.

Knowing information about geology from my elder brother, I admitted in Bachelor Level for B.Sc. at Tri-Chandra campus. When I first visited Tri-Chandra Campus, I was totally confused and wondering but my seniors helped me. I never thought that the environment in such government college would be so friendly and helpful. I am really glad to be the part of such a college and historical building.

The best book I have gone through until that time was “Chicken soup for the soul” written by Jack Canfield and Mark Victor Hansen and published by HCI, Florida. The book was collection of all the inspirational and motivating true stories about ordinary people’s life. It really inspired and encouraged me.

As we know that learning and teaching is one endless cycle of our life. Likewise, I’ve learned many things from my teachers and also from my friends and brothers. Teachers not only taught me about the subject materials but they also helped me to grow up my confidence, to be bold and independent. And my friends helped me to build my attitude and to express my feelings freely. They really changed my way of living as I used to be shy, which is really eliminated from my life.

The 1st year course was really tough for me, actually I lose my year after my high school as I was trying to get admission in Engineering course and also in Nepal army but could not be successful. Then only I started concentrating my study in geology course seriously.

Previously I used to throw a piece of stone in river but now I get curious to know about the mineral composition of that rock. It’s really amazing that earth is dynamic and every creature that ever lived in this magnificent earth is stored in between rocks. And we can tell almost everything just by looking at it. We can tell the history about the rocks that are exposed in earth surface.

Another interesting and most important thing of being a geology student is field visit. Mapping, measuring, maintaining diary, making route map, identifying the exposed rocks and mineral compositions, etc. are really exciting and makes me feel like I am already the geologist.

Considering the facts mentioned above and based on my own wisdom, I would expect to be successful and competent geologist in future ahead.

Status of Sand Mining in Northern Kathmandu, Central Nepal

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Abstract: For thousands of years, sand and gravel have been used in the construction of roads and buildings. Growing trend of urbanization in Kathmandu has increased the demands of sand for building materials. Demand of sand has been fulfilled from terrace and riverbed mining in northern region of Kathmandu and by importing from west of Kathmandu. About 60% demands of sands have been fulfilled through riverbeds while 40% have been fulfilled through terrace deposits. The river or terrace sands do not differ much in major constituents, but the former sands are more matured. Both sands are hazardous in terms of mica content that approaches 10 to 32% lying beyond the acceptable limit of 8%. Other deleterious materials are quite low in percentage and do not exceed 3%. If processing can be applied to reduce mica content at a commercial-scale, the sands in the Kathmandu Valley will be probably of good quality.

Key Words: *mining, terrace, riverbeds, hazardous, fluviodeltaic*

1. BACKGROUND

Rapid urbanization for last two decades in the Kathmandu Valley 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 Manahara Rivers are the sources of sand. Gneiss and granite (Stöcklin and Bhatrai 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. 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). Several workers studied on sand of the Kathmandu Valley with different aspects (Kharel et al. 1992; Sadaula 1993; Paudel et al. 1995; Kharel et al. 2002).

2. OBJECTIVES

The main objectives are as follows

- To identify the places and proper uses for mining;
- To maintain a balance relation between the human and environment without degrading its status
- To implement the laws and policies regarding the mining industries.

3. METHODOLOGY

Most of the data are extracted from the the internet sources as well as books, journals, articles and newspapers.

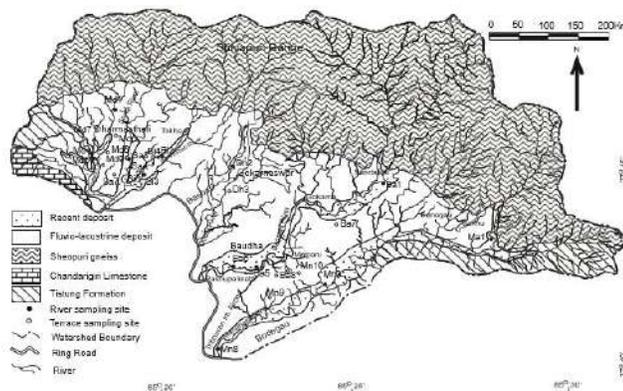
4. RESULTS AND DISCUSSION

4.1 Laws and policies of mining

Since fiscal year 1977/78, sand deposits have been leased, licensed and exploited under the supervision of the District Development Committee. The following norms were regulated for the exploitation of sand.

- Five meters must be left at both banks of a river while exploiting sand from river and the depth of excavation should not exceed more than 1 m from the riverbed.
- No excavation should be made within the radius of 200 meters from any infrastructure.
- Authorized permit must be submitted from the concerned persons or agencies if they use road to the mining sites.
- Leaseholders must submit progress and product quantity to the concerned institution.
- Product of the quarry must give priority of local demand.

The concerned authority must give information regarding leased and licensed area to the Department of Mines and Geology within 35 days of issued date. Regardless of permits and licensing the quarry area, the rest of the statements are not clear and neither there are policies concerning environmental protection, public health, proper taxation and penalty for the illegal mining.



4.2 Fig: Map showing the sampling sites of sand (After Sayami and Tamrakar)

Illegal river mining

Although, Nepal Government banned river mining after 1991, several river excavation sites have been located in the major rivers of the valley. Commonly, miners used excavators to dig a channel in pre-monsoon season, so that sand could be collected in the ditches during monsoon (June–September). Along the channel, bamboo net was built in several rows to retard discharge of sand downstream. Besides that, channel was diverted for trapping sand in the ditch and was also diverted to collect water in flood plain to wash sand. During post-monsoon, different sieves were used directly in the channel to separate gravel and sand. Generally, the domestic tools like shovel, twangro, bamboo bucket, sieves and water pumps were used in the riverbed mining. In the flood plains of the Sanla and the Manahara Rivers, the riverbeds were dug up to 8 meters from their original surface levels.

4.3 Legal and advance mining

Most of the large-scale mining from terraces were legal and were more sophisticated than the traditional method. In sites, hydraulic back-hoe excavators and dump trucks were used to remove overburden and excavate sand. Benching and stripping methods were used to excavate sand from terraces. Plastic pipes of about 0.2 m diameter were used to load sand from the site to the dump trucks. Contractors directly supplied sands to the market or to the consumers or to the processing companies where further washing and screening of gravel and clay would occur. The scraps are used for filling the ground and are also supplied to the market. The cost of sand thus excavated is higher compared to the unprocessed sand.

4.4 Environmental aspects

Environment of Kathmandu is degrading with time. One of the major causes is haphazard mining without considering environment. Riverbed excavation of sand has affected bridge, roads, cultural heritages (temples and crematories) and many houses. Exposure of foundation of bridge has been caused by excessive riverbed sand excavation. Tamrakar (2004) and Bajracharya (2006) stated that riverbed mining was one of the major causes of river degradation and accelerated stream bank erosion. Water quality of the rivers has been deteriorated because of sediment flux caused by river mining. Several aquatic lives have lost their habitats because of high turbidity of water and pollution of surface water. Excessive extraction of sand beyond the reported depth has also caused degradation of land where water impounds during monsoon. Terraces are generally located near the agricultural land and most of them are covered by vegetation. Sand excavation helps to accelerate the erosion rate of exposed slopes.

5. CONCLUSION

Sand mining in the Kathmandu Valley has been continuing in terraces and riverbeds. About 1865 m³ sands from river (60% of demand) and 1238 m³ from terraces (40%) have been excavated each day. The total of 3103 m³ of sand has been excavated each day to fulfill the demand in the Kathmandu Valley. In future this demand may increase considering 40 to 60% increase of household in the valley. The Sanla and the Manahara Rivers are the most efficiently excavated rivers, while the Mahadev and the Manahara River areas are the most excavated terraces. About 45% of excavation were found to be illegal (40% of river sites and 5% of terrace sites). Mining policy and laws are not strong enough to control illegal mining and to bring miners and dwellers into the framework of taxation. The local government could not obtain benefit from the mining despite of huge loss of river environment in the valley. The river or terrace sands

do not exhibit significant difference in texture and composition, but river sands are mineralogically more matured than the terrace sands. These sands are hazardous in terms of mica content that approaches 10 to 32% and lies beyond the acceptable limit of 8%. Other deleterious materials are quite low in percentage. If processing can be applied to reduce mica content at a commercial-scale, the river and terrace sands in the Kathmandu Valley will be probably the good quality sands.

ACKNOWLEDGEMENT

I would like to express my gratitude towards our respected teacher Dr. Tara Nidhi Bhattarai and colleagues who supported and inspired me to write this article. Also the editorial board of the Geo-World, vol 7. Finally to all my friends and all the teachers of geology department.

REFERENCES

- Adhikari, B.R. and Tamrakar, N.K., (2005) Bank instability and erosion problems of Bishnumati River, Kathmandu, Nepal, **Journal of Nepal Geological Society**, Special Issue, V.32
- Bajracharya, R., (2006) Study of geoenvironmental problems of the Manohara River, Kathmandu, Nepal. Unpublished M. S. Thesis submitted to Central Department of Geology, Tribhuvan University, Kathmandu, Nepal, 132p.
- Fookes, P.G. and Revie, W.A., (1982) Mica in concrete—a case history from Eastern Nepal. *Concrete*, V. 16, No. 3, pp.12–16.
- Kharel *et al.*(2002). Sand resources assignment in the Kathmandu Valley, a report submitted to Department of Mines and Geology, Kathmandu, 10p.
- Kharel *et al.*(1992). Preliminary evaluation of the problem concerning and extraction in the Kathmandu Valley. A report submitted to Department of Mines and Geology, 17p.
- Paudel *et al.*(1995) Sand mining in Kathmandu and its environmental implication; a case study. A report submitted to CEDA, 22p.
- Sadaula, D.K. (1993) Sand in Kathmandu Valley: prospect and problem. Unpublished M.Sc. Thesis submitted to the Central Department of Geology, Tribhuvan University.
- Stocklin, J. and Bhattarai, K.D. (1982) Photogeological map of part of central Nepal. Tehran Naqshah Offset Press, Iran.
- Yoshida, M. and Igarashi, Y., (1984) Neogene to quaternary lacustrine sediments in the Kathmandu Valley, Nepal, **Journal of Nepal Geological Society**, Special Issue, v. 4,



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Born in Sirshekot V.D.C., ward No.7, Dumrebhanghang village, Syangja, I attended Shishukalyan Higher Secondary School, Syangja and completed +2 from Bernhardt Higher Secondary School, Kathmandu.

I was doing my nursing at Kathmandu Model College. From a friend of mine, I came to know about Bachelor in Geology. My entrance exam went good plus the subject was of my choice, I got admitted to the college. The environment at the college was friendly and I come to meet many friends. The first college days went by gathering information about the course as well as checking schedules for classes and making more friends.

First year started and our curriculum took a pace within some months. The practical labs and the facilities were real good. Teachers were helpful never denied to solve our queries. The subject matters were not as easy as I had expected. The college academic tour to kakani was knowledgeable; we had a practical experience of what we had theoretically learned in our classes. It was fun too being all the friends together. After some months the real pressure of board exam started and we had very few time to prepare ourself. I too did my best and took the exam.

With lots of experience we started second year of our journey. Whatever happened regarding my studies in first year, I got prepared to make my journey much better academically. Classes started and we had run over the classes to the practical. Days went by, the days of fun, the days of hardships and the days of friendships, I kept on pushing myself better. We again went for academic fieldwork at Chobar, Kathmandu. We studied about rocks, their formation and geological structure. Again it was a great experience with friends and our knowledgeable teachers. Had a very good knowledge to us.

Third year started and again we had same days go through. The academic field work to Malekhu for 15 days was a memorable time of my life. We had to walk a lot and identify minerals, fossils on those hills and jungles. We use to have a very tired day, but those tired days use to have very good moments with friends and teachers. We successfully completed identification process and returned back for regular college days.

I am writing this article consuming all the previous memories and continuing my journey for my fourth year with lots of hope to carry on good future in geology. The article presents some idea about geology of Pokhara.

Liquefaction as a Hazard in Pokhara Valley

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Abstract: Pokhara is located center part of Nepal at between 83.58'30" E to 84.02'30" Longitude and 28.10'N to 28.16' N Latitude. Elevation ranges from 730 m to 1030 m above sea level. Situated on the southern foot of Annapurna Himalayan range, Pokhara sub-metropolitan city covers an area of 55.66 sq. km and covers 2.7 percent area of the district and 0.04% area of the nation. Liquefaction potential is a function of both the susceptibility of surface deposits to liquefaction and the probability that earthquake ground motions will exceed a specified threshold level, or opportunity. A sinkhole is a natural depression or hole in the surface topography caused by the removal of soil or bedrock, often both, by water. Sinkholes form by the gradual removal of slightly soluble bedrock (such as limestone) or semi-consolidated sedimentary deposits bonded calcareous matrix (such as lime mud).

Key Words: *geology, pokhara, liquefaction, sinkhole, hazard*

1. BACKGROUND

Due to the sinkhole, caves formations in Pokhara people are afraid of having some disaster at near future. But this is just the process and no disaster will happen soon, it might take 100s of years for a disaster to happen. To look into the good impacts the diverse geology of Pokhara, it has created a lot of tourism attraction. The international and domestic tourist love and enjoy the naturally created caves, landscapes and lakes. This has surely generated a good income level for the people of Pokhara.

2. OBJECTIVES

The objectives of the article are:

1. Liquefaction susceptibility of Pokhara
2. Liquefaction hazard of Pokhara
3. Sinkhole and surface collapse of Pokhara
4. Liquefaction and collapse of land in Pokhara
5. Quaternary of Pokhara.

3. METHODOLOGY

Most of the data are collected by searching through Google and navigating through different online portals.

4. RESULTS AND DISCUSSION

4.1 Liquefaction Susceptibility

Liquefaction potential is a function of both the susceptibility of surficial deposits to liquefaction and the probability that earthquake ground motions will exceed a specified threshold level, or opportunity (Witter, et al. 2006). A liquefaction susceptibility map reflects the distribution of surficial deposits with different physical properties and variations in hydrologic conditions. The opportunity for liquefaction is determined by the proximity of seismic sources, the magnitude and recurrence interval of earthquakes the seismic sources are capable of generating and local site conditions that control the amplification or attenuation of shaking. Liquefaction susceptible zones can be determined by two approaches: qualitative and quantitative methods. Quantitative method requires enough geotechnical parameters such as Standard Penetration Test (SPT) N-value, overburden pressure, density, etc. that can only be obtained by in situ measurements using field instruments. These tests are very difficult, expensive, and time consuming too. So, in this study, the liquefaction susceptibility mapping was performed by qualitative method incorporating as possible as more parameters, in which the liquefaction depends upon.

4.2 Liquefaction Hazard

Liquefaction is a process in which the soil suddenly undergoes from solid state to liquid state, or having the consistency of a heavy liquid. Liquefaction is more likely to occur in loose and moderate saturated granular soil with drainage, such as silty sand or sands and gravel capped with or containing seams of impermeable sediment. During an earthquake, the ground shaking produce increased pore water pressure in unconsolidated deposits, which reduces the effective stress, and therefore reduces the shear strength of soil. If there is a dry soil crust or impermeable cap over the saturated sand or gravel, the excess water will sometimes come to the surface making cracks in the impermeable layers, bringing liquefied sand with it. The liquefaction results by an earthquake shaking, and is a major contributor to urban seismic risk. In the liquefaction process, the sediments below the water table temporarily loose strength and behave as a viscous liquid rather than solid mainly due to seismic waves. Deposits most susceptible to liquefaction are well-sorted (of similar grain size) cohesion less sands and silts deposited in within the last 10,000 years (Holocene-age). Such deposits are often found along riverbeds, beaches, dunes, and areas where windblown silt (loess) and sand have accumulated. (UNDP Nepal, 2009,)

4.3 Sinkhole and surface collapse

A sinkhole is a natural depression or hole in the surface topography caused by the removal of soil or bedrock, often both, by water. Sinkholes form by the gradual removal of slightly soluble bedrock (such as limestone) or semi-consolidated sedimentary deposits bonded calcareous matrix (such as lime mud). Sinkholes are most common where the rock below the land surface is limestone, carbonate rock, salt beds, or deposits that can naturally be dissolved by circulating groundwater. As the rock or semi-consolidated deposit dissolves, spaces and caverns develop underground. Because of such sinkholes, a sudden collapse of the land surface can occur. During an earthquake, land collapses are likely to occur because the land surface cannot bear the substantial load without adequate underground support. Therefore, the land collapse is another major hazard in urban areas during an earthquake is observed.

4.4 Liquefaction and land collapse susceptible zones in Pokhara

In the present study, the liquefaction potential zones are identified on the basis of above mentioned criteria. The Pokhara Municipality area mainly comprises the deposits less than 10,000 year's old (Holocene-age) showing fluvial and fluvio-lacustrine environment of deposition. Active floodplain deposits found along either bank of major rivers are susceptible to the liquefaction. These deposits are composed of loose sand and sandy gravel with very little or no fine sediments. Similarly, alluvial fan and Lacustrine deposits are also marked as liquefaction susceptible zones due to the favourable characteristics of the sediments. Depicts that the liquefaction susceptible zone covers the floodplain and lower level terraces of rivers that include Dowilla, Sahara Academy's proposed stadium location, Laltin bazaar, and the area near to Mahendra cave. Rests of the places in the Pokhara Municipality are safe to the liquefaction hazard. In Pokhara sub-metropolis and adjoining areas, a number of sinkholes and sites of land subsidence have been reported. Geologically, all these recorded sinkholes lie in the Ghachok Formation. This unit belongs to the debris flow deposits that comprise boulder to silt sized sediments with limestone fragments and capped by 1-3 m. thick silty layer. Therefore, the Ghachok Formation is here allocated as land collapse susceptible zone in the Pokhara sub-metropolis. The core city area of Pokhara from Baidam and Rastra Bank to BaglungBuspark lies in the land collapse susceptible zone. Similarly, Chhorepatan and its adjoining areas, Pokhara stadium and adjoining areas, left bank of the Seti River near to Golf palace, and area around the Batulechaur and Mahendra Cave are also susceptible to land collapse and subsidence when a large earthquake occurs. (UNDP Nepal, 2009)

S.N	Type	Area (sq.km)	Percentage
1	Liquefaction susceptible zone	5.80	9.14
2	Land collapse potential zone	16.24	29.61
3	Others	34.26	61.63
Total		55.59	100

Table 1: Distribution of liquefaction susceptible and land collapse zones (source: UNDP Nepal, 2009)

4. Quaternary

4.5.1 Residual Soil This is characterized by loamy to sandy gravel on hill slopes of Phewa lake catchment. Thickness of the unit varies from 1 to 5 m and occasionally exceeds this value. It has low bearing capacity and susceptible to mass movements.

4.5.2 Colluvial Soil

This is inhomogeneous deposit at the foot of the Phewa lake catchment with composition of silt and sand at places with boulders and humus on top. The thickness of this unit is generally more than 1 m and is creased towards centre of the valley. Bearing capacity is moderate and seismic impact may cause mass movement in slope region.

4.5.3 Active and Non active alluvial Fan Deposit

It is composed of poorly sorted gravel, sandy gravel, sand and silt. Fine grained material is increasing towards the margin. Thickness generally increases towards centre of fans. It shows moderate to low bearing capacity and medium to loose density.

4.5.4 Flood Plain and Lower Alluvial Terrace Deposit

It is dominantly composed of gravel, sand, silt, and clay deposits. It has low bearing capacity, loose density and soft consistency.

4.5.5 Undifferentiated Lake Deposit

It is characterized by soft to stiff calcareous silty clay to clayey silt interfingering with carbonaceous clay and clayey silt towards foot hills. Pocket of peats occasionally present with thickness of 1 to 6 m. It has low bearing and soft to firm consistency.

5. CONCLUSION

With the susceptibility of liquefaction in Pokhara, various hazard of liquefaction such as sink hole, caves were observed. There was a presence of rocks and minerals like: Limestone, lime mud, carbonic rock, and salt bed. These rocks and minerals are highly soluble in water and this combination brings out high liquefaction which has caused the formation of sink holes and caves in Pokhara region.

ACKNOWLEDGEMENT

I, would like to express my gratitude to the respected teacher, Dr. Tara Nidhi Bhattarai, for inspiring us to write an article for the Bulletin “Geo - World”. Similarly, I’m very thankful to my friends, local people at Pokhara and editorial board for their precious suggestions. I would not have been able to complete this article without their help and encouragement.

REFERENCES

UNDP Nepal, 2009, Earthquake Vulnerability Profile and Preparedness Plan, Earthquake Risk Reduction and Recovery Preparedness Programmed for Nepal UNDP/ERRRP – Project Nep/07/010



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I was born in Udaypurkot Ward No: 7, Pyuthan and later migrated to Dang. I have completed my school level studies from Shree Sarbodaya Higher Secondary School, Deaukhuri, Dang and completed my +2 from Gorkha International College, Ghorahi, Dang. Initially I did not think of studying a Bachelor's Degree in Geology. I previously had no knowledge of Geology until I attended college. After studying at college I now have a better understanding of its definition and scope. My time studying geology at college peaked my interest in this subject and I therefore undertook a Bachelor's Degree in this subject.

Joining Tri Chandra firstly was not a happy decision for me. I really struggled with the crowds. It was challenging to adapt to the environment here. I had never seen such a huge mass of students in a single classroom before. But, eventually with the supportive guidance from my friends, teachers I managed to adapt. I never thought my journey in Tri Chandra could be so fascinating. I was really impressed by the Department of Geology. I am very happy that I chose to be a student of geology.

I am interested in visiting new places; gossiping about new topics, reading books, helping others, playing games and increasing my knowledge. I have recently read China Harayeko Manche Novel by Hari Bansa Acharya, which really interested me.

Currently I am studying B.Sc 4th year on Geology Major. I am determined to be a good geologist in near future and serve my nation.

Earthquake Disaster in Nepal

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Abstract: Earthquake, a destructive natural hazard, is powerful, sudden and temporary vibration set up on the earth surface ranging from faint tremor to a wild motion due to sudden release of energy stored in the rock beneath the earth surface. Nepal has experienced many earthquake disasters. Recently, the biggest earthquake “Gorkha earthquake”, was occurred on 25 April 2015 at 11:56 a.m. a depth of approximately 15 km, with its epicenter approximately 34 km east-southeast of Lamjung, Nepal, lasting approximately fifty seconds. The earthquake triggered an avalanche at different places. Above 8000 people were dead, some are still missing and thousands of people became homeless across many districts of country. Some other adjoining countries were also affected. Continued aftershocks occurred at interval of 15- 20 minutes with one shock reaching 6.7 M on 26 April at 12:52 and major aftershock occurred on 12 May at 12:51 with magnitude of 7.3 M.

Key Words: *gorkha earthquake, major damaged structure, life loss, natural hazard, remedies*

1. BACKGROUND

A powerful 7.8 magnitude earthquake struck Nepal at 06:11 on 25 April 2015. The epicenter was about 80km North West of the capital Kathmandu. Several aftershocks have occurred since then, notably a 6.6 magnitude aftershock around 30 min after yesterday’s main event and another one of 6.7 magnitudes at 07.09. 7 minutes after the occurrence of the main earthquake event.

This is the worst earthquake in Nepal since 1934, when some 8,500 people were killed. The earthquake and aftershocks have caused heavy damage and numerous casualties in the vulnerable and landslide-prone country. Out of 75 districts, 30 are reported affected; most heavily affected appear to be the greater Kathmandu area and the districts of Gorkha and Lamjung, North West of the capital. As of late afternoon today, international media and government sources report more than 2000 people dead in Nepal (at least 700 in Kathmandu), 51 in India (Bihar, Uttar Pradesh and West Bengal) and 17 in Tibet. Numerous old buildings have collapsed and many landslides are blocking road transport and relief efforts.

2. OBJECTIVES

The main objectives of field study were as following:

- General observation of the condition, present situation and disaster risk in Nepal.
- Observation of the affected area population and life loss.
- Evaluate the consequences in the visit side due to the possible earthquake.

3. METHODOLOGY

The common methods used were data collection, from internet as well as papers, journals; books, etc. Also photographs were taken in many sites.

3. FIELD INVESTIGATION AND DATA COLLECTION

A magnitude 7.8 earthquake struck Nepal on April 25 and caused massive destruction. The main quake was followed by numerous. Aftershocks of magnitude 5 or higher causing further damage and losses.

The epicenter area is mountainous and valleys are steep so sedimentary rocks are heavily folded and faulted resulting from the tectonic movements huge mass movements were caused by the earthquake. The mass movements were observed in Gorkha district as well as Tibetan side of Himalayas. The shallow depth of the quake and the nature of Kathmandu valley have contributed to the high losses in the capital of Nepal. Many recently built reinforced concrete structures, many brick structures heavily damaged. Also, historical monuments as well as religious structures tremendous damage induced by the 2015 Gorkha earthquake.

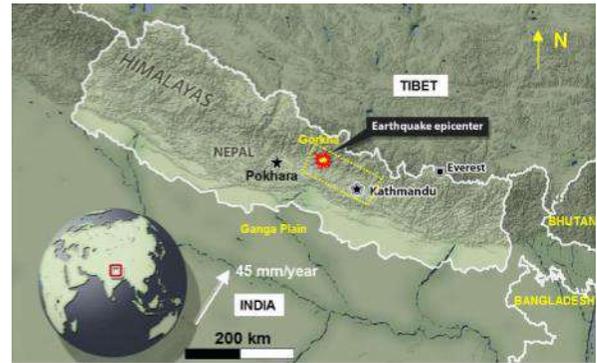


Figure 1: 25 April, 2015 Gorkha earthquake (kantipur online paper)

4. RESULTS AND DISCUSSION

The earthquake occurred as the result of thrust faulting between the subducting India plate and the overriding Eurasia plate to the north. At the location of this event the India plate is converging with Eurasia towards the north-northeast, driving the uplift of the Himalayan mountain range (Yagi *et al*, 2000). The relative variety of strong earthquakes in the recent past increases the vulnerability of the affected places: Many old and weak buildings remain inhabited, and mental and physical preparation of the population to deal with strong earthquakes is very low.



Figure 2: damaged monument (dharahara), (kantipur online paper)

5. CONCLUSION

To understand Nepal's risk to disasters in the future, it is necessary to better understand the underlying drivers of these risks. Given the fact that Nepal has a high level of frequent hazards, exposure and vulnerability the country is still very much at risk for future disasters. Looking at the impact of the earthquake the report explains that the earthquake largely affected the Nepalese economy, in terms of its infrastructure, tourism, cultural heritage, schools and hospitals. These will also be key areas in building back better after the disaster. There is a lot of scope to build back better than before and to ensure that the risks are not rebuilt for future generations to suffer from again.

ACKNOWLEDGEMENT

The major sources of pictures relevant to the aspects of this document are obtained from the following web-sites and they are gratefully acknowledged for providing and sharing the information through images and reports of the earthquake. Also I would like to acknowledge to my sir Mr. Tara Nidhi Bhattraai who gave me this opportunity and thanks to my friends.

REFERENCES

USGS, (2015) Poster of the Nepal Earthquake of 25 April 2015 - Magnitude 7.8 (online)

[Available on] <http://earthquake.usgs.gov/earthquakes/eqarchives/poster/2015/20150425.php>

Yagi, H., Maemoku, H., Ohtsuki, Y., Saiju, K., Nakata, T (2000) Recent activities faults distributed in and around Kathmandu valley, Lower Himalayan zone. Proceedings of the Active Fault Research for the New Millennium, pp. 557-560.



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Born in Jagatradevi V.D.C, ward no 2, Balam village, Syangja, I attended Aakash Deep English Secondary School, Kathmandu, and completed +2 from Manakamana Higher Secondary School, Kathmandu. Being interested in geology, I admitted in Bachelor Level for B.Sc at Tri-Chandra College, Ghantaghar, Kathmandu.

But the educational environment at Tri-Chandra College was not as good as I had thought. Here the so called student leaders were so many and they were much more concerned about their political parties rather than student's welfare. And so were some teachers. Some teachers were so irresponsible at Tri-Chandra College. This made me frustrated and I was not enjoying my study. Despite of all these, Department of Geology was student friendly. Here the teachers were so good and co-operative, and there was different system of teaching as compared to other departments of Tri-Chandra College. And I was much happier and I started enjoying geology. The practical works and field works conducted by Department of Geology made me much more interested towards geology and that is why I am studying Geology and taking it as my career. Considering the facts mentioned above and also based on my own wisdom, I would expect to be a reputed geologist in 10 years' time from now. An article of my interest is presented below:

Process of Sediment Production Transportation and Deposition in a River

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Abstract: Sediments are the small particles formed by the breaking down of the rocks. These sediments are then transferred to different directions by air and water. The sediments firstly formed by disintegration and decomposition of rock bodies are then responsible for the formation of other different depositional landforms on different parts of earth. We know that the earth is dynamic, and this dynamic nature of earth is only due to the formation of sediments, its transportation on different directions and due to its deposition. Hence sediment is very important and is the fundamental component of the earth along with the different natural structures on the earth.

Key Words: *disintegration, decomposition, depositional landforms, dynamic, fundamental component*

1. BACKGROUND

Sediments are the fundamental particles for the formation of the earth. The dynamic nature of earth is only possible due to the erosion, transportation and deposition of the sediments. Sediments are formed by disintegration and decomposition of rocks due to heat, water, natural forces and different other factors. Then these sediments are transported mainly by wind and water and are deposited in different places on earth forming different geological structures and resulting the change on earth's morphology.

2. METHODOLOGY

This article was written by the help of the notes provided by our teachers during our first, second and third year of bachelor level. Also I have gone through the textbook An Introduction To Physical Geology for the preparation of this article. And finally, lecture notes, text books, wikipedia, and the knowledge that I gained from my teachers was the key source for this article.

3. RESULTS AND DISCUSSION

The small particles formed by the disintegration and decomposition of rocks are sediments. The external process like weathering, mass wasting and erosion are the major agents for transforming solid rocks into sediments. Weathering is a slow process and it takes place in all the directions. Mechanical fragmentation and chemical alteration due to natural process and chemicals on any rocks result in sediment production. The change in shape and size of any exposed material in long interval of time on the earth surface is the consequence of sediment production. Heat, water, and the natural force first decomposes the rocks and then the rocks get disintegrated into smaller pieces resulting the sediments. Thus produced sediment is then transported to different areas by air and water and are deposited in different places forming different depositional landforms. The running water transports sediment in three different ways like by solution form, by suspension, and by sliding or rolling along the bottom. The material in the solution goes wherever the stream goes. Similarly large part of sediments are carried by streams by suspension. (Lutgens et al. 2012).

The sediments produced in highlands are transported to the low land by river, and wind. After the sediment formation when they reach stream, they are transported in different ways. The dissolved and suspended loads are carried in general flow and the bed loads are transported by rollings, sliding and

by saltation. Whereas the sediments in the deserts are transported by winds. Also like a stream, wind transports fine particles in suspension while heavier one are carried as bed load.

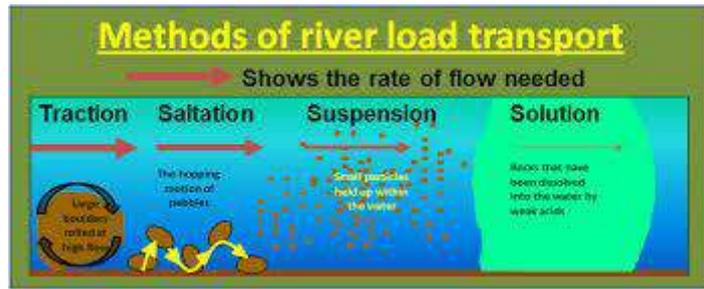


Fig 1 : Process of sediment transportation by water (Available at: Coolgeology)

However the transport of sediments by wind differ from that of running water in significant ways. Winds lower density compared to water renders it less capable of picking up and transporting coarse material. And as wind is not confined to channels, it can spread sediment over large areas. The bed load of winds consists of sand grains skipping and bouncing along the surface in the process termed saltation. Fine dust particles are capable of being carried by wind great distance as suspended load.

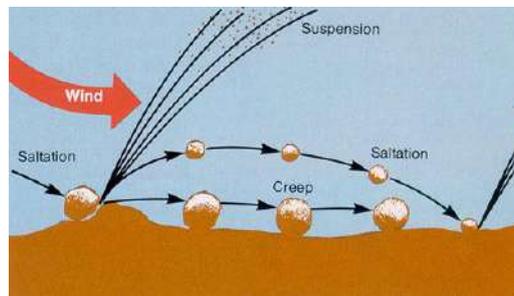


Fig 2 :Process of sediment transportation by wind(Available at:Geocaching.)

The sediments carried by wind and rivers are responsible for the formation of various depositional landforms. The deposition of sediments by wind forms mounds and ridges of sand; dunes from the winds bed load and extensive blanket of silt called loess area also formed due to suspension process.



Fig 4: Sand Dune (source: 7-Themes.com)

The deposition by river occurs whenever the stream slows, causing the reduction in competence. As its velocity decreases, sediments begins to settle the largest particle first. Thus stream transport provides a mechanism by which solid particles of various size are separated.

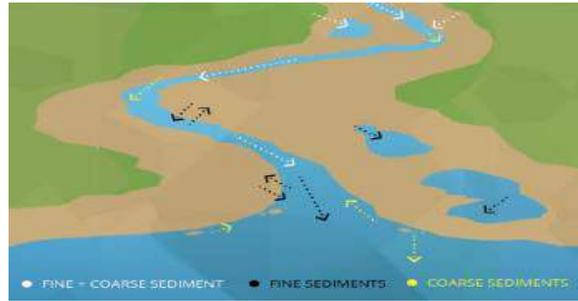


Fig 5: Sediments deposited by river (Available at: fondriest)

The cutting, transportation and deposition of sediments by water from different structures within the streams way. Meanders, cut banks point bars, oxbow lakes, braided streams, natural levees and alluvial fans are formed due to the deposition and transportation of sediments. Similarly, the formation of small and big flood plains along the river and many river valleys are also the result of sediment deposition. When sediment –charged streams enter the relatively still water of a lake or sea or ocean, delta is formed.

4. CONCLUSION

Sediments are the smaller rock particles formed by the disintegration and decomposition of rocks. The transformation of rocks into sediments by weathering, mass wasting and erosion is a slow process. The produced sediment is then transported in different areas by wind and water by different process like saltation and suspension. Thus produced and transported sediment is then deposited in different parts of the earth forming different landforms. And are also changing the Earth's morphology.

ACKNOWLEDGEMENT

I would like to express my gratitude to Dr. Tara Nidhi Bhattarai for his encouragement to write articles. I am also thankful to my colleagues and to the members of the editorial board for their tremendous support, valuable comments, suggestion and helping me to write this article.

REFERENCES

Lutgens, et al, (2012) Essentials of Geology, 11th edition, Pearson.



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I was born in Lekhani ward no. 1 Baglung, Dhaulagiri zone, Nepal. I completed my high school from New Oasis Academy, Baglung & + 2 from National Integrated College, Dillibazar Kathmandu. I got to know about geology from my elders & was admitted in bachelor level for Bsc at Trichandra Campus.

Since Geology was a new subject to me. I was excited to take classes on it. The fascinating fact of 1st year was meeting new friends studying under the historical roof of Ghantaghar. One thing that I love during those days that I was taking classes from almost PHD degree holder teacher. I felt so proud at that time. The most unforgettable moment in Trichandra campus is during my 3rd year geological fieldwork along Malekhu, Dhading. Where I gained knowledge about fundamental aspects like different rock types, lithology & many more practically. I would expect to be a good geologist in future.

Challenges in Conservation of Chure Bhawar

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Abstract: Chure Bhawar range rises steeply from the terai plains along an East-West direction comprising 33 districts of Nepal. These are the first lowest ridge and youngest hills formed due to collision of two plates Indian and Tibetan plate by the process of upliftment. It is composed of unconsolidated loose materials such as clay, sand, and pebble, and cobble, boulder originated from sedimentary, metamorphic and igneous rocks. It is the main recharge zone for the ground water system of the gangetic plain which is one of the largest ground water reservoir in the world. It covers 13% of total land area & comprises 26% of the natural forest of Nepal & therefore a home for different endangered wild creatures. But due to the numerous anthropogenic interventions biodiversity of the area is degrading day by day. So a program for a sustainable development and a model for its conservation should be made as soon as possible.

Key Words: *chure, mining, construction materials, challenges, conservation*

1. BACKGROUND

Until the mid-eighteenth century the terrain was divided into several smaller kingdoms & the forest were little disturbed. After the unification of Nepal in the late 1760, rulers granted large areas of fertile land & forest resources to the members of royal family, officials, priests & selected groups of the society. The beneficiaries of grants had right to collect revenues from cultivated land & forest products. In the late 1920s the rana rulers ordered the clearing of the forests & extraction of timbers for export in order to collect revenues and cleared areas were subsequently used for agriculture. After the advent of DDT and the eradication of the malaria mosquito in 1950s the area became habitable & people from hills migrated to the terai, encroachment of the chure from both the south & north took place. Historically the massive deforestation of churia hills happened in Panchyat era (1984). Today the area is being indiscriminately mined for sand, gravels & aggregates for the construction of highway, irrigation canals & cities. The growing demands for timbers, agricultural land & construction materials are leading to the fast denudation of the hills whereas other environmental consequences are getting starker then ever (Department of Hydrology and Metrology, 2006)

2. OBJECTIVES

Chure bhawar area is very important area from ecological, social, economic & political perspective of Nepal. Thus the main objective of this article is

- To give information on the importance of Chure Bhawar.
- Identifying probable impact on geological aspects.
- To aware local inhabitants, government about its deteriorating condition.
- To know causes & future consequences.

3. METHODOLOGY

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

Field Investigation and Data collection

Since the title is related to environment, field investigation is an integral part. The results and conclusion were made from comparative analysis of different research based on books, articles, websites & project reports.

4. RESULTS AND DISCUSSION

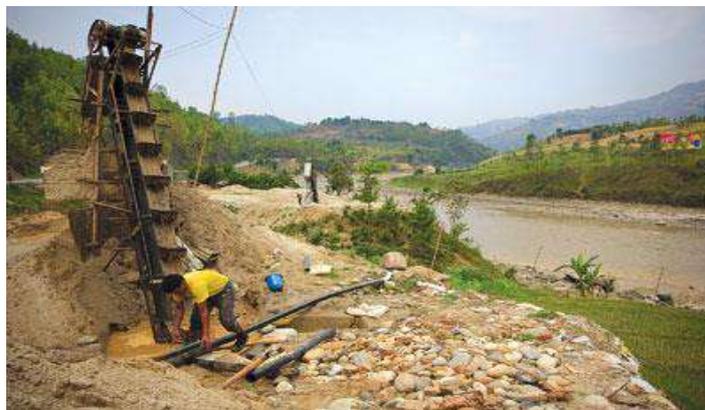


Fig: Chure mining for sand, stone and construction aggregates (Photo credit: Nepaltimes)

The loss of the forest & unmanaged extraction & excavation of the construction material in the hills & rivers running down them has caused waters sources including wells to dry up & the environmental degradation has caused irreparable losses to our natural riches & prospects (Hasegawa et.al, 2009). As per the estimates, 6.5 million cubic meter of gravel, stones & sands are legally extracted every year from the region and illegal extraction are expected to be twice as much. One of the majors drivers of negative human impact are accelerated migration into the forested areas of churia region .Annual deforestation rates is estimated to be 1.7 % in the churia region. Additionally, the level of awareness about the environmental degradation & casual effect of the human induced natural disasters is low among the local communities of the churia region. Many people make livelihood from the churia forest without noticeable attention towards its sustainability. The chure is being desertified and the forest have lost their indigenous King Cobra, world largest flying bird Stroke.The pythons here are also threaded because of habitat loss as is the Pygmy Hog can't be found anywhere. The indigenous inhabitants of the chure like Tharu, Chepang, Danuwar, Mushaar and others are going to be adversely affected. Due to the human wanton activity the risk of Landslides, Floods, dry up of a drinking water source has increased which may give rise to the social problem in the future. Impact of all these consequences can be felt downstream in terai region of Nepal & down to India. The situation of the chure bhawar range is getting starker than ever. Government of Nepal has emphasized for its conservation since 1970 & started Rastrapati chure Conservation program but state authorities are remaining mute spectators to reckless quarrying & smuggling of sand. So a positive vision for the chure & a model for its conservation in consultation with the stakeholder, local inhabitants are required.

5. CONCLUSION

Chure Bhawar region is the treasure trove of biodiversity and have an environmental importance because it serve as the water reserve for terai region (The Grain Basket of Nepal) and is critical for both national economy and integrity. So everyone have to recognize the sensitivity of the region and act cautiously.

ACKNOWLEDGEMENT

I'm lucky to be a student of geology. I would like to extend my heartfelt gratitude & sincere appreciation to Dr. Tara Nidhi Bhattarai. I am very thankful to the editorial board and all my colleagues, friends of bachelor level who directly & indirectly supported me.

REFERENCES

Department of Hydrology and Meteorology (2006). Climatological Records of Nepal (Several Volumes), Babarmahal, Kathmandu

Hasegawa, S., Dahal, R. K., Yamanaka, M., Bhandary, N. P., Yatabe, R., & Inagaki, H. (2009). Causes of large-scale landslides in the Lesser Himalaya of central Nepal. *Environmental Geology* 57 (6): 1423–1434.



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In the year 1995 AD April 11, I was born as youngest son of Krishna Hari Karki and Sabitri Karki in Bhaktapur district. I was born and raised in Madhyapur thimi, Bode where I passed my S.L.C from the Glad Stone Academy, thimi and I completed my +2 in Kathmandu from Ambition Academy.

As I was interested in the natural science, I joined Tri-Chandra Multiple Campus for my Undergraduate program on geology, botany and zoology. I was baffled on geology because for the very first time I was hearing about the field related to it but consulting with the seniors I finally planned to major in geology.

Because of my own lax, in first year my studies was not satisfactory but after failing to achieve what I have dreamed about .I started focusing more scrupulously on my studies and I did good in my subjects and my interest in engineering geology has become a major part for my Graduate program.

As a geology student in Tri-Chandra multiple campus, I have so many friends who helped supported me and gave a good memories for rest of my life. Every classes of Tri-Chandra multiple campus had made me from a puzzled boy to a perfect dreamer for the matter of interest in my life and I would be always be thankful to geology department to show me the right path to be a successful student in the geology.

I have belief on me and I have the power to do good with my subject in near future and 5 years from now you will see me as a successful Engineering geologist.

The San Andreas Fault

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Abstract: The San Andreas Fault is more accessible than any other fault in the world. With California's large population and temperate climate, there are many roads that snake along the fault. They are uncrowded and peaceful, perfect for family outings. There is abundant camping, bird watching, wild flowers and wildlife, rock collecting and natural beauty along the way. State and National parks are strung along the fault like beads on a string. All it takes is a good map, a comfortable car and a desire to see the world's most famous fault.

Key Words: *california, fault, rock, natural beauty, national park*

1. BACKGROUND



Figure 3 San Andreas Fault (copyright by David Lynch)

San Andreas Map: The red line on this map follows the surface trace of the San Andreas Fault across California. Areas to the east (right) of the fault are on the North American tectonic plate. Areas to the west (left) of the fault are part of the Pacific tectonic plate. The arrows show the directions of relative motion along the fault.

The San Andreas Fault is the sliding boundary between the Pacific Plate and the North American Plate. It slices California in two from Cape Mendocino to the Mexican border. San Diego, Los Angeles and Big Sur are on the Pacific Plate. San Francisco, Sacramento and the Sierra Nevada are on the North American Plate. And despite San Francisco's legendary 1906 earthquake, the San Andreas Fault does not go through the city. But communities like Desert Hot Springs, San Bernardino, Wrightwood, Palmdale, Gorman, Frazier Park, Daly City, Point Reyes Station and Bodega Bay lie squarely on the fault and are sitting ducks.

2. OBJECTIVES

This article omphalos on following questions:

1. What Type of Fault is the San Andreas?
2. How Fast Does It Move?

3. METHODOLOGY

A literature review was done to collect various data and information through various reports, journals related articles and books.

4. RESULTS AND DISCUSSION

What Type of Fault is the San Andreas?

The San Andreas Fault is a transform fault. Imagine placing two slices of pizza on the table and sliding them past one another where they touch along a common straight edge. Bits of pepperoni from one side crumble across the boundary onto the anchovy side. The same thing happens with the fault, and the geology and landforms along the mighty rift are extremely complicated.



Figure 4 (Photograph copyright by David Lynch.)

You Can See a Plate Boundary Photo of the San Andreas Fault near Gorman, California, showing rocks of the Pacific Plate (gray rocks on the left side of the fault) and the North American Plate (tan rocks on the right side of the fault). There are very few places on Earth where you can see two plates in contact like this.

How fast does it move?

The plates are slowly moving past one another at a couple of inches a year - about the same rate that your fingernails grow. But this is not a steady motion, it is the average motion. For years the plates will be locked with no movement at all as they push against one another. Suddenly the built-up strain breaks the rock along the fault, and the plates slip a few feet all at once. The breaking rock sends out waves in all directions, and it is the waves that we feel as earthquakes.



Figure 5 Google map of San Andreas Fault (David Lynch)

Google Map of the San Andreas Fault: This map displays the approximate trace of the San Andreas Fault as a red line atop of a satellite image in the Google Maps program. Using the controls of the map, you can zoom in on the fault and follow it across California from where it is first noted near the Salton Sea in Southern California to where it turns into the Pacific Ocean north of San Francisco.

Is the Fault Visible at the Surface?

In many places like the Carrizo Plain (San Luis Obispo County) and the Olema Trough (Marin County), the fault is easy to see as a series of scarps and pressure ridges. In other places, it is more subtle because the fault hasn't moved in many years and is covered with alluvium, or overgrown with brush. In San Bernardino and Los Angeles Counties, many of the roads along the fault cut through great mountains of gouge, the powdery, crumbled rock that has been pulverized by the moving plates.

The hallmark of the San Andreas Fault is the different rocks on either side of it. Being about 28 million years old, rocks from great distances have been juxtaposed against rocks from very different locations and origins. The Salinian block of granite in central and northern California originated in Southern California, and some even say northern Mexico. Pinnacles National Monument in Monterey County is only half of a volcanic complex, the other part being 200 miles southeast in Los Angeles County and known as the Neenach Volcanic.

Fault Myths

There are many myths and legends about the San Andreas Fault, the biggest being that it will one day crack and California will slide into the sea. WRONG! It won't happen and it can't happen. Nor is there anything such as "earthquake weather" or preferred times of day when earthquakes hit.

ACKNOWLEDGEMENT

To make a readable and informatic article we need to be fastidious on making article by using the meaningful words so that it would make the article lither. And I would like to extend my feigned appreciation to Dr. Tara Nidi Bhattarai of Tri-Chandra multiple campus who invested his full effort in tutoring me in achieving this goal. Finally, I would like to concede Mrs. Prakriti adhikari and Aakash jung karki for the technical help and editorial members for their suggestions.

REFERENCES

David K. L,(2005) PhD, geology.com, SanAndreasFault.org. Online available <http://geology.com/articles/san-andreas-fault.shtml>



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Born in 2050 B.S in Kharelthok-7, Bastalabeshi, Kavrepalanchowk, I attended primary schooling from Bright Future Boarding School, Kavre secondary schooling from Sunlight English Secondary School, Kathmandu and passed SLC in 2066 B.S. and completed +2 from Guinness International College, Kathmandu in 2069 B.S. In search of a good college to complete my further study I visited Tri-Chandra Multiple College with my friend and inquired about the subject and found Geology interesting among all them.

I admit that I could not pay attention in the class in first years of study because I was preparing to go for abroad study and I failed. After a while I remained focused on geology subject and acquired more knowledge about it. The most interesting thing about geology was it is a more research based multi-disciplinary subject and the thing that kept my eye on it was how it explained the earth history early from its origin, processes and phenomenon that is responsible for the present and it's amazing.

The most unforgettable movement during first year of my study was the lecture class of T.N. Bhattarai sir which was blushed with unique technique of reading, learning and writing, pushing the capacity of students to further limit. Also the field visit to Ranipauwa, Nuwakot helped to encounter with research and on field study cannot be ignored. At the end of second year I was fond of reading structural geology because it explains the structure of earth even from study of surface, the making of topographical map, stratigraphic projection etc. was the plus point of reading structural geology. During third year of study, my attention was towards geophysics because this subject was responsible for understanding the internal structure of Earth; crust, mantle and core.

Besides, the journey to Malekhu, Dhading with teacher and friends where I got the opportunity to interact with the teachers, locals and friends was a true memory that sharpened my knowledge and understanding geology in day to day situation and eventually gave me feeling of a geologist.

Selecting geology in fourth year as major subject was an easy. I was excited to study applied branch of geology; engineering geology, hydro-geology, exploration and mining geology too.

There is a Chinese proverb saying "I hear and I forget, I see and I remember, I do and I understand" that is what geology is about. It's all about observing and getting things done that sharpens our capability with experience.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be engineering geologist in 10 years' time from now.

Geology of Mt. Everest

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Abstract: This paper presents a geological map combined with structural geology, petrology, and geochronology to interpret the tectonic evolution of the Everest Himalaya. The Himalaya is the result of an ongoing orogeny — the result of a collision between two continental tectonic plates; Indian and Euro-Asian plate 50.5 mya. This immense mountain range was formed by tectonic forces and sculpted by weathering and erosion. Two low-angle normal faults cut the Everest massif at the top of the Greater Himalayan slab. The earlier, lower Lhotse detachment bounds the upper limit of massive leucogranite sills and sillimanite–cordierite gneisses, and has been locally folded. The upper Qomolangma detachment is exposed in the summit pyramid of which cuts all leucogranite in the footwall. Being the highest place on Earth people has curiosity how Everest got such ultimate height to understand which the geological study can prove to be essence.

Key Words: *everest, himalaya, detachment, formation, geology.*

1. BACKGROUND

The Himalaya stretch about 2400 km long and 300 km wide across South Asia between the Namche Barwa syntaxis in Tibet and the Nanga Parbat syntaxis in Pakistan. They are home for 14 of the tallest mountains on the planet and one rise above all others; Everest (8848m). Mt. Everest also known as “Sagarmatha” in Nepal and “Chomolungma” in Tibet is located in the Mahalangur mountain range of Nepal. In order to figure out how this giant mountain was made field study, evidence and rock sample are needed.

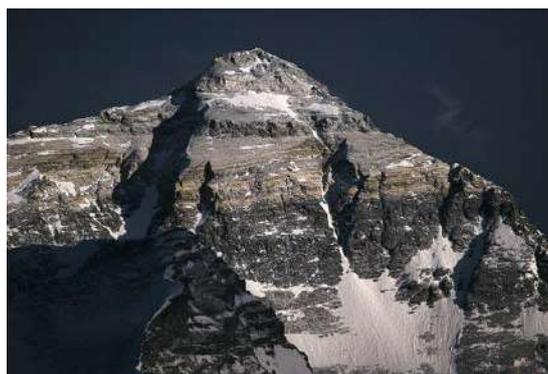


Fig. 1 Mt. Everest three distinctive rock layers

The upper part of Mt Everest is seen here from the north. The topmost strata are grey limestone that in places contains fossil fragments. Below this is the so-called Yellow Band, made of pale yellow-brown metamorphosed limestone. The break in metamorphic grade here marks the position of an important low-angle extensional fault – the Qomolangma Detachment. Beneath the Yellow Band are the black schists of the Everest Series.

2. OBJECTIVES

The main objectives of this article are:

- To give general idea about the geological history of Mt. Everest.
- To understand the process and consequence taking place in Mt. Everest in future.
- To understand the current status of the Mt. Everest.
- To assist the study about ancient life, preserved fossils, lithology etc. of the Mt. Everest.

3. METHODOLOGY

Basically the desk study which involves gathering of the secondary sources such as books, article, documents, published papers, geological map, aerial photograph, electronic media etc. was collected, and presented systematically in the form of an article.

FIELD INVESTIGATION AND DATA COLLECTION:

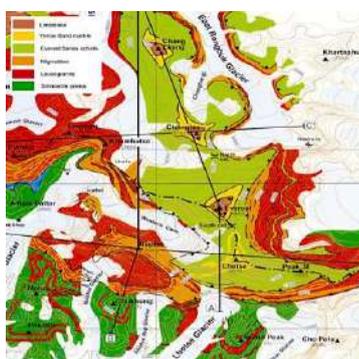


Fig. 2 The geological map of the Everest area by M P Searle (original scale: 1:100,000)

The above geological map shows Mt. Everest and neighboring peaks capped by sedimentary limestone and underlain by low grade metasedimentary rocks (Yellow Band and Everest Series). These in turn pass down into granite, migmatites (alternations of granite and schist) and high-grade metamorphic gneisses in the valley floors and to the south.

4. RESULT AND DISCUSSION

Paleontologists interpreted the presence of ancient terrestrial tree fossils *glossopteris* in every continent which was dated 250 million years, is evidence once the continents were part of super continent called Gondwana. Gondwana split up by violent tectonic forces which pushed continent apart, 80 million years ago, India broke away from Gondwana travelled north and eventually smashed into Asia. The exact date for collision was turned to marine fossils and age of youngest marine fossils from Himalaya precisely dated 50.5 my. The limestone sample from summit of Mt. Everest is taken to Oxford University Lab and cut into thin section and examined on microscope which later revealed the presence of marine fossils; *sea lily* which was dated- 400 million years.

The first step in the formation of Everest Himalaya is the rock folded, giant fold when that process continues the rock can no longer fold so that they become overturned fold and when the process continues even further that overturned fold actually moves along a very discrete fault plane. That exactly we see throughout the whole Himalaya so rocks are formed by folding and thrusting. Once rock has been bent beyond its limits, it breaks and causes a fault. The process of faulting put different rock types one on top of the other. Faults are just opposed rock of two different types so the big huge fault cut through the higher Himalayas pushing limestone over marble.

The presence of kyanite gneiss in Kalamdi khola gives clue how rock is formed. Kyanite is very specific mineral to geologist and it tells us that this rock has been buried to depth of about 30 miles or more in high temperature and pressure. The heat and pressure changed rock and formed kyanite.

The white band in granite at base of Everest gives idea that rock is partially molten during mountain building process at 4000°F and began to melt Indian plate rocks melting to produce granite and forced back to earth surface, cooled and formed solid.

According to Geologists, 20 million years ago the amazing conveyer belt system was at work as India push northward, a liquid band bayonet rock was forced towards surface and called forming solid layer of granite. A process called “channel flow” that forms the inner of Mt. Everest.

Geologists have divided Mt. Everest into three distinct rock formations. From the mountain base to the summit, they are: the Rongbuk Formation, the North Col Formation and the Qomolangma Formation. These rock units are separated by low-angle faults, called “detachment” forcing each one over the next in a zigzag pattern.

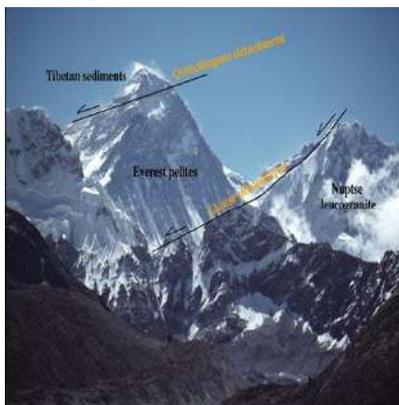


Fig. 3 Detachment System of Mt. Everest

The Rongbuk Formation: The Rongbuk Formation composes the basement rocks below Mt. Everest. The metamorphic rock includes schist and gneiss, a finely banded rock. Intruded between these old rock beds are great sills of granite and pegmatite dikes where molten magma flowed into cracks and solidified.

The North Col Formation: The complex North Col Formation, located between 7,000 and 8,600 meters, divides into several distinct sections. The upper 400 meters composes the famous Yellow Band, a yellowish brown rock band of marble, phyllite with muscovite and biotite, etc. The band also contains fossils of crinoid ossicles, a marine organism with a skeleton. Below the Yellow Band are more alternating layers of marble, schist, and phyllite. The lower 600 meters is composed of various schists formed by metamorphism of limestone, sandstone, and mudstone. At the bottom of the formation is the Lhotse detachment, a thrust fault that divides the North Col Formation from the underlying Rongbuk Formation.

The Qomolangma Formation: The Qomolangma Formation, the highest rocks on the summit pyramid of Mt. Everest, is formed by layers of Ordovician-age limestone, recrystallized dolomite, siltstone, and laminae. The formation starts at 8,600 meters at a fault zone “Qomolangma detachment” above the North Col Formation and ends on the summit. The upper layers have many marine fossils, including trilobites, crinoids, and ostracods. One 150-foot-thick layer at the bottom of the summit pyramid contains the remains of micro-organisms including cyanobacteria, deposited in shallow warm water.

5. CONCLUSION

The rock sample shows three distinctive rock types of Mt. Everest. The rock of Mt. Everest contains marine fossils concluding it started life from bottom of sea. The GPS data reveals Himalaya is the most active mountain range in planet.

As Indian plate is still moving about 2 inches/year and is losing out force under Euro-Asian plate but unfortunately they are locked frictionally and eventually over the course of 100 years that strain is accumulated and then released suddenly and giant earthquake occur in the region. Everest is still growing by 2 cm/yrs. Everest today stands as the highest place on Earth but in millions of years to come there will perhaps be other mountain big enough to challenge Everest.

ACKNOWLEDGEMENT

I would like to express my deepest appreciation to all those who provided me the possibility to complete this report. A special gratitude to our respected sir Mr. Tara Nidhi Bhattarai, whose contribution in stimulating suggestions and encouragement helped me in writing report.

Furthermore I would also like to acknowledge with much appreciation the crucial role of editorial board that helped a lot to improve my presentation skills. Finally I would like to thanks other teachers and colleagues for their supports, comments and advices.

REFERENCES

Searle, M.P., Simpson, R.L., Law, R.D., Parrish, R.R. and Waters, D.J. (2003) The structural geometry, metamorphic and magmatic evolution of the Everest massif, High Himalaya of Nepal-South Tibet, *Journal of the Geological Society, London*, Vol. 160, 345-366.

Searle, M.P. (1999) Extensional and compressional faults in the Everest–Lhotse massif, Khumbu Himalaya, Nepal., *Journal of the Geological Society, London*, Vol. 156, 227–240.



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I was born in Kumari V.D.C, ward no.9, Falamechawor; Nuwakot. I started my primary level from Shree Adarsha Public Boarding English School. Then I came to Kathmandu and continued my further study in Gorakhkali Boarding English School where I completed my secondary level on 2064 B.S. Then I passed my intermediate level from Himalayan White House Int'l Collage, Baneshwor, Kathmandu. Finally, I joined Tri-Chandra College for my bachelor studies.

Batchers' and Geology subject, I heard it from my brother. Then I collected some information about Geology and also consulted with a senior which makes me feel it as a field based study. They explained me about Geology as a leading subject for the future development of country and about its scope in personal life. The one word "field based subject" I hear from him was enough for me to take my steps towards Geology. Then I was convinced. I have started reading a book named "you can win" written by Shiva kheda attached me a vital role for studying Geology and winning myself. His views about winning the life steps are really important to me.

I got admitted on Tri-Chandra College in GSM combination and started concentrating on Geology course seriously. I have learned many knowledge of Geology which has changed my views towards our surrounding. Afterward I always look at the nature and feel it, think of it just curious to know why it is?

The most memorable and important thing I learned in geology is discipline and behavior. I always thought of the view of geologist in my first year and also started to watch documentaries about the earth, various geoscientists and their views about geology. Even I get confused on some of the key words related to the topics. I work hard to understand these things.

By 2nd year, I found myself much interested in rock types and its effects with the revolution of earth. It explains about the deposition, environment, their structures and related mechanics. By 3rd year the economic minerals deposits and the relation between the rocks makes me more enjoyable on my studies, and this time I have learnt the very important thing which is a team work and finally my path starts from here to be a good student of geology and best future Geologist. I will be a good geologist professional within ten years.

Earthquake and Human Understanding

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Abstract: Earthquake is a sudden release of large amount of energy in the form of vibration at surface and subsurface. The vibration may last for some second or even some minutes depending upon the nature of energy stored beneath the earth surface and the human understanding of an earthquake is related to the knowledge about it to human beings, their concept of watching and handling its effects and causes.

The human understanding of an earthquake can be divided into two ways, which are taken as layman concept related to myth and scientific concept of understanding. The layman concept is generally used by an uneducated related with their awareness through myth whereas scientific concepts are used by general to researcher which further helps on living with an earthquake. A human understanding of an earthquake starts from layman concept to this period is gradually developing day by day with its solution and prediction.

Key Words: *earthquake, human understanding, layman. scientific Prediction.*

1. BACKGROND

Earthquake is one of the most devastating natural phenomena. Understanding the causes and mechanism of this phenomenon is the key to reducing its troll on human life and property (Sanders, 2007). For thousands of years, people have speculated about why the ground sometimes shakes, attributing it to everything from the tantrums of angry gods to blasts of air blowing through subterranean cravens. Earthquake have been, for a long time, the subject of legends and mythological representations, in most cultures.

According to Hindi mythology, the Earth is held up by four elephants standing on the back of turtle, which is balanced on cobra. When any of these animal moves, the Earth trembles and shakes, causing an earthquake.



Figure 1 Religious understanding of an earthquake (Hindu)

Japanese thought that, earthquakes were the result of sudden movement of giant spider that carried the earth on its back.

According to the Mongolian Mythology “huge, but occasionally unbalanced supporter of the earth was a giant mole (a fur animal living underground or tunnel)”.

In Romania, it is tied to deeds of mankind. As the world rests on the divine pillars of faith, hope and charity, whenever the deeds of humans render one of the pillars weak, the Earth shakes and quakes.

According to Mozambique mythology,” the earth is like a living creature, suffering from ailments similar to man”. When it get sick with fever and chills, it shakes and tremors.

In ancient Greece, people believed that the god of the sea, Poseidon, caused earthquakes. When he was angry, Poseidon would strike the ground with his trident and set off an earthquake. His unpredictable, violent behaviour earned him the nickname “Earth-Shaker.”

Also the ancient Greeks believed that earthquakes were caused by winds rushing out from caves inside Earth.

Greek and Roman described earthquakes as a air escaping from underground caverns or for the collapse of vast subterranean cavities.

The understanding of an earthquake logically starts from many years ago, China technology invented first seismoscope invented in 132AD by ZhangHeng and the scientific era begun from not more than some few 100 years.

2. OBJECTIVES

The objective of this article is to understand the development of human’s awareness on earthquakes.

3. METHODOLOGY

The following methodology was used to achieve the objectives.

1. Reviewed the existing articles, reports, journals and available literature in order to deliver the reality of understanding.
2. Consulted with social worker and other related personalities (DMG).

4. FIELD INVESTIGATION AND DATA COLLECTOIN

On visiting some part of Nuwakot at Kumari district in an average ,almost 60 percent of people are even unknown about the causes of earthquake and handling its situation .About 10% of the people are unknown about how it occurs, having no logics at all. Some people in this place believe that earthquake causes because of deforestation, and most of them take the logic with god. Some people believe that the earthquake occurs because of the 21st century and the dress wear by women makes the god angry and make it happen. This is only the sample which reflects the understanding of an earthquake in rural part of Nepal on earthquake and human understanding on rural area. On the other hand DMG (seismological centre) is doing a research on different station at Nepal.

5. RESULTS AND DISCUSSION

Seismologists have searched for some predictable relationship between strained rocks and some measureable properties to understand the earthquake. Most of the human efforts have been applied only for the measurement of magnitude of already occurred earthquakes till now. As the time been in scientific era scientist gives more effort on the prediction of earthquake which yet hasn’t been

completed. Many new technologies however been used by the well developed country and the accurate measurement of the wave propagation and alarming are called as the advance system yet now. The awareness of people on the other hand is growing up from layman view to some logic. People are learning living with an earthquake time after time the earthquake energy releases and vibration makes loss to their house and property.

6. CONCLUSION

Most of the human efforts have been applied for understanding of an earthquake and developing the advance technology for sensing it and release them to the general people at well developed country but the underdeveloped country are not succeed so far to do it. The people suffered because of their own construction that had been made. The social and economic factor plays the important role for having a less risk to this hazard and awareness is one of the most important factors for it .So we must have to deliberate about the idea for the forecast of the future earthquake as well as take the responsibility of maximum awareness about the construction, geology and all related topics.

ACKNOWLEDGEMENT

I especially thank to Tribhuvan University, as well as Tri-Chandra Multiple Campus for giving me chances for study in this university and college. I also thanks for department of Geology, Ghantagar Kathmandu which also gives chance to study geology subject in this collage.

I would like to thanks all my friends for their support and also I would like to thanks for my whole family for fully support for my study.

REFERENCES

Sanders, J E. (2007) Principle of Physical Geology, 3rd edition, Columbia University



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Tarkeshwor Municipality, Ward no -15, Dharmasthali village, Kathmandu District is where I was born. I studied my school at the Guinness public secondary School, Dharmasthali and completed my +2 level from Kamana International College, Dhungedhara Kathmandu. I admitted in Bachelor level for B.sc. at Tri-chandra College only to read Geology as I was attracted to this subject from my senior brother. I was regular since first year in both theory and practical classes of Geology. Geology was a interesting subject for me since first year. The first year's field trip to Kakani, second years field excursion to Chobhar and third years 14 days field excursion to Malekhu made me more interested in this field.

There was excitement of Geology after third year field work at Malekhu, which was very interesting and applied knowledge. In Third year course with Engineering Geology, mining and exploration Geology and so on. While studying this I realized that Geology is important aspect of human to Live, cultivate, construct, and develop.

I have interest of visiting beautiful places, reading novel, dancing, playing game, helping and doing new work, etc. currently I am studying fourth year Geology as a major subject My dream nowadays is to be good Geologist in the future.

Sunkoshi Landslide

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Abstract: A landslide is the movement of rock, debris or earth down a slope. They result from the failure of the materials which make up the hill slope and are driven by the force of gravity. Landslides are known also as landslips, slumps or slope failure. A massive landslide occurred at around 02.30am, local time on Saturday, 2 August 2014 at Jure village in Sindhupalchowk district in the boarder of Mankha and Ramche VDC. Due to heavy rainfall, landslide occurred at the Sunkoshi River, killing 156 people, injuring 27 and displacing 436 people. However 33 dead bodies including those of 7 children have been pulled from the debris but 123 missing people buried in the debris were also presumed to be killed in the landslide remaining bodies buried in the debris. The landslide blocked Sunkoshi River creating a high dam across the river and damaged Ariniko Highway.

Key Words: sunkoshi landslide, landslide, hazard, life loss and properties, current situation

1. BACKGROUND

A massive landslide occurred at around 02.30am, local time on Saturday, 2 August 2014 at Jure village in Sindhupalchowk district in the boarder of Mankha and Ramche VDC. The landslide killed 156 people, injuring 27 and displacing 436 people. However 33 dead bodies including those of 7 children have been pulled from the debris but 123 missing people buried in the debris were also presumed to be killed in the landslide (DPnet, 2014). The local government provided immediate relief in cash to the affected family declaring the dead for remaining bodies buried in the debris. The landslide blocked Sunkoshi River creating a high dam across the river. The landslide dammed lake has created havoc amongst the local residents and people living in the downstream and upstream riverside areas. The landslide has completely obstructed the Arniko Highway.

2. OBJECTIVES

The main objectives of field study were as following:

- General observation of the condition of the landslide-dam and the lake formed.
- The overall stability condition of the surrounding slopes.

3. METHODOLOGY

The common methods used were the site selection and field observation. Different places suitable to the study were. Also photographs were taken in many sites.

4. FIELD INVESTIGATION AND DATA COLLECTION

The landslide occurred in the Jure, Sindhupalchowk (see Figure 1) is an unusual mass movement. This landslide is a typical rock avalanche or slope failure type of mass movement. The rock fragments were dropped from about 800m height to the base of the landslide. The air in the Sunkoshi narrow valley was trapped by the dropping of the huge mass of the landslide suddenly so that the rock fragments spread up to the opposite bank of the Sunkoshi river and due to surging of the Sunkoshi and the landslide material, the Dabi khola and surrounding villages with jungles were badly damaged up to 100m high. The dust of the landslide was reached up to 600m height which covered the Dabi Khola village area. The landslide created about 13.5 million tons of rock debris and dust. The rock debris avalanche dammed the Sunkoshi River completely within approximately 2 -3 minutes. A local quake of 3.3 magnitudes was recorded on that day due to the landslide. The debris deposit across the river created a massive landslide-dam which was completely filled in about 12 hours, after which the river started overflowing. The two gates of the Sunkoshi hydropower dam was damaged due to the pressurized surging of the mud and debris created in the Sunkoshi River. After few minutes of this event the flow of the Sunkoshi was stopped and it took about 12 hours to over top the Natural dam created by the landslide (Ministry of Irrigation,



2014)).

Figure.1 Sunkoshi landslide, 2 August 2014
(Ministry of Irrigation)

Due to landslide, the land surface in the crown part is still in unstable condition. There are present of many cracks, spring water is coming out, different blocks are moving and toppling down from the cracks, trees are tilting down. The landslide claimed 156 lives and many more livestock. The event has displaced about 436 people. The highly affected 4 VDCs are Ramche, Mankha, Dhuskun, and Tekanpur. About 165 houses were damaged completely (Ramche 60; Mankha 79; Tekanpur 17; Dhuskun and 9) whereas about 37 households were partially damaged. Approximately 27 people have been injured and are under treatment in Kathmandu.

Based on the initial preliminary observation at the site; the followings are the losses of physical properties:

S.N.	V.D.C.	House Family	Total population	Total death	Migrated No	Remarks
1.	Mankha	36	181	116	65	
2.	Ramche	3	11	8	3	
3.	Tekanpur	3	32	21	11	
4.	Dhuskun	-	-	-	-	
	Total	42	224	145	79	

Table.1 Migrated family number due to the sunkoshi Landslide (after DPN, 2014)

Losses	Amount (approximate)
School building-RCC Building (Ban Sanghu Secondary School)	Rs. 10 Million
Primary Schools at Dawi and Jure (1 in each location)	Rs 2 Million
Bridge and Rosad at Jure	Rs. 40 Million
Math and Temple 2 Nos	Rs 2 Million
Paddy field (300 Ropany)	Rs 15 Million
Small shops (25):	Rs. 12.5 Million
Fish Pond	Rs. 1.5 Million
Poultry firm (6)	Rs. 2.4 Million
Vehicle (10	Rs.45 Million
Total: Rs. 130.4 Million	

Table.2 losses in physical properties in sunkoshi landslide (after DPNNet, 2014)

5. RESULTS AND DISCUSSION

The landslide blocked river, killed 156 people, reduced 10 percent of Nepal's hydropower, washed out a portion of Kodari highway and displaced hundreds of people with property loss of millions of ruppes. The deadliest landslide in Nepal in a decade is raising fresh questions about Nepal's ability to maintain infrastructure to exploit the waters of the Himalayas to export the electricity.

Different types of awareness trainings including audio-visual, disaster information dissemination to the people of disaster area and other disaster prone areas should have organized. The laboratory should have facilities to analysis and study different types of disasters with models for flood, different types of landslides, earthquakes and other disasters. The equipment's related to early warning system, seismograph, hydrometer, GIS and other latest technologies must be provided.

6. CONCLUSION

Many hilly regions in Nepal have weak geographical formation along with steep topography. Due to unique geological structure, like many places in Himalayan region, the Himalayan Nation have frequently witnessed the increasing impact of climate change resulting into different types of water-induced hazards, including landslides (Upreti and Fort, 1999). On Saturday morning, a massive landslide took place at Jure in Sindupalchowk district, nearly 200 kilometer east of the capital Kathmandu, leaving 156 people dead and many other are still missing.

ACKNOWLEDGEMENT

The major sources of pictures and related references of this document are taken from the web-sites and they are gratefully acknowledged for providing and sharing the information through images and reports of the jure landslide. Also I am grateful to my professor Mr. Tara Nidhi Bhattra and my friends.

REFERENCES

DPNet, (2014) Report of Field Visit of Sunkoshi/Bhotekoshi Landslide Affected Area, DPNet Nepal

Ministry of Irrigation, (2014) Report on Jure Landslide, Mankha VDC, Sindhupalchwok District

Upreti, B.N., Le Fort, P (1999) Lesser Himalayan crystalline nappes of Nepal: problem of their origin. In: Macfarlane A, Quade J, Sorkhabi R (eds), Geological Society of America special paper, Vol 328, pp. 225–238



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My Name is Nawa Raj Dhakal. I was born in Aampipal-5, Ratdada Gorkha but I spent my childhood in Aanboo khaireni-6, Tanahun.I passed my SLC with distinction from Shree Ram Shah higher secondary school located in the Aanbookhaireni. My favourite place is Pokhara. My hobby is watching cricket, watching discovery for science programme and exploring the beauty of nature. After SLC, I moved to Bandipur to accomplish my +2 Science from Notre Dame Science Campus. Then I joined Tri-Chandra College with GPM combination. Then I found my aim of studying where I got a chance to feel about the earth. Really it brought so much interest in studying geology. Now it became my passion not only the study. Now, I am learning so many things day by day by realizing our nature. I. I enjoy studying the geology as I get a chance to feel the nature in every sense. There are so many hidden theories inside the earth so I wanted to explore that knowledge as a geologist. Really it's a great honor to be in touch with geology as I found my destination connecting with geology. In future I will try my best to be lady geologist and try to give my best in this field.

I, also enjoy studying the novels' have studied so many interesting novels like khushi,11 minutes,KarodauKasturi,Palpasa Cafe and so on. I always adore studying the Palpasa café again and again written by Narayan Wagle. The story is related with the war between Nepal government and UML Maoist. Writers tried to convey a message to new youngster that life style during that time was so difficult especially for village people .A silent love story is also presented. Atit, leading actor of book, witnessed so many person especially he is there when his GF lost her life during Bomb explosion in Bus going to village. At last he also disappears kidnapped by Nepal Army.it is my all-time favorite novel.

Disasters in Nepal

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Abstract: Nepal is blessed with amazingly beautiful place which is just like a heaven. Nepal having the total land area of 1, 47,181 square kilometer is situated between two large countries China (north) and India (east, west & south) in South Asia. Nepal is divided into 3 regions namely Terai, Hilly and Mountainous region. With its unique geo-physical settings and socio-economic conditions, Nepal is highly vulnerable to disasters. In addition, natural and human induced factors such as, including adverse geo-climatic conditions, topographic features, environmental degradation, population growth, urbanization, unsustainable development practices etc. Nepal is one of the most vulnerable countries in the world to natural disasters. Our geographical difficulties have added further vulnerability to our national efforts. Due to this, Nepal's economy is going down year by year because disaster leads in the way of poverty. Nepal's 86% landscape is occupied by hills and mountain.

Key Words: *nepal, disaster, earthquake, hazard,*

1. BACKGROUND

Every year Nepal is facing a serious disastrous activity, due to which life style of many Nepalese have become bad to worse. Due to geographical and other climatological conditions, rugged & steep topography, extreme weather events and fragile geologic conditions, the country is regarded as a disaster hotspot because of vulnerability of a population together with regular and frequent occurrences of different natural hazards (NDR, 2009). Disaster is causing a loss of number of lives, economic property and making people's life difficult to live. Every year a large rock slides and causing a terror life and avalanche dammed the sunkoshi River in central Nepal and claimed about 137 lives (NDR-2013). Such events are frequent on the steep slopes of antecedent Himalayan. As far as the geographical place is concern, terai is affected by big volume of flood, landslide is troubling a hilly region and GLOFs is affecting a Himalayan region. Such event cannot be controlled but the loss of lives and property can be minimized if country utilizes our geology, meteorology and hydrology manpower well. They can provide a good shape to the country in order to minimize the disaster loss and can increase the people's belief in their nation's preparation for the disaster. In Nepal another significant event related to the debris flows and flash floods of 5 may 2012 in the Seti river Valley claimed about 72 lives (NDR-2013). krishnabhir caused the many problem to public which lies in the one of the busiest highway Prithvi Highway near jogimara. it is a major landslide of Nepal which is causing a problem in every season of monsoon. it was a major threat to the Nepalese manpower to address the issue but after investigating and doing research in that area properly it was found that Montmorillonite was the driver of the landslide which is most commonly formed by alteration of beds of commonly volcanic ash and due to its slippery nature but technician found a good way of getting rid of it which is bio-engineering. Now it has eased down a bit but still a specialist person are thinking about this issue.

2. METHODOLOGY

All the data are collected from websites, journal papers, books, magazines, newspaper article and so on.

3. RESULTS AND DISCUSSION

There are many big landslides like Krishnabhir which causing a trouble in every year. Jure landslide is also another landslide which caused a death of almost 92 people and caused a lot of damage of wealth (Abstract NGC-VII-vol 48(1), 2015-10-20). Nepal's landscape which is predominant composed of hills and steep mountains combined with fragile geologic formations and heavy monsoon rainfall, leads to wide range of geological and hydrometeorological hazards affecting the country. Nepal's geological characteristics together with torrential rain during rainy season often result in landslides, debris flows and floods. Statistics from the EM-DAT show that floods are most frequent hazard with 50 events reported from 1900 to 2014 (NDR, 2013). The Pacific Disasters Center ranks Nepal as 37 out of 172 countries in its disaster vulnerability index.

Geologically, Nepal is considered to lie on a seismic zone which experiences frequent earthquakes. As a result, earthquakes of various magnitudes occur almost every year and have caused heavy losses of lives on several occasions. The recent disastrous earthquake happened in Nepal was Gorkha earthquake 2015. Gorkha earthquake killed more than 9000 people and injured more than 23000. (Gorkha Earthquake 2015 report). Hundreds of thousands of people were made homeless with entire villages flattened, across many districts of the country centuries old buildings were destroyed at UNESCO world heritage sites in the Ktm valley including some at the Kathmandu, Paten and Bhaktapur Durbar square, Changunarayan, Swayambhunath stupa. Geophysicist and other experts had warned for decades that Nepal was vulnerable to a deadly earthquake, particularly because of its geology, urbanization and

Architecture

Nepal lies towards the southern limit of the diffuse collisional boundary where the Indian plate underthrusts the Eurasian Plate occupying the central sector of the Himalayan arc, nearly one third of the 2400 kilometers long Himalayas. The convergence rate between the plates in central Nepal is about 45mm (1.8 inch) per year (April 2015 Gorkha earthquake - Wikipedia, the free encyclopedia, 2015-10-25). The location, magnitude and focal mechanism of the earthquake suggest that it was caused by a slipping along MFT. The earthquake's effects were amplified in Kathmandu as it sits on the Kathmandu Basin which contains up to 600m (2000 ft.) of sedimentary rocks representing the infilling of a lake. This Gorkha earthquake exposed our condition at seismic vulnerability. Any one cannot control the disaster risk but the number of loss of lives and property can be reduced but specialist person can only address such type of disaster risk.

GLOFs is affecting a mountainous region. Apart from the landslides and flood, the high mountainous or Himalayas of Nepal covering about 15% of the country are quite susceptible to land degradation caused by glacial lake outburst floods (GLOF). These mountains with an average elevation of 4500m on are mostly covered with snow and ice throughout. Since the 2nd half of the twentieth century, the large glaciers of the high mountains have been experiencing rapid melting resulting in the formation of a large number of glacial lakes. This may well be a result of global warming. GLOFs can cause serious damage to infrastructure, houses and the environment along the flood path downstream. Recent research shows that Chho-Rolpa glacial lake has a greater risk of GLOF in Dolakha, so people should have their preparation ahead of the risk happening. Several studies have also shown that Nepal is

exposed to a multitude of hydro-meteorological hazards, including floods, landslides, droughts, windstorms, hailstorms, cloudbursts, fires and epidemics. Of the 75 districts, 49 are prone to floods and/or landslides, 23 to wildfires, and one to windstorms (NDR, 2009). According to one study, Nepal is ranked the fourth most vulnerable country in the world in terms of climate change-induced hazards. A survey of 200 countries ranks Nepal in the 11th and the 30th places as the most vulnerable country in terms of earthquakes and floods respectively. The records between 1971 and 2010 reveal that climate-related disasters accounted for almost 25% of deaths, 84% affected by disasters, and 76% suffered economic losses. In the last 20 years, properties worth over USD 288 million, or about USD 23 million a year, have been lost (New spotlight, vol-8, 6 Aug-2014).

Disaster types and their impact in Nepal (1971-2012)

SN	Disaster Types	No of events recorded	No of Deaths	No of Injuries	Affected Family	Destroyed houses	Damaged houses
1	Epidemic	3446	16563	43076	512969	0	0
2	Landslide	2942	4511	1566	555705	18414	13773
3	Flood	3685	4079	488	3665608	94700	87261
4	Fire	6999	1416	1347	255172	75581	2282
5	Thunderbolt	1403	1200	2257	6729	379	427
6	Accident	1000	969	359	2137	5	415
7	Earthquake	105	880	6840	4539	33708	55318
8	Coldwave	390	515	83	2393	0	0
9	Structural collapse	389	404	596	2016	1170	623
10	Boat capsize	140	279	140	410	0	0
11	Others	2892	1092	1458	928492	5210	9998
	Grand total	23391	31908	58210	5936170	229167	170097

Source; Desinventar 2011, MOHA 2011 and 2012

Above table show how Nepalese peoples are affected by the disaster that happened in Nepal

3. CONCLUSION

Nepal does not lack policy frameworks in disaster Management but the people at higher level is not playing a clear roles and responsibilities. Due to the vulnerable groups mainly the poor and the marginalized people from the rural and urban areas are facing economic hardships and bearing all kinds of burden. Insufficient knowledge on disaster management, emerging climate risks, low literacy rates, inadequate physical infrastructure, poor forecasting facilities and unplanned settlements have

worsened the situation. Disasters are a serious impediment to Nepal's development and have undermined its development efforts at poverty alleviation and their gains. Any major disasters can easily sweep out the success Nepal has gained in the millennium Development goals (MDGs) because it will hit the poor and the disadvantaged the hardest. Despite having policies, laws, institutional mechanics and capabilities, Nepal is yet to manage disasters properly. Several years of efforts and lessons have singled out the absence of an effective co-ordination mechanism as a major problem in dealing with disasters. The established mechanism and effectiveness are always lacking. Disasters involve man's institutions, which is always felt in rescue and rehabilitation. The public people should also co-operate with the government and disaster act should be set according to the suggestion of specialist persons. Government shouldn't be afraid of investing money in disaster research which helps the public to save their property and lives.

ACKNOWLEDGEMENT

I am grateful to the geology department of Tri-Chandra Multiple campus for providing me such a golden opportunity to write about the geology related article which is going to be published in Geo world in near future. I would also like to express my gratitude to Dr. Tara Nidhi Bhattarai for guiding us through and for the inspiration as well. I could not stay calm without thanking the editorial board for their editing task as well. Lastly, I am very grateful to my class friends who always help me in difficult phases and guide me till this point, I would not have got a chance without their support and care.

REFERENCES

- Dahal, R.K., (2014) Reactivation of Krishnabhir Landslide
 DPNET- Nepal, (2015) Hazards of Nepal
 Ghimire, P. (2014) Impact of Disasters in Nepal, Newspot light Magazine, Vol: 8



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Born in Chhaterebanjh V.D.C, ward No. 2, Dapcha, Kavrepalanchowk, I attended Shree Krishna Higher Secondary School Dapcha, Kavrepalanchowk, and completed I.SC from Amrit Science Campus lainchaur, Kathmandu. Knowing information about geology from a teacher, 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 I have listen by people but have never seen before.

The best book I have gone through until that time was Steve jobs written by walter iyyaksan. The book conveys a message that technical concept should be develop is important part of the life and also describe about practices make man perfect. Similarly, the best book I have gone through until time was Binod Chaudhary written by Sudip Shrestha and published by Publication nepa-laya Kalikasthan, Kathmandu Phone No. 01-4439786. This biography sent message about by struggle to get one simple person change into perfect and famous people on the world. It gives an account of how Mandela fought for the political freedom in his country.

The knowledge and wisdom that I have gained during my school life has encouraged me To make a commitment that discipline is important part of our life.

I admit that I could good attention to geology classes during my first year course. I started concentrating my study in geology course seriously. Although I have learned many fascinating knowledge of Geology, I was much delighted to know that weathering, erosion, some points of evolution of earth, importance of rock, some geological features in earth surface by using geological map, concept of structural geology.

The most unforgettable moment during my first year study was practical classes should be start, in first homework I can't complete practical in whole night it is so shame for me and so hard for me. Life is for learning and we should not miss any opportunity to utilize the facility available at Tri-Chandra Campus.

While coming at the end of the second year course, I started liking Petrology. It deals about the different type of igneous, sedimentary and metamorphic rocks and also study about properties of rocks.

During my 3rd year, my attention was towards geophysics- a subject that helped us in understanding the internal structures of the Earth. Besides, I was equally enthusiastic to study geology of Nepal Himalaya because this subject convincingly helped me to understand how the bottom of an ocean became the world's highest peak. These facts encouraged me to select Geology as a major subject in my 4th year study.

Studying Geology in 4th year was even more fascinating because of field works, occasional lectures by renowned geoscientists, workshop on "Underground Excavation" many other academic activities organized by the department, develop concept about economics and there study. During 4th year study, geological mapping exercises attracted me a lot. It was an indispensable 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 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 one perfect geologist and I share best concept about geology knowledge.

Drying Groundwater in Swoyambhu Area

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Abstract: This report base on the drying groundwater in swoyambhu area which deals about the cases of dry groundwater, condition of groundwater, and some sources of water. Water sources found maximum in summer season but in winter season water sources should be found less them summer season and some cases there should be no water present time because of development of housing and blasting system. Also people know about the concept of management of land. Some tectonic forces also case for drying water because of its moment. Its change the internal part of the earth directly or indirectly. Seawater is also main part of the groundwater. A soil property also important of groundwater because of it depends on the geological structure of the present and past time. Rainwater management is also perfect in each all houses. Tap water also controls carefully and manmade structure also develops perfectly.

Key Words: *Clearwater, Rainwater, Seawater, Tap water, Wastewater*

1. BACKGROUND

Groundwater resources exploration and identification activities in Nepal started as early as 1967 through unit under the department of irrigation. To enhance groundwater study and investigation activities and to delineate potential area for ground irrigation development, government board (GWRDB) under the former ministry of water resources (MOWR) in 1976 (Ministry of Irrigation, nd). Different types of instrument should be use to analysis the groundwater condition in different country. In our country springs, wells, rainwater are main sources of water. Groundwater related information should be study is important. In my case, Groundwater drying related studies in Swoyambhu area.

2. OBJECTIVES

- To study cases of drying groundwater
- To study about some sources of water
- To study the condition of groundwater

3. METHODOLOGY

Due to some technical things and material should be use to collect data but in my case field visit to collect data and also collect concept of people and read some articles to ready this report. Internets also use to fine different concept about the drying water.

4. FIELD INVESTIATION AND DATA COLLECTION

Groundwater hydrology may be defined as the science of the occurrence, distribution and movement of water below the surface of the earth. Utilization of groundwater dates from ancient time, although

an understanding of the occurrence and movement of subsurface water as part of the hydrologic cycle is recent.

In my study, visit in swoyambhu area to collect given below data table 1. It proves that when summer season water should be found in the well but in winter season well should be dry. Development of housing, industries, also cases of drying water in swoyambhu. Drying the water sources some examples Tulshidhara(Dallu), Maruhitti(Basantapur), water well(buddhapark), Dhimelow(Dallu) etc. Some tectonic forces also case of dry water. It change the direction of the groundwater by change of geological structure.

Table 1 water condition in winter/summer season (Ministry of Irrigation)

Name of people/museum	Address	Sources of water	Winter season	Summer season	Remarks
Ajita Lama	Budhapark Swoyambhu	Well	No	No	Before 5 year ago there is water
Suman Ratna Shakya	Kimdol-15 Swoyambhu	well	Less than summer season	Yes	
Tasi Lama	Kimdol-15 Swoyambhu	well	Yes	Yes	New well (2071)
Manoj Maharjhan	Dallu Chautara	well	No	Yes	
Swoyambhu Museum	Kimdol-15 swoyambhu	Well/water well	No	Yes	

Present time, we deal and study about the groundwater and its scope to help the next generation. We save water and use perfectly.

5. RESULTS AND DISCUSSION

Hence, a main case of the dry groundwater in swoyambhu area is civilizing in present time. And also people don't know about how to control water, concept of groundwater so drying the ground water. Cementation in ground is also main case of the drying water.

6. CONCLUSION

We use Clearwater for different proposes. We need our daily activities so that we develop present and future concept about the groundwater. No water in the mud should be case of dryness. Dryness of mud is harmful of our environment so we develop the concept of use wastewater.

ACKNOWLEDGEMENT

Heartly thank you our respected teacher Tara Nidi Bhattarai and our friends (students) who develop this Geoworld concept. I would like specially thank our Geology department and our respected teachers.

Finally I would like to thank to their contribution from different sector at the time of this work.

REFERENCES

Ministry of Irrigation, (nd) Welcome to GWRDB, Groundwater Resources Development Board (online)

[Available on] [tp:// htwww.gwrdb.gov.np](http://www.gwrdb.gov.np) [7th Nov 2015]

Todd, D.K. (2008) Groundwater Hydrology, 3rd edition, John Wiley and Sons



Year of Admission: 2069

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I was born in Lamabagar- 9, Dolakha District. But I spend my childhood in lamidanda-6, singati bazar Dolakha. I passed my SLC and +2 from Kalinag High School, Singati Dolakha. Then I joined Tri-Chandra Multiple Campus for higher studies. Knowing about Geology from my friends, I got admitted in geology subject.

One of the best book I have gone through is 'thought of science' by Khaptad Shwami which conveys about power of thought and advantage of positive thought for man. Similarly, another impeccable book I have gone through is 'she and return of her' written by Raigurd Hegurd, translated in Nepali by Sumitra sing. It is a dangerous mysterious and romantic noble about love.

In Tri-Chandra, during 1st year I learned many fascinating facts about geology. It was very instating subject. Due to Geology class I came to 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 I am able to identify mineral present in that rock. I know about process of earthquake and tsunami.

Another interest of being student of geology is field visit. While coming at the end of second year course I came to know about compass handling, identify different rock type and there properties. Along with identifying different geological structure, geogical map and route map.

During 3rd year, my attention was towards geophysics-subject which helped us in understanding the internal structure of the earth. Besides, I was equally enthusiastic to study geology of Nepal Himalaya because this subject convincingly helped me to understand how the bottom of an ocean became the world's highest peak. These facts encouraged me to select Geology as a major subject in my 4th year study.

Studying Geology in 4th year was even more fascinating because of field works. During 4th year study geological mapping exercises attracted me a lot. It was an indispensable tool to know how rock types and geological structure 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 to design various infrastructures in an environmental friendly matter.

Considering the facts mentioned above and also based on my own wisdom, I want to be good geologist like as my respected teachers.

Nepal Earthquake 2072

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Abstract: Nepal earthquake that was occurred on the 25th April 2015 was destructive earthquake. Two major stike was occurred in that earthquake, which have magnitude of 7.8 as mainshock and 6.7 of after shock in the Gorkha and Dolakha district. Due to this destructive more than 9000 people were killed, several thousand people were injured and millions of people were out of their shelter. Historic palace, temple and monuments were destroyed throught the affected distict ofearthquake. In the same way 1 million people were drag below the poverty line.

Key Words: *earthquake, magnitude, nepal, mainshock, aftershock*

1. BACKGROUND

The Baishak 2072 Nepal earthquake also known as the Gorkha earthquake killed more than 9,000 people and injured more than 23,000. It occurred at 11:56 NST on 12, Baishak with a magnitude of 7.8. It was the worst natural disaster to strike Nepal since the 1990 BS Nepal–Bihar earthquake. The earthquake triggered another huge avalanche in the Langtang valley, where 250 people were reported missing. Hundreds of thousands of people were made homeless with entire villages flattened, across many districts of the country. Centuries-old buildings were destroyed at UNESCO World Heritage sites in the Kathmandu Valley, including some at the Kathmandu Durbar Square, the Patan Durbar Square, the Bhaktapur Durbar Square, the Changu Narayan Temple and the Swayambhunath Stupa. Geophysicists and other experts had warned for decades that Nepal was vulnerable to a deadly earthquake, particularly because of its geology, urbanization, and architecture. Continued aftershocks occurred throughout Nepal at the intervals of 15–20 minutes, with one shock reaching a magnitude of 6.7 on 13th Baishak at 12:54:08 NST. The country also had a continued risk of landslides. A major aftershock occurred on 29th 12:51 NST with a moment magnitude of 7.3. The epicenter was near the Chinese border between the capital of Kathmandu and Mt. Everest. More than 200 people were killed and more than 2,500 were injured by this aftershock (Kaini, 2015).

2. OBJECTIVES

The main objectives of the article are:

- Basic knowledge about geology of Nepal
- To understand about cause and affected area of that earthquake
- Human loss and physical loss of that earthquake.

3. METHODOLOGY

The information for this article is collected through different websites, newspapers and other articles.

4. FIELD INVESTIGATION AND DATA COLLECTION

4.1. Earthquakes

The earthquake occurred on at 12th Baishak, 2072 BS 11:56 a.m. NST at a depth of approximately 15 km with its epicenter Barpak Gorkha, Nepal, lasting approximately fifty seconds. It is also known as Gorkha Earthquake. The first quake measured 7.8 M and its epicenter was identified at a distance of 80 km to the northwest of Kathmandu, the capital of Nepal. Bharatpur was the nearest major city to the main earthquake, 53 km from the epicenter. The second earthquake was somewhat less powerful at 6.6 M. It occurred 65 km east of Kathmandu and its seismic focus lay at a depth of 10 km below the earth's surface. Over thirty-eight aftershocks of magnitude 4.5 M or greater occurred in the day following the initial earthquake, including the one of magnitude 6.8 M (Kaini, 2015).

4.2. Geology and Cause

Nepal lies towards the southern limit of the diffuse collisional boundary where the Indian Plate underthrusts the Eurasian Plate occupying the central sector of the Himalayan arc, nearly one-third of the 2,400 km long Himalayas. Geologically, then Nepal Himalayas are sub-divided into five tectonic zones from north to south and, east to west and almost parallel to sub-parallel. These five distinct morpho-geotectonic zones are:

- (1) Terai Plain
- (2) Sub Himalaya (Sivalik/churia Range)
- (3) Lesser Himalaya (Mahabharat Range and mid valleys)
- (4) Higher Himalaya
- (5) Tibetan Tethys Himalaya

Each of these zones is clearly identified by their morphological, geological, and tectonic features. The convergence rate between the plates in central Nepal is about 45 mm per year. The location, magnitude, and focal mechanism of the earthquake suggest that it was caused by a slip along the Main Frontal Thrust.

4.3. Affected area

The affected area of that earthquake was Nepal, India, china and Bangladesh. But Nepal loss many people, physical properties and economic properties because Nepal was the epicenter of that earthquake. In central Nepal and Easten Nepal was more affected then other part of Nepal. Westen part of Nepal it was only feeling of earthquake abstract Gorkha district.

4.4. Aftershocks

A series of aftershocks began immediately after the main shock, at intervals of 15–20 minutes, with one aftershock reaching 6.6 M within 34 minutes of the initial quake. A major aftershock of magnitude 6.9 occurred on 13th Baishak 2072 in the same region at 12:54 NST, with an epicenter located about 17 km south of Kodari, Nepal. Aftershocks had occurred with different epicenters and magnitudes equal to or above 4 M out of which 51 aftershocks are equal to or above 5 M and 5 M aftershocks above 6 M and more than 20,000 aftershocks less than 4 M.

29th Baishak, 2072:- A second major earthquake occurred on 29th baishak 2072 at 12:51 NST with a moment magnitude of 7.3; 18 km southeast of Kodari. The epicenter was near the Chinese border between the capital of Kathmandu and Mt. Everest. It struck at the depth of 18.5 km. This earthquake occurred along the same fault as the original magnitude 7.8 earthquakes of 12 baishak but further to the east.

4.5. Human loss: - The earthquake killed more than 9,000 in Nepal and injured more than twice as many. Thousands of people were made homeless. More than 9000 people were death Nepal, 130 death in India, 27 death in china and only 4 were death in Bangladesh also more than 23000 were injuries in Nepal , 560 in India, 383 in china and 200 were Bangladesh. In Nepal 89 foreign were death from that earthquake. And more than 450,000 people were displaced in Nepal.

4.6. Physical loss and Damage

Thousands of houses were destroyed across many districts of the country, with entire villages flattened, especially those near the epicenter. The Tribhuvan International Airport serving Kathmandu was closed immediately after the quake, but was re-opened later in the day for relief operations and, later, for some commercial flights. Kathmandu Durbar Square Before the earthquake Building damage as a result of the Earthquake Several of the churches in the Kathmandu valley were destroyed. Several pagodas on Kathmandu Durbar Square, a UNESCO World Heritage Site, collapsed, as did the Dharahara tower, built in 1832; the collapse of the latter structure killed at least 180 people, Manakamana Temple in Gorkha, previously damaged in an earlier quake, tilted several inches further. The northern side of Janaki Mandir in Janakpur was reported to have been damaged. Several temples, including Kasthamandap , Panchtale temple, the top levels of the nine-story Basantapur Durbar, the Dasa Avtar temple and two dewals located behind the Shiva Parvati temple were demolished by the quake. Some other monuments including the Taleju Bhawani Temple partially collapsed. The top of the Jaya Bageshwari Temple in Gaushala and some parts of the Pashupatinath Temple, Swyambhunath, Boudhanath Stupa, Ratna Mandir, inside RaniPokhari, and Durbar High School have been destroyed. In Patan, the Char Narayan Mandir, the statue of Yog Narendra Malla, a pati inside Patan Durbar Square, the Taleju Temple, the Hari Shankar, Uma Maheshwar Temple and the Machhindranath Temple in Bungamati were destroyed. In Tripureshwar, the Kal Mochan Ghat, a temple inspired by Mughal architecture, was completely destroyed and the nearby Tripura Sundari also suffered significant damage. In Bhaktapur, several monuments, including the Fasi Deva temple, the Chardham temple and the 17th century Vatsala Durga Temple, were fully or partially destroyed. Outside the Valley, the Manakamana Temple in Gorkha, the Gorkha Durbar, the Palanchok Bhagwati, in Kabhrepalanchok District, the Rani Mahal in Palpa District, the Churiyamai in Makwanpur District, the Dolakha Bhimsensthan in Dolakha District, and the Nuwakot Durbar suffered varying degrees of damage (Kaini, 2015).

5. RESULTS AND DISCUSSION

In 12 baishak 2072 the great earthquake was occurred in Nepal. For the reason of that earthquake thousands of people were death and hundreds of thousand injured, homeless and displaced. From the earthquake millions of governmental and public houses were distorted and damage. Landslides also occurred in weak geomorphic structure by that quake.

6. CONCLUSION

Nepal is such type of country which is situated in risk zone of natural digester. We don't stop such type of digester; we only follow safety for natural digester.

In 12, Baishak 2072 BS the earthquake occurred in Nepal. Its epicenter was in Barpak, Gorkha but it also affected in India, china and Bangladesh. It was historical quake after 1990 BS. It killed more than 9000 people, injured more than 23,000 and displaced more than 450,000 people. It also distorted more than million governmental and public houses. Thousands of religion properties also damage and distorted.

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I would express my guided our respected sir Dr. Tara Nidi Bhattarai for this inspiration to write. Also I would for editorial board and my all friends for their valuable comment and inspiration to write this article. I would like thank my teacher, friends, colleagues, and my family who help and support study and write article.

REFERENCES

Kaini, S. (2015) "Great earthquake wipes out Barpak". The kathmandu post. Retrieved 2 may 2015.



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I was born in Kathmandu. I live in Newbaneshwor Kathmandu, Ward no. 34. I started my schooling from N.K. singh memorial English Preparatory Higher Secondary School (E.P.S) located in Minbhawan, Kathmandu. I finished my school leaving certificate (SLC) from the same school. After that my career took slight of some swing and blew me up to Sainik Awasiya Mahavidhyalaya (S.A.M.V) located at Sallaghari, Bhaktapur. The cause of this academic switching was actually my dad who had a great ambition on his son being an army. I too liked the field as they graduate youngsters like us making us responsible and nation loving cadets. But in between life gave me a thunderbolt which was quite strong to make a change and take me off straightly, to land me to an awesome destination which was no other than Tri-Chandra Campus. I started my Bachelor's degree in Geology taking me to the day's paasing by. I find myself wise and lucky to be a student of Geology in the days passed and those yet to be seen!

I am not actually fond of reading books but one of those I've read in quite a curious way was Palpasa Café by Narayan Wagle. His writings are quite interesting and rather very much inspirational. Apart from these reading writing things I usually love playing basketball, going to places; take pictures, talk with people sharing happiness, sorrows and many more.

These three years at department of geology have been very interesting indeed. Learning and knowing about a completely new stream has been quite exceptional, despite the way people use to exaggerate the study risk and so on. The theory classes, the practicals and the field works are a good source to learn about our very own mother Earth.

Interpretation of Geology among Engineers

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Abstract: Geology and Engineering are two children of a same family where we practically (for instance) have never tried to keep both of them in an equal seat knowing that they both are of the same father-mother gene. Engineers should basically have geological concept as one should definitely know where actually he/she is working. Illustrations can be given by asking a tree cutter whether to cut the tree from the top? Or the bottom? The base of any possible things are ought to be strong, relating it to constructions making the geology of the place the major thing to be thought of.

Key Words: *Geology, Engineers, Engineering aspects, Structure*

1. BACKGROUND

We and our engineering got some serious slap on the face by the devastating earthquake occurred this year in Nepal. Those building construction can never be strong until and unless proper care is taken to its base(say foot) by which it is going to stand, for this work an engineer is not just enough as he works exactly the same way other does and often only takes care of the superficial parts. We got to take care of the part where the base of the building/construction stand for this detailed study of geology is required.

The major problem for us around here is the nature of the movement we're facing. "The eastern part (Australia) is moving northward at the rate of 5.6 cm per year while the western part (India) is moving only at the rate of 3.7 cm per year due to the impediment of the Himalayas."(Indo-Australian plate,2015) . Since this is the problem for us we live in the base of the himalaya with different tectonic setting we should be aware to relate geology among enginners. The rate of movemnt of structures makes a lot difference in its engineering, when a part of land is moving certain inches in adjacent to the other, in near future if we don't care about the geology it will certainly act as the structure collapses since one part will move apart from the other .The trend is something like blamming the engineer for making the false constnruction practice but the thing is certainly different.

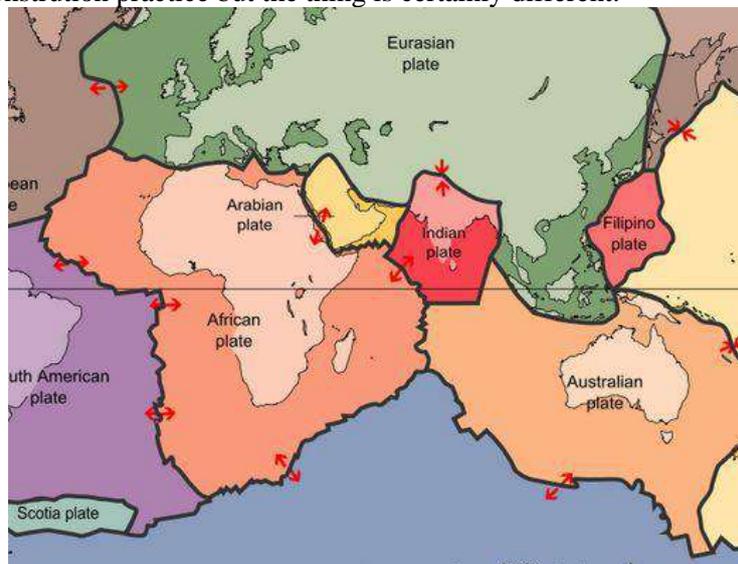


Fig 1: Plate Movements

Despite of this serious situation we are living our government never emphasizes on the problem and relate geology to our engineering construction.

2. OBJECTIVES

The major objectives behind the preparation of this research article are:

- To relate geology with engineering aspects.
- To emphasize people to use geological solutions for engineer problems.
- To promote geology.

3. METHODOLOGY

This article is prepared by using literature review method. Various books and publications were reviewed in the process of preparing this research article.

4. RESULTS AND DISCUSSION

In the days to come engineers have to think a lot before they decide to draw a framework on how they are working on the infrastructure they're making by the help of a Geologist. They should probably have to learn some good knowledge how to work on excavations, finding primary as well as secondary structures and so on. The soil material its strength, activeness and so on are to be calculated beforehand and the structures are to be made accordingly.



Fig 2: Living with landslide (after Dahal, 2010)

We can take an example in here. No matter about the engineering done here in this hill (Fig:2) which is on the verge of sliding if an engineer builds a house in here, he's surely got to fail, because the hill is going to slide in the near future spoling all the structures built in here.

Some more examples can be explained by the position of building to be constructed in the near future that an engineer can never figure out. If an engineer locates a house to be constructed in a cut bank of a river. He/she would never be aware that the river will come closer and closer every year to a time when the river almost meets the structure causing damage and excavation of the building. If only a geologist would have been employed he/she could have figured out the drainage pattern and the nature of the river flowing then the problems would not have arisen.

5. CONCLUSION

Hereby, we can easily say that the geology is a must education to be given to all the engineers around the world. The subject which relates both geology and engineering known as Engineering Geology which is to be promoted with its best qualities and knowledge specifically in the field relating both the subjects. The construction practice is surely got to improve and I'm pretty sure that the trend of using geologist among engineering construction is implemented.

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I would like to thank Dr. Tara Nidhi Bhattarai for helping me in the best possible way in the completion of this research article. Also I would like to thank Mr. Madan Ratna Manandhar and the Department of Geology, Ghantaghar, Kathmandu for providing me an opportunity to be a part of this magazine. I cannot forget to mention my friends Sanjeeb Thapa, Anil Aryal, Praveen Upadhyaya Kandel and Rishi Raj Baral for their unending support.

REFERENCES

- Dhakal, R.K. (2006) *Engineering geology of Nepal*, [Online], Available: <http://www.ranjan.net.np/ranjan/index.php/resources/engineering-geology-of-nepal> [7 November 2015].
- Dhakal, R.K. (2006) *Geology of Nepal*, [Online], Available: <http://www.ranjan.net.np/ranjan/index.php/resources/geology-of-nepal> [7 November 2015].



Year of admission: 2069

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25 April 1994 AD, I was born as a younger son of Man Bahadur and Tika Maya Katwal in Khotang district. After migration, my family moved to Sunsari where I passed my S.L.C. from unique academy, Jhumka. I completed my +2 in Kathmandu from pyramid international college.

Because of my keen interest in natural science, I admitted in Tri-Chandra multiple campus to read physics. Despite of my interest in physics, geology became interesting and fascinating to me. So, I planned to major in geology and dedicated on it.

Due to my own negligence, in first and second year my studies went in inverse direction. After third year, I started focusing on my studies. Engineering geology is my subject of interest at present. Geophysics is equally fascinating to me.

So far, I am fascinated by motivating and inspiring books. The Alchemist by Paulo Coelho and Ageless Body, Timeless Mind: The Quantum Alternative to Growing Old by Deepak Chopra is my personal favorite. They have the power to motivate and inspire you and teach you to live life in a better way.

As a geology student in Tri-Chandra Multiple Campus, I have tons of friends who helped and supported me and gave some good memories to me. Every lectures, every practical classes and every field works are memorable for me.

I am a dreamer and I have the power and belief to achieve my dream. Being a confident, motivated and dedicated student, 10 years from now you will see me as an engineering geologist and a university professor.

Root Causes of Recurring Natural Hazards and Their Mitigation in Nepal

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Abstract: Every nook and corner of the world is subject to different kinds of natural and man-made hazards. Nepal is a hazard-prone area due to its rugged topography, unstable geological formations, intense rainfall and active tectonics. Landslides, floods (including flash floods), earthquake, fire and others (thunderstorms, road and river accidents, avalanches, etc.) are recurring natural hazards in Nepal. We cannot stop hazards from occurring, but we can surely minimize the risk and damage caused by them. A Literature review was done to address the following questions: ‘why are hazards recurring in Nepal’? And ‘How can hazards in Nepal be mitigated’? Sadly Nepal has witnessed an alarming increase in the frequency and severity of hazards.

Key Words: *Nepal, natural and artificial hazards, causes, mitigation, epidemic*

1. BACKGROUND

“Hazards refer to any potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation” (Bass *et al*, 2008; 6). Hazards may originate geologically (earthquake, tsunami, volcanic activity), Hydro-meteorologically (flood, glacial lake outburst flood (GLOF), landslides, storms) or biologically (epidemics and diseases). As Nepal is a landlocked country, it is safe from coastal hazards and, so far, from volcanic hazards. The past study of disasters during 1971-2006 AD, reveals that epidemics have taken the largest toll of life every year, followed by landslides, floods (including flash floods), fires, earthquakes, thunderstorms, accidents and avalanches (National Strategy for Disaster Risk Management in Nepal, 2008) (see Figure 1). Hazards can be single, sequential or combined in their origin and effects.

2. OBJECTIVES

This article focuses on the following questions:

- Why are hazards recurring in Nepal?
- How can hazards in Nepal be mitigated?

3. METHODOLOGY

A Literature review was done to collect various data and information through various reports, journals, related articles and books.

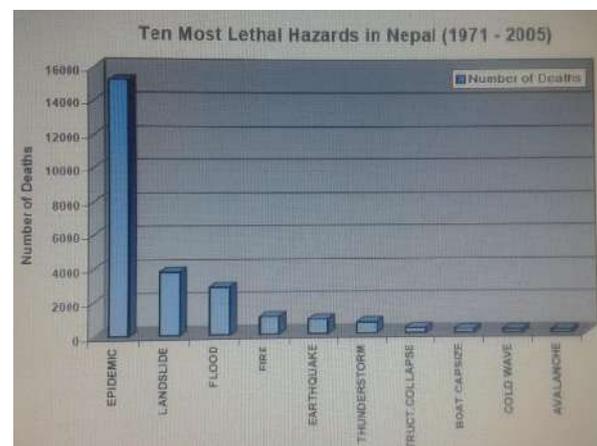


Figure 6: Casualties by different disasters in Nepal (after National Strategy for Disaster Risk Management in Nepal, 2008)

4. RESULTS AND DISCUSSION

4.1 Why are hazards recurring in Nepal?

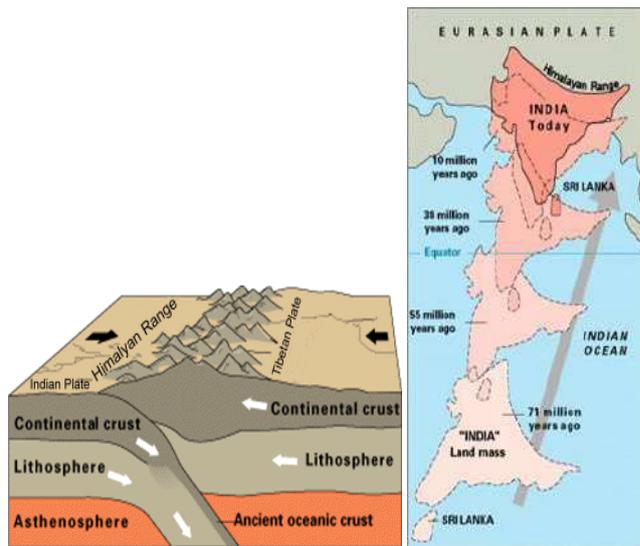


Figure 7: Subduction of north-moving Indian plate into stationary Eurasian plate, giving rise to Himalayan ranges, thus making Nepal a seismically active zone. (after USGS, 1999)

Geologically, Nepal lies just above the subduction zone between the stationary Eurasian plate and north moving Indian plate (see Figure 2) and ranges from the flat plain of the Terai to the highest mountain peaks over the distance of 149 km (average width of Nepal). Thus, Nepal is seismically active and its rivers flow south with high gradient. Also, Nepal has rugged topography, unstable geological formations, and is subjected to intense monsoon rainfall. In addition, Nepal lies in the Himalayan arc, which consists of the largest glacial ice and perennial snow outside of the polar region (Joshi, 2014; 27). These are the major factors that make Nepal a ‘perfect storm’

for geophysical and climatic hazards. Global warming and rapidly changing climatic conditions have put Nepal at high risk of GLOF.

Besides its geology and climatic conditions, exploitation of natural resources, ongoing unsustainable development, haphazard land use pattern, limitation of plans in policy level, violation of building code, lack of infrastructure, training, education and awareness, poor Disaster Risk Reduction (DRR), Disaster Risk Management (DRM), Climate Risk Management (CRM) & Emergency Preparedness Response (EPR) system, lack of Multi-Hazard Risk Assessment system, political unrest and poor economic condition of Nepal are the root causes of recurring hazards in Nepal. The vulnerability to hazards is increasing day by day in Nepal due to rapid growth in population, especially in urban and urbanizing areas.

4.2 How can hazards in Nepal be mitigated?

We cannot stop hazards from occurring, but we can surely minimize the risk and damage caused by them. For this to happen, the main focus must be given to proper DRR plans, DRM, CRM and Multi-hazard risk assessment systems, which will identify the risky and vulnerable areas and act accordingly to manage the risks focusing on pre-hazard actions such as prevention, mitigation and preparedness and post-hazard actions like search and rescue, relief and rehabilitation. We have seen how the search and rescue (see Figure 3), relief and rehabilitation done by the Nepal government, Nepali army, Nepali police, armed police force,



Figure 3 participation of Nepal army in search & rescue programme during Gorkha earthquake 2015 (nepal army twitter photo @nepalarmy99)

members of different NGOs and INGOs and local people saved hundreds of life during the Nepal megaquake of 2015.

Early forecasting system like flood forecasting, improvement in infrastructures such as roads, earthquake resistant schools, hospitals & residential buildings and strong EPR system largely reduces the vulnerability to hazards. In case of the solution of the problem such as floods, Price (2009:11) suggests controlling the flow of rivers by construction of dams within the river, instead of raising the natural levees or using construction dykes. Such dams may also provide irrigation facilities in dry seasons which will aid in agriculture in Nepal. Afforestation and retaining structures can largely minimize the risk of landslides. Earthquakes are not deadly, but the infrastructures we have made make them deadly. Buildings made in vulnerable areas violating the building code will surely put thousands of lives in danger. So, strict implementation of building code is necessary in Nepal. Community based DRM should be designed and promoted as they are the first one to respond to the disaster. Proper sanitation, health facilities, shelter and food should be provided to the disaster victims in order to reduce the loss of life due to epidemics and diseases.

5. CONCLUSION

Nepal has witnessed an alarming increase in the frequency and severity of hazards. So, to minimize the vulnerability, strong EPR system, DRR, DRM, CRM, multi-hazard risk assessment and community based DRM should be immediately and efficiently integrated in overall development planning and works. Wise use of natural resources, strengthening the policy and implementing it at the grass-root level will surely reduce the loss of life and property due to different kinds of hazards. Last, but not least, ongoing unsustainable development must be transformed to sustainable development.

ACKNOWLEDGEMENT

It takes a lot of energy, determination and commitment to prepare an article and conclude it. There are many individuals as well as institutions, which directly and indirectly helped me during this project. First of all, I will like to extend my sincere gratitude and appreciation to Dr. Tara Nidi Bhattarai of Tri-Chandra Multiple Campus who invested his full effort in guiding me in achieving this goal. Furthermore, I would like to acknowledge Mr. Sujit Shah of HUDEP Nepal and Mrs. Sushmita Luitel for their technical support.

REFERENCES

- Baral, R.R. (2015), 5000 building in pokhara foul building code, the himalayan times (online)
 [Available on] <http://thehimalayantimes.com/nepal/5000-high-rise-buildings-against-building-code-in-pokhara/>
- Bass *et. al.*, (2008), Disaster Risk Management system analysis A guide book; FAO, Rome.
- Joshi, G. (2014), Glaciar Lake Outburst Flood: GLOF, Geoworld, vol. 5, pp 27.
- Koirala, P.N. and Sharma, S. (2014), community based forest fire management in fragile mountain nepal (online)
 [Available on] <http://www.slideshare.net/GRFDavos/community-based-froest-fire-mgmtppt-nepalkoirala2014-davos>

National Strategy for Disaster Risk Management in Nepal, (2008) UNDP.

Price, D.G. (ed.) (2009) Engineering Geology Principles & Practices, London, UK, Springer.

Shrestha, A. (2014), Managing Flash Flood Risk in the Himalayas, Geoworld, vol. 5, pp 4-6.



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I was born in Kanpur VDC; ward no: 8, Bohore, kavre. I was started my Academic carrier from Biginurse English school, Gatthaghar, Bhaktapur. After LKG I admitted in class 2 in Satmul Secondary school, Bohore; Kavre. I completed my S.L.C from Satmul Secondary school and +2 from Chaitanya multiple campus in Banepa. Then finally came Trichindra collage for my B.Sc class. Firstly, I attend the class of physic, statistics and maths. I was determind to study physics because I have never heard about the subject Geology But One day my friend Bishowraj Adhikari Suggested me for study Geology. I attained the class of Tara Nidhi Bhittarai, In the initial classes, I was so happy and really impressing. Then after I was bounded in the combination of Geology, Physics and maths.

The best book that I have gone through is “Seto Baagh” by Diamond samser. The book focus on the society and environment of that time before developing Democracy in Nepal. I am also impress the book of “Mother” by Maxim Gorke (1868-1936) which is focus on the revolution developed in the Russia.

The day of collage during these four year were really memorable. However studying geology in 3rd year was more fascinating because of field work, we are in a real laboratory where we made geological map, identified rock type in the field saw many geological features like fault, fold. Also we learned how to work in group. The field work also helped to the established a good relationship between teacher and student.

I enjoy reading Nobles, Books, make a new friends and listening to music. With the wisdom on my own I hope to become a renowned geologist within 10 years.

A Case Study on Landslide

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Abstract: The study area lies on opī VDC of kavre district at the Northwest (about 3 km) of Dhulikhel Bazar and Northeast about 4 km of Banapa Bazar (elevation from 1280m to 1400m). The area is composed by Bhimphedi Group of Lesser Himalaya (Stocklin and Bhattarai, 1980). The Rock on this group comprises Precambrian Metamorphic rock of Schist, Quartzite and few Marble horizon (Stocklin and Bhattarai, 1980). Land covered by residual soil on the crown. There are few major discontinuities that play the rock of the soil rock slides around the area the attitude of rock foliation is $225/34^\circ$. The major Joints are $205/40^\circ$ and $155/60^\circ$. The joints plays main role in plane and wedge failure. Surrounded by kutal village in south and chapletidanda having latitude 27.6410° and 27.6414° N longitudes 85.5477° to 85.5472° E. The Jhiku Khola is the main draining river there which finally meets with Sunkoshi River.

Key Words: landslide, Joints, Rock, Elevation, Draining.

1. BACKGROUND

During the Aug-sep 1994 a severe rainstorm hit the jhiku watershed causing catastrophic landslides floods and debris flow the incident was responsible for heavy loss of property and washout. The farm land of the downsides. The landslide damaged 3 house and cattles but no human casualty has occurred due to this landslide (UNDP Nepal, 2002).

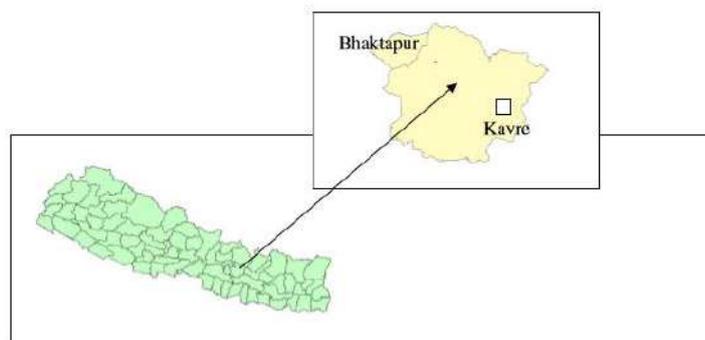


Fig. 1.1 Location map of the study area

Scale 1.5cm=50km

1.1 Geology

Lesser Himalayan crystalline is made of bedded sequence of metasediments with occasional fossiliferous rocks lying over the low grade metamorphism as klippe in the Lesser Himalaya. The rock on the area is Precambrian green schists metamorphosed rock of schist quartzite a few marble

horizons the upper part of the area covered by Higher Himalayan Crystalline that includes the Precambrian high grade metamorphic rocks comprising Gneisses Quartzites and Marbles. Magmatites, Granite and gneiss are predominantly in the upper part (Stocklin and Bhattarai, 1980).

2. OBJECTIVES

- To understand Geology as well as rock type of selected area.
- To learn cause and reason of landslide Develop in such area.

3. METHODOLOGY

- Information was collected through secondary sources such as books, articles, project reports, website etc.
- Field visit for measurement of discontinuity (orientation, spacing).

4. FIELD INVESTIGATION AND DATA COLLECTION

The measurement of discontinuity provided by field investigation is given below.

Table 1: Measurement of discontinuities

S.N	Strike	Dip amount
1.	225	34°
2.	155	60°
3.	315	65°
4.	205	40°

The main discontinuities is 205/40° and 155/60°

The orientation of foliation plane is 225/34°

Opening of joints are 2.5 to 10mm.

5. RESULTS AND DISCUSSION

Field observation showed that the sliding materials mainly composed of brown to yellow colored completely colluvium soil. The composition of the sliding materials of the landslide is boulder gravely soil with significantly fines.

On the crown of the slide few residential building are also observed. Little vegetation (grass) along with 0.5-0.7 mm thick top soil and south faced slope of ridge that extends upto the western foot of the Panchkhal valley.

The landslide zone is further classified as

1. Eastern plane failure
2. Mid wedge failure
3. Western wedge failure



Fig.2 Landslide zone

The eastern plane failure is observed fresh with clay filling along with slightly undulated and it is very favorable to plane failure due to dip amount, natural slope and rock discontinuity. The attitude of slope discontinuity is $205/40^\circ$. The friction angle of Gneiss is $23^\circ-29^\circ$ that indicates the slope is very favourable to the plane failure (Rimal, L.N., Shikrikar, S.M., Piya, B. and Tuladhar G.B., n.d.)

The plane areas to westward part along the ridge and makes a wedge to the joint $145/60^\circ$. The rock of mid wedge is fresh.

The western wedge failure is discontinuity having same discontinuities as mid wedge. Which is seems to be older than mid wedge.

6. CONCLUSION

The result and data calculation conclude that the major factors of the opi landslide are,

- Structure of mountain slopes
- An inclined slope between 45° & 55°
- 4 set discontinuities of opening 2 to 10 mm.
- Rocks types are fully weathered Phyllite with intercalated with Gneiss.

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First of all i would like to thank our respects teacher Dr. Tara Nidhi Bhattarai and our geology department for the inspiration and providing an opportunity to write article and publish them. Also, i am grateful of my teacher Dr. Subodh Dhakal who provide me some article which is help to give guide line about my research. Finally, I would like to thank my friends who help me directly and indirectly.

REFERENCES

Dahal, R.K. (2006) Geology for technical students; Kathmandu: Bhrikuti academic publication, pp221-337.

Kafle, K.R. Slope mass rating in middle mountain of Nepal, Kathmandu University Journal of science Engineering and technology, vol 6 No. II November 2010 pp28-38.

Rimal, L.N., Shikrikar, S.M., Piya, B. and Tuladhar G.B. (n.d.) An over view of Chandistan landslide, News Bulletin of Nepal Geological society, Vol 21&22, pp 51-54.

Stocklin, J. And Bhattarai, K.D. (1980), Geology of Kathmandu Area and Central Mahabharat Range, unpublished UNDP report.

UNDP Nepal, (2002) Systems of recording Disaster Information in Nepal, Present Publish in web address <http://www.undp.org.in/dmweb/bsdisa/undpnepal.ppt> .



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Born in Rampur Municipality, ward No.8, Palpa, I attended Shree Ram Tulasi HSS, Palpa and completed +2 from Kathmandu Bernhardt HSS Kathmandu, Knowing information about geology from brother's friend 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 I have read in history book but have never seen before. The best book I have gone through is Jeevan Kanda Ki Phool by JhamakKumariGhimire. The book conveys a message that with our will power and hard work we can achieve success in spite of our physical weakness.

The knowledge and wisdom that I have gained during my school life has encouraged me to do something for nation and welfare of humankind. Although I have learned many fascinating knowledge of Geology, I was much delighted to know that by the study of processes in the earth today we can tell what had happened in the geological past and a small thing like fossils, minerals and structures, we can know the paleoenvironment and paleocurrents and with the help of study of rocks and the structures we can plan different projects that helps in the improvement of civilization.

The most unforgettable moment during my first year study was an encounter with the friend who encouraged me to do your best whatever you are doing and as student study as hard as we can and also encouraged me to utilize leisure time in college by reading in library. He was in the opinion that student

Life is for learning and we should not miss any opportunity to utilize the facility available at Tri-Chandra Campus. While coming at the end of the second year course, I started liking Paleontology the most. It tells all about the history of earth, types of climate prevailed, lives roamed and past your recent photograph extinct, natural calamities occurred and most importantly human evolution and their role in giving a shape to the present-day development.

During my 3rd year, my attention was towards geophysics- a subject that helped us in understanding the internal structures of the Earth. Besides, I was equally enthusiastic to study geology of Nepal Himalaya because this subject convincingly helped me to understand how the bottom of the ocean became the world's highest peak. These facts encouraged me to select Geology as a major subject in my 4th year study.

Studying Geology in 4th year was even more fascinating because of the more important topic and internationally accepted syllabus proposed by Tribhuvan University. During 4th year study, engineering geology subject attracted me a lot because this subject helps us to apply our geological knowledge to engineering study. So, it helps us to apply our knowledge in real world for the improvement of civilization. All these studies of engineering geology plays an important role to provide the geological and geotechnical recommendations, analysis and design associated with human development and various types of structures. The investigation on how earth or earth's processes impact human made structures and human activities makes it even more interesting.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a competent engineering geologist in near future.

Reconstructing Earth's Evolutionary History

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Abstract: Earth is dynamic. Geography and geomorphology are not constant. Continents and oceans are continually rearranging and evolving in response to the plate motions and internal plate deformation. This dynamic condition affects the ocean/atmosphere circulation, the connectedness and distribution of biological communities, distribution of chemical masses and distribution of mass and heat in and out of mantle. So, the well study of rearrangement of earth's surface is necessary to understand the evolutionary history. This article focuses on idea to reconstruct the geological past on the bases of continuous evolution of plate boundaries and plate interiors, rock records and rock succession, fossil records, chemical components, fundamental boundary conditions within which an earth system operates and sea level change.

Key Words: *Reconstruction, Rock succession, Paleogeography, Paleotectonics*

1. BACKGROUND

Earth is the third planet from the sun and fifth largest. Earth is divided mainly into three layers; crust, mantle and the core, which have distinct chemical and seismic properties. This article focuses mainly in the crust and other earth processes on the surface. Crust varies considerably in thickness. It is thinner under the ocean, thicker under the continents (earth facts, n.d.). The reconstruction of historical evolution of earth's crust during the geological past is based on four different aspects of the historical geology. The first aspect is to establish the age of rock formation exposed on different segments of earth's surface. The second aspect pertains to paleogeography which describes the distribution of landforms and sea in the geological past. The third aspect covers past tectonic movements inferred on the bases of paleography and structures of rocks. The fourth aspect deals with the synthesis of paleogeography and the paleotectonics of different segments of earth's crust.

The history of earth's evolution can be reconstructed only when the succession of rock formation has been worked out. The succession is generally established in terms of older and younger ones i.e. their relative time of formation. Paleontology that deals with organic remains preserved in rock also aids help in dealing with rock succession. Techniques of geochronology help in determining the age of rocks in absolute terms with the help of radioactive elements present in some rocks. Stratigraphy deals with the mutual relationship and succession of rocks. The distribution of land and sea, climate and animal and plants over the earth's surface of the geologic past are displayed with the help of paleogeographic maps (Kumar, 1985: 3-4).

2. METHODOLOGY

Secondary sources such as books, websites etc. are used to overcome the necessity of information required to complete the article.

3. OBJECTIVES

The main objective of this article is to provide the information on how earth's evolutionary history can be reconstructed / how past geologic process can be explained in terms of the contemporary processes which can be observed and recorded at present.

4. DISCUSSION

'The ruins of an older world are visible in the present structure of our planet, and the strata which now compose our continents have been once beneath the sea, and were formed out of the waste of pre-existing continents. The same process are still destroying by a chemical decomposition or mechanical violence, even the hardest rock, and transporting these materials to the sea, where they are spread out, and form strata analogous to those of more ancient date' (University of Maryland, 2015).

Historical geology aims at reconstruction of the earth's evolutionary history and formulation of general laws governing the evolution. It focuses on geologic processes that change the earth's surface and subsurface and the use of stratigraphy and structural geology and paleontology to tell the sequence of events. The reconstruction is based on the study of rock successions exposed on and below the surface of earth. Historical geology with all its basic data on the succession of rock formations, paleogeography and palaeotectonics helps in establishing a generalized theory of evolution of the crust.

4.1 Paleogeographic Reconstructions:

Paleogeographic reconstruction is based on the facies analysis of the stratigraphic successions of the area. A facies is represented by a typical association of rock types and, for Phanerozoic rock formations, by a typical assemblage of fossils. Facies also represents an environment of deposition of rock types. But the environment in which the organism accumulates after their death need not always coincide with the environment in which they lived. However for palaeogeographic reconstructions, only a part of fossil assemblage is considered which represents organism inhabiting in the basin of deposition. For example, the sessile and burrowing organisms are in most cases fossilized at the place of their habitat, and the litho-facies of rock help in determining whether the organism lived in those basins or were transported. Degree of chemical weathering of detritus indicates the type of weathering which helps in suggesting the climate operating in the provenance. The provenance of detritus is often established on the basis of palaeocurrent analysis with the help of sedimentary structures such as current bedding and current ripple marks. Chemical precipitates of sediment on the other hand indicate the physio-chemical conditions of the area of deposition. For example, abundant calcium carbonate indicates warmer climate and alkaline condition, presence of volcanic components indicate a volcanic phase in the neighborhood of the basin. Dynamic environment of basin of the basin is inferred on the basis of textures and structures of sedimentary rocks. Thin parallel stratification is characteristics of littoral, fluvial and deltaic deposits. The inclination angle and directions of stratification enables to predict the paleocurrents. Grain sizes and shapes are used to infer the proximity of erosional areas to the basin of deposition.

Such paleogeographic analysis are summarized and graphically represented by a set of paleogeographic maps. A palaeogeographic map shows the broad characters of physiography and climates which existed on the earth's surface at particular stage of earth's evolution.

4.2 Paleotectonic Reconstructions:

Tectonic movements bring changes in the structure of earth's crust and hence changes in the relief of earth's surface. Processes of sedimentation are directly controlled by the tectonic movements operating in deeper parts of the crust and in the upper mantle. Emplacement of all types of mineral deposits is also controlled by the tectonics of the evolution of the earth's crust. The most common manifestation of tectonic movement is observed in gradual uplifts and subsidence of large segments of earth's surface. Quicker tectonic movements are observed in the form of earthquakes. Tectonic movements of the geologic past are most commonly observed in the form of general warping of the layers of earth's crust into synclines and anticlines which are often expressed on the earth's relief in the form of hills and valleys. Primarily two types of tectonic movements are observed; horizontal and vertical. Tectonic movements of geological past are inferred with the help of deformed structures of the rock succession. On the basis of rate of tectonic movements, their two broad divisions are recognized; Epierogenic movements that spread in time over a few hundred million years and orogenic movements that takes place in a shorter span of geological time i.e. few tens of million years. The stable tectonic environment is often inferred as a representative of epierogenic movement, whereas the fluctuating tectonic environment are related with the orogenic movements.

Past tectonic movements can be inferred with the help of facies maps which shows the distribution of various litho-facies deposited during a particular interval of geological time. Based on these interpretations, paleotectonic maps are prepared which give tectonic zonations of the earth's surface for various intervals of geological time. Analysis of stratigraphic thickness is carried out with the help of isopach maps which are prepared by joining the points of equal thickness of particular stratigraphic units on different parts of sedimentary basis. Such lines are known as isopach lines. Tectonic analysis of isopach maps is carried out with the help of facies map of the same stratigraphic units. The basin relief is inferred on the basis of the litho-facies. Positive vertical movements are inferred from the stratigraphic records of diastems and angular unconformities which are at the same time natural boundaries of the lithostratigraphic units. Causes of tectonic movements are not yet clear but the observed results of the movements obviously depend on the depths of the processes with which they are related. (Kumar, 1985: 33-39)

5. CONCLUSION

Historical geology concerns with the evolution of earth and it's life forms from its origin to the present and uses the principles and techniques geology to reconstruct and understand the geologic history of earth. It focuses on geologic processes that change the earth's surface and subsurface and uses the principles of stratigraphy, structural geology, tectonics and paleontology to tell the sequence of events and to reconstruct the evolutionary history. Paleoclimate change, biological response to environmental change, the dynamics of plate tectonics, reversal of geomagnetic field, ocean chemistry, and sea level change – all rely on plate tectonics and/or paleogeographic frameworks. Thus, paleotectonic and paleogeographic studies are indispensable components for the reconstruction of earth's evolutionary history.

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I would like to offer my hearty gratitude to Dr. Tara Nidhi Bhattarai for his incredible suggestions counseling and inspiration to write the article. And I am also thankful to the friends of editorial board for their crucial time and effort for syntactical and semantical co-operation for this article.

REFERENCES

Earth facts [online], available: nineplanets.org/earth.html [30 Oct 2015]

Kumar, R. (1985) Fundamentals of Historical Geology and Stratigraphy of India, New Delhi: Wiley Eastern, pp 33-39

University of Maryland, (2015) GEOL 102 Historical Geology, the History of Earth and Life (online) [Available on]: www.geol.umd.edu/~tholtz/G102/102intr.htm [30 Oct 2015]



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I was born in Kathmandu. I live in Manamaiju VDC, Ward no.2 'Kha'. I completed my schooling from Bhanubhakta Memorial Higher Secondary School, Panipokhari, and Kathmandu, Nepal. I appeared in the SLC examination in the year 2066. After the completion of my schooling I continued my higher studies in Bhanubhakta Memorial College. After I completed my college I wasn't quite sure about what to study. Incidentally I came to know about Geology from my college teacher. After I heard about it I found it quite interesting and was quite excited about getting admitted in the college and studying under the historical roof of Ghantaghar. And as I started studying in Tri-Chandra Multiple Campus the first few days were quite boring but as time went on I found it more and more interesting. The best part of studying in this college has to be the geology classes and the time spent with my four friends. Meeting these four wonderful people has been a blessing to me and I just don't know how to thank god for providing me with such a strong friendship.

Among the books that I have studied I have found one book in particular very interesting. "How to Enjoy your Life and your Job" written by Dale Carnegie is a very inspiration book for youngsters like us because it provides an insight about how life is to be lived, how u need to treat ourselves and the ways to enjoy our job. Apart from reading books I'm fond of sports mainly football, cricket and basketball. I love playing these sports and travelling to new places.

These three years at department of geology have been very interesting indeed. Learning and knowing about a completely new stream has been quite exceptional. The theory classes, the practicals and especially the fieldworks have been a great new experience. I dream about being a good person and a great geologist in the near future.

Energy Crisis in Nepal

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Abstract: There are very limited amount of fossil fuel reserves in our country. Out of those available resources only very little are being utilized. This makes our country incapable of being self-dependent on fossil fuels. To make matters worse very less work has been carried out in the field of exploration and identification of fuel reserves. This has a very negative impact on our national economy as we need to import all our required fuel and gas from foreign countries. Therefore alternative sources of energy should be identified and utilized.

Key Words: Fossil fuel, Lesser Himalaya, Exploration, Government, Renewable energy

1. BACKGROUND

Recently Nepal has been facing a serious state of energy crisis which has made the lives of Nepalese people troublesome. One of the reasons behind it is the fact that there are no notable fossil fuel reserves in our country. Because of it, Nepal is forced to import all of its fuel supply from neighboring country India. To understand the lack of reserves in Nepal, understanding the Geology of Nepal is a must. Nepal can be divided into Terai region, Siwalik region; Lesser Himalaya region, Higher Himalaya region and the Tibetan Tethys region (see fig. 1).

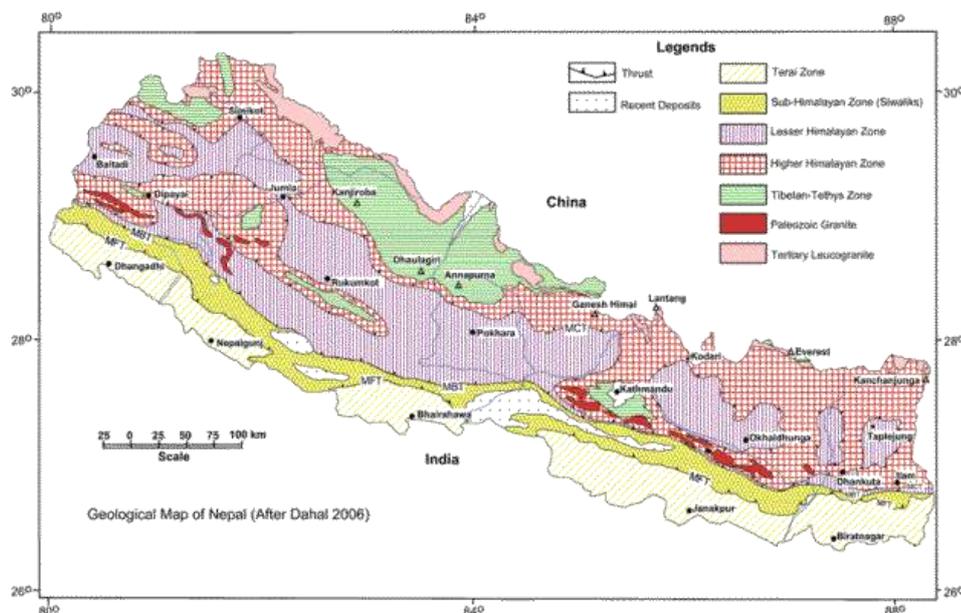


Figure 8: Nepal Himalaya (Dahal, 2006)

It is a well-known fact that most of the fossil fuels are found in sedimentary rocks formed after the carboniferous period. The presence of rocks formed after the carboniferous period increases the possibility of fuel reserves being formed. But as we all know Nepal has very less amount of rocks

formed after the carboniferous period it limits the possibility of having a big fossil fuel reserve. The Terai region of our country is dominated by alluvial deposits while the higher Himalayan rocks are highly metamorphosed. This leaves the Tibetan Tethys and lesser Himalaya zone as the potential reserve zones. In the Tibetan Tethys zone also the difficult terrain and the high altitude makes it really very difficult for the exploration and extraction of fossil fuels. Thus only a small area of lesser Himalaya zone is left behind as the practical source of fuel reserves and energy in our country. Even there much exploration has not been done and where exploration has been done, no major steps have been taken to perform extraction.

However, there are some reserves that are being utilized.

2. OBJECTIVES

The major objectives behind the preparation of this research article are:

1. To know the reasons behind the energy crisis in Nepal.
2. To know the present status of fuel reserves in Nepal.
3. To identify the permanent solutions to resolve this problem.

3. METHODOLOGY

This article is prepared by using literature review method. Various books and publications were reviewed in the process of preparing this research article.

4. RESULTS AND DISCUSSION

In the present context of our country only limited amount of fuel reserves have been identified and explored. Even fewer out of them are being utilized. Their details are given below:

3.1 Coal:

‘Existence of peat, lignite and coal are known in the different parts of the country. Such occurrences are known in four stratigraphic positions e.g. (i) Quaternary lignite in Kathmandu valley (ii) Siwalik coal (iii) Eocene coal and (iv) Gondwana coal. Lignite deposit in Kathmandu valley. Small scale 19 coal mines are in operation in Dang, Salyan, Rolpa and Palpa districts. Gondwana Coal encountered near Barahakshetra and Kampughat areas are not up to the suitable grade. Coal production in Nepal is insignificantly small (100-200ton/day)’ (Department of Mines and Geology, 2015).

4.2 Petroleum and Natural Gas:

‘A series of Oil and Natural gas seeps are recorded in a stretch of 14km in Padukasthan, Sirsathan and Navisthan area in Dailekh and only gas seep in Muktinath (Mustang). GON/ DMG are giving high priority to explore and promote petroleum exploration in Nepal since 1982. DMG/ Petroleum Exploration Promotion Project (PEPP) identified 10 prospective blocks in the southern parts of the country (Fig.6). Shell Company of Netherlands conducted exploration in Block no.10 in eastern Nepal. It has drilled a well up to 3520m deep but the hole appeared dry. At present Texana Resources Company of USA and Cairn Energy PLC of UK have initiated the exploration works in Block no 3 & 5; and 1, 2, 4, 6 & 7 respectively. The possibility of finding oil in some of these blocks appears fairly high’ (Department of Mines and Geology, 2015).

3.2 Methane:

‘**Methane gas** in Kathmandu valley is associated with ground water that exists in the lake sediment of the Kathmandu valley. Initial exploration was carried out with the assistance of Japanese International Co-operation Agency (JICA). DMG explored this gas in 26 sq. km area in Kathmandu valley and proved 316 million cubic meter methane gas deposit. The purpose was to assess the

available reserve and the possibility to use it as an alternative energy. The feasibility study was conducted in 1996/97 by a private consultant. The study concludes that the use of methane gas is viable for both domestic and industrial purposes. Based on the above results, DMG had invited proposals 5 times from the potential investors to bid for the development and commercialization of the gas resources for the benefit of society. But so far no one has taken such initiative. It is available for the potential investors to develop and commercialize for the benefit of the people of Kathmandu valley. Recently two companies applied for the promotion of Kathmandu natural gas' (Department of Mines and Geology, 2015).

With these facts in mind it is clear that there are no fossil fuel reserves in Nepal that can sustain the need and demand of energy for its population for a long period of time. Therefore, practical and suitable alternative is to utilize renewable forms of energy. Renewable sources of energy include solar energy, wind energy, biogas, geothermal energy etc. Here also Geology presents an important role as it is needed for exploring the possibilities to develop these energy resources, especially geothermal energy. Some details about it are given below:

'It is recorded that a number of **Hot springs** are confined to the Main Central Thrust (MCT) zone in Mahakali, Karnali, Tila, Kaligandaki, Myagdi Khola, Marshyangdi, Trishuli, Bhotekoshi Rivers, Kodari and Surai Khola. The temperature of the geothermal hot springs varies from 32 to 115°C. Proper use of such spring water has yet to be made' (Department of Mines and Geology, 2015).

5. CONCLUSION

It is clear that a lot of work needs to be done in order to solve this state of energy crisis in Nepal. Especially the identification and exploration of possible fossil reserves will help in solving this problem. We as geologists should be more involved in works regarding the possibilities of fossil reserves in our country. Also the government needs to undertake a lot of fruitful works in this field of energy development. And for the future and the present more renewable and alternative sources of energy need to be developed to limit the use of nonrenewable sources of energy.

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I would like to thank Dr. Tara Nidhi Bhattarai for helping me in the best possible way in the completion of this research article. Also I would like to thank Mr. Madan Ratna Manandhar and the Department of Geology, Ghantaghar, Kathmandu for providing me an opportunity to be a part of this magazine. I cannot forget to mention my friends Sanjeeb Thapa, Anil Aryal, Om Prasad Dhakal and Rishi Raj Baral for their unending support.

REFERENCES

Department of Mines and Geology, (2015) *Fuel Minerals*, (Online)
[Available on]:<http://www.dmgnepal.gov.np/resources/fuel-minerals> [7 November 2015].

Dhakal, R.K. (2006) *Geology of Nepal*, (Online),
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I was born in Deurali V .D.C Ward No: 6 Nawalparasi. My schooling begins from Arpan English boarding school at Jhyalbas where I attend Primary level of education. Due to my family problems I had to leave that beautiful and enjoyable school. Then I jointed Shree saraswoti Sanskrit and general higher secondary school and completed my school level. From my childhood I was interested in science so I went Kathmandu for my Higher education. I completed +2 in Kathmandu Valley higher secondary school .After the completion of +2 level I was interested in joining Engineering but the cost of Engineering course and my family background did not match so I eventually changed my desire to join B.Sc. in Tri-Chandra campus. I had no idea to choose the combination but two of my friends suggest me to choose the combination of GPM so I did the same. After attending few classes of Geology, I find somewhat different than other subject. I was really attracted by the environment, teaching methods and technique of the geo-department.

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 were 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 objective of work was very much interesting.

The best book I have gone through unit that time was” Shiris ko phul” written by Parijaat, Bishnu kumara waiva. Reading this book I got the message that ‘A simple things can affect the human life seriously’. The writer has compared the life of the main character with the flower of Blue mimosa. Similarly another book I have gone through is “Muna Madan” written by Laxmi prasaid devkota which conveys a message that a man is considered to be respected based on his work not based on his cast.

While coming at the end of the second year course, I started liking structure geology the most. It tells all about the structure and orientation of strata. During my 3rd year, my attention was towards geophysics- a subject that helped us in understanding the internal structures of the Earth. Besides, I was equally enthusiastic to study geology of Nepal Himalaya because this subject convincingly helped me to understand how the bottom of a ocean became the world's highest peak. These facts encouraged me to select Geology as a major subject in my 4th year study.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be a good geologist in 10 years’ time from now.

Groundwater and its Present Status in Chitwan Dun Valley (Inner Terai Region)

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Abstract: Terai plain along the foothill of Himalaya forms a potential zone for groundwater resource. It is generally believed that the Bhabhar zone situated at the foot of the siwalik (churai) hills. This aspect is analyzed from the fluid potential distribution of the confined aquifer system. The piezometric surface is found to be undulating both in north-south and east-west direction. The rise in pressure head in the southern part in comparison to the central part do not subscribe to the concept of a single recharge source on the north. Pale channels in the terai plane are found to be acting as recharge zones. The conventional method of groundwater recharge estimate from rainfall infiltration is not appropriate to the study area. The realistic approach would be the deferred perennial yield method taking into consideration the induced recharge from the present and paleo-stream beds.

Key Words: *Aquifer, recharge zone, subsurface geology, groundwater condition*

1. BACKGROUND

Groundwater is the water located beneath the ground surface, filling the pore space between grains in bodies of sediments and clastic sedimentary rocks, filling cracks and cervices in all types of rocks. It is stored in and moves slowly through geological formation of soil, sand and rocks called aquifers. Groundwater is the largest sources 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 ocean and permanent ice. Groundwater is the important sources of domestic, industrial and agricultural use in Nepal. High rainfall totals generally gives rise to abundant water supplies, at least seasonally and surface water and groundwater are both important sources for domestic, and industrial and agricultural use. Groundwater is abundant in by the limited development of irrigation.

Shallow and deep aquifers are also present in the young alluvial sediments throughout most of the terai region (Jacobson, 1996). The shallow aquifer appears to be unconfined and well-developed in most areas, although it is thin or absent in Kapilvastu and Nawalparasi district (Upadhyay, 1993). The deep aquifer of the terai (depth is unknown) is reported to be artesian (Banyat, 2001).

1.1 Groundwater Condition

Groundwater generally depends on the subsurface geology of the areas. Chitwan Dun valley consists Chitwan and Nawalparasi district so the sediment distribution is almost same in dun valleys. These dun valley aquifer is chiefly filled with highly porous and permeable unconsolidated to poorly consolidated pediment alluvial or fan deposits which forms the large aquifer system underlying the study areas. These unconsolidated valley-filled deposits consists of thickly bedded conglomerates with

pebble to boulders clasts in a fine grained matrix and are called Dun gravels. The valley fill deposits forming the main aquifers system is homogeneous as evident in the tube well log and by their hydraulic properties. The Chitwan Dun lies at a slightly higher elevation than the Terai plain.

The porous and permeable piedmont deposits form the main large aquifer system in this area. The aquifer system is multilayered in nature, as commonly found in alluvial deposits. Ground water is unconfined in shallow aquifer and semi-confined in deep aquifer. The deep aquifers are productive and have been tapped through hundreds of tubes wells.

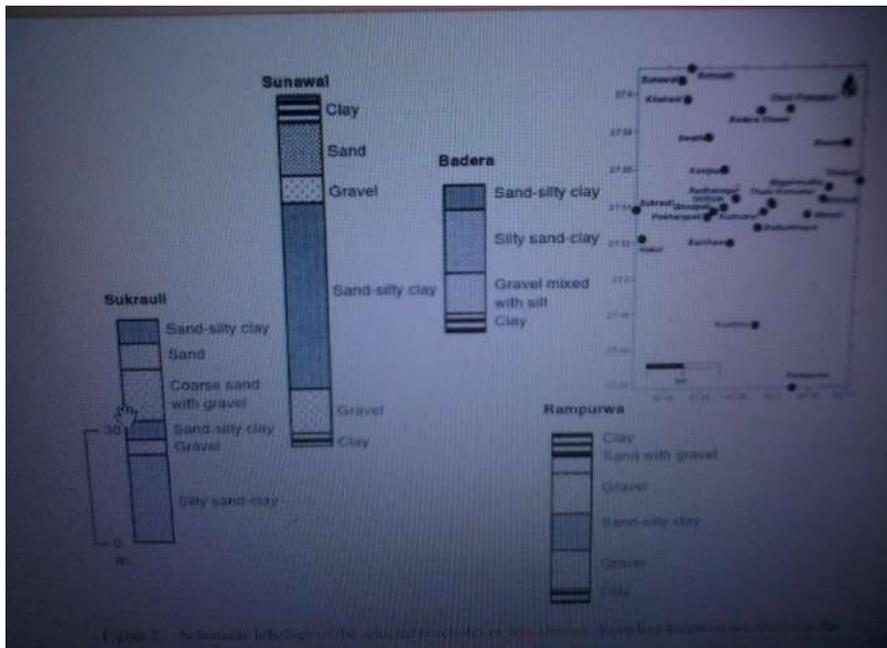


Fig.1 subsurface lithology of Nawalparasi district (Neupane, R. and Shrestha, S.D., 2009)

1.2 Groundwater Quality

There is an overall lack of water quality data for Nepal and have assessment of the main quality problems is difficult. Many of the documented problems are related to pollution of both surface water and shallow groundwater from domestic agricultural and industrial wastes. Most of the Nepalese population uses surface water for portable supply which is most vulnerable to pollution. Hence only 34% of the populations are through to have access to safe drinking water (Nepal net, 2001).

The chemistry of shallow groundwater in the terai region depends to a large extend on the lithology of the sediment; the shallow aquifer are vulnerable to pollution if surface sediment are sandy and permeable, but less if a protective layer of low permeability (clay or silt) is present . However, in some part of the shallow aquifer of the terai, anaerobic conditions are observed as some shallow groundwater has high concentration of arsenic iron. The Nepal Red cross society (NRCS) from testing in 17 out of 20 terai districts, found 3% of groundwater sources sampled had concentrations above 50µg/l and the worst affected district being Nawalparasi.

2. OBJECTIVES

The main objective of this report is

- To establish an understanding of the existing groundwater condition in and around the site.
- To assess potential impacts of development on the groundwater condition.
- To design for a program for the monitoring and management of groundwater impact.
- To understand the ground water level of the site.

3. METHODOLOGY

The necessary information for the article were collected from various sources such as books, Various websites, articles published in journals etc.

4. FIELD INVESTIGATION AND DATA COLLECTION

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

5. RESULTS AND DISCUSSION

Groundwater is 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. In addition, groundwater is the sources of drinking water for the people of this region, is an important sources for agriculture and industries. Therefore to improve our understanding of groundwater resources issues, it is important to have a better understanding of the role that groundwater plays in the overall ecosystem of this region.

6. CONCLUSION

The grain size of the alluvium gradually decreased from north to south. The aquifers are multi layered interconnected lenses of sand, gravel and pebble alternating with silt and clay. Aquifer materials for unconfined and semi-confined aquifers are generally sand, gravel, pebble and even cobble and boulder. Estimation of total groundwater storage in the area on both confined and unconfined condition is 87.31 MCM per year and potential recharge calculated by applying Duba's estimation is 48.60 MCM per year. As annual recharge by precipitation exceeds rate of evapotranspiration in the valley area there could be ample scope for groundwater utilization. Groundwater is major natural resources in the dun valley because it indirectly contributes more than 50% of the stream discharge to the rivers and its tributaries.

ACKNOWLEDGEMENT

I would like to express my gratitude to our respected sir Dr. Tara Nidhi Bhattraai for the inspiration to write. Also I am indebted to Madan Ratna manandhar (Head of department) of geology, Tri-chandra campus Ghantaghar. I would like to thank my friend as well as chief editor and the friends of editor board for their valuable comments and inspiration. Also I am thankful to all the teachers and my colleagues for the support and hope to get it again and again.

REFERENCE

Basnyat, k. (2001) Sustainable Manageable Models Essential, The Rising Nepal (Daily) Kathmandu, jan12, 2001.

Jacobson, G. (1996) Urban Groundwater database AGSO report

Nepal Net, (2001) Contamination of drinking water in Nepal

Neupane, R. & Shrestha, S.d. (2009) Hydrogeologic assessment and Groundwater reserve evaluation in northwestern part of Dun valley aquifer of Chitwan, inner Terai, Bulletin of the central Department of Geology, Tribhuvan university, ktm, Nepal, vol 12, 43-54

Upadhyay, S.k. (1993) Use of Groundwater resources to alleviate poverty in Nepal



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I was born in Ralukadevi V.D.C. Ward No.7, Prabhudanda, Nuwakot. I started my primary level at prabhudanda primary school and then sundara higher secondary school, Sundaradevi-2, satbise, Nuwakot and completed +2 from Canvas International College, basundhara, Kathmandu. Knowing information about geology from friend, I admitted in bachelor level for B.Sc. at tri-chandra campus. When I first visited tri-chandra campus Ranipokhari and its environment attracted me a lot because it was something I have read in history book but never seen from close before.

The best book I have gone through until that time was “seto dharati” by Amar Nepaune. The book conveys a message that how rude and bad culture in our society due to illiteracy.

At first geology is totally new course for us. At the first class of B.Sc. the crowd of students make me little nervous but the discipline maintained in the class of geology really inspired me. The unforgettable moment during first class of geology in first year by Tara Nidhi sir (physical geology) I was totally fascinated by his teaching methodology. Then I used to love studying geology. It was totally new style of studying with projector views, pictures and question answer classes. During second year course I started liking structural geology the most. It tells how the earth goes on deforming during its formation. During third year, my attraction was towards geophysics, a subject that helps us in understanding the internal structure of the earth beside, I was equally enthusiastic to study geology of Nepal Himalaya because this subject convincingly helped me to understand how the bottom of the ocean became the world’s highest peak. Also the 15 days field at Malekhu helps to understand real and practical geology and to do the research. During fourth year course I have two options to study physics or geology then I decided to study geology. Engineering geology and hydrogeology even fascinating this helps to design various infrastructures in environment friendly manner.

Supposing the fact mentioned above and based on my own wisdom I would expect to be a good engineering geologist in 10 years from now.

Geology of the Nepal Himalaya

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Abstract: Nepal can be divided into five east-west trending major tectonic zones. (i) The Terai Tectonic Zone which consist of recent alluvium concealing the churia group and underlying rocks of northern peninsular India. (ii) The Churia Zone, which consist of Neocene to quaternary alluvial deposits and forms the Himalayan mountain fronts. It represents the most tectonically active part of the Himalaya and was deposited around 14 Ma. (iii) The Lesser Himalayan Zone, with dominant Precambrian rocks and sedimentary rocks.(iv) The Crystalline High-Grade metamorphic rocks of the Higher Himalayan Zone form the back bone of the Himalaya and give rise to its formidable high ranges. The main central thrust (MCT) marks the base this zone. (v) The Tibetan Tethys zone is represented by Cambrian to cretaceous-Eocene fossiliferous sedimentary rocks overlying the crystalline rocks of Higher Himalaya along the Southern Tibetan Detachment Fault System (STDFS)- a north dipping normal fault system.

Key Words: Cambrian, tectonic zone, crystalline zone, himalaya, metamorphism

1. BACKGROUND

The kingdom of Nepal occupies the north-central position in south Asia and is geographically sandwiched between Tibet (China) in the north and India in the south. It is located in the central part of the 2400 km long Himalayan arc and covers about one third of its length. The Mechi and the mahakali rivers mark the eastern and western political boundaries with India. Nepal covers an area of about 147,181 sq km and is bounded by north latitudes 26⁰22' and 30⁰27' east longitudes 80⁰4' and 88⁰12'. Geometrically it forms an elongated rectangle with the average E-W axial length of 885 km and varying width of 130 to 255km.Geographically, major part of Nepal (83%) falls within the mountainous region and the remaining portion covers the northern edge of the alluvial plains of the Gangetic basin.

It is generally agreed that the Himalaya were generated as a result of the collision of the northward moving Indian continent with the Asian landmass. That orogenic process continues, and mountains are still being formed. Continued activity is manifest in the present day northward movement of India at a rate of nearly 5 cm a year and in the occurrence of frequent seismic events along the mountain range and in the surrounding (Seeber and Armbruster, 1981; Jackson and Bilham, 1994). Most of the convergence is accommodated within the Himalaya by movement on various thrusts and folds.

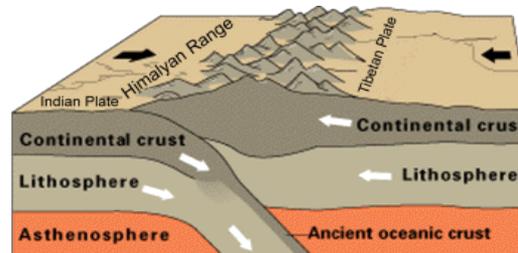


Fig 1: collision of Indian plate with Tibetan plate

And formation of Himalaya (modified after USGS, 1999)

2. OBJECTIVES

The main objectives of the study are as follows:

- To study the Geographic condition of Nepal.
- To study the physiographic features of Nepal.
- To study the major tectonic zone and activities of Nepal.
- To study the different hazard risk (seismic, landslide etc.) associated with geology of Nepal.

3. METHODOLOGY

The report mainly based on the secondary sources such as books, journals, articles, document, websites etc. The field study done during excursion also helped for report preparation.

4. RESULTS AND DISCUSSION

Specially, the report is based on the secondary sources. The data collected in the report is based on different books, journals, websites etc.

4.1 Major Tectonic Zones of Nepal

In the entire 2400 km long Himalayan Range Nepal Himalaya occupies almost one third of its total length and is divided into the following five major tectonic zones from south to north respectively (Gansser 1964, Hagen 1969).

4.1.1 Terai Zone

This zone represents the northern edge of the Indo-Gangetic alluvial plain and forms the southernmost tectonic division of Nepal. In the north it is delineated by Himalayan frontal thrust (HFT). The Terai plain gradually rises from 100 m in the south to 200 m in the north. Geologically the Terai plain is covered by Pleistocene- Recent alluvium with average thickness is 1500 m.

4.1.2 Sub-Himalayan Zone (Siwaliks)

This zone is bounded to the north by the Main Boundary Thrust (MBT) and to the south by the Main Frontal Thrust (MFT). This zone basically consist rocks of fluvial origin belonging to Neocene age. The lower siwaliks consist of finely laminated sandstone, siltstones and mudstones. The middle siwaliks are made up of medium to coarse grained pepper and salt appearance sandstone. The upper siwaliks comprise conglomerates and boulders beds. The dun valleys within siwaliks are covered by the Quaternary fluvial sediments.

4.1.3 Lesser Himalayan Zone

The lesser Himalayan zone is bounded in the south by the MBT and the north by the Main Central Thrust (MCT). The rock throughout this zone consists of two sequences: allochthonous and autochthonous to paraautochthonous. The MBT has brought the older lesser Himalayan rocks over the much younger siwaliks. It consist mostly of the unfossiliferous sedimentary and metasedimentary rocks like slate, phyllite, schist, quartzite, limestone etc. ranging in age from Precambrian to Eocene.

4.1.4 Higher Himalayan Zone

This zone has been mapped and traced along the entire Himalayan region. Geologically it includes the rock lying between MCT and South Tibetan Detachment System (STDS). The northern or upper limit of this zone is generally marked by normal fault. This zone consists of about 10 km thick succession of crystalline rocks also known as the Tibetan slab (Le fort 1975). The high grade kyanite- sillimanite bearing gneisses, schists, marble of this zone forms basement of the Tibetan Tethys zone. Tertiary granite occurs at the upper part of the unit.

4.1.5 Tibetan- Tethys Zone

This zone begins from STDS and extends to the north in Tibet. In Nepal the fossiliferous rocks of Tibetan-Tethys zone are well developed in thakkhola (Mustang), Manang, Dolpa. Most of the great Himalayan peaks of Nepal including Mt. Everest, Manaslu, Annapurna and Dhaulagiri belongs to this zone. This zone composed of sedimentary rocks such as shale, limestone and sandstone ranging in age from lower Paleozoic to Paleocene.

Geological cross-section of Nepal Himalaya is shown in figure below:

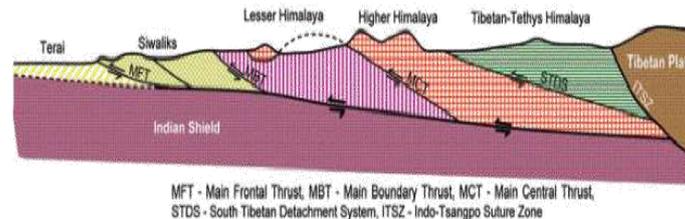


Fig 2: Generalized cross-section of Nepal Himalaya (after Dahal, 2006)

From the study it was found that the Himalaya was formed by the collision between Indian plate with huge Asian landmass and this process is still continuously happening in present day. Due to this process different E-W trending faults and thrusts were created which discussed above. These faults and thrust may be active or passive. From this study we can predict that other tectonic zone may also form in coming future.

5. CONCLUSION

It is found that our Nepal is situated above the convergent plate boundaries and mountain building process is also continuously happening in present days. Beside the major thrust and faults other small or large scale thrust, fault and other structure is also present. Due to such active movement many seismic energy are releasing in the form of earthquakes which may loss many human civilization that we saw in recent days. Also many landslide hazards are occurring in Himalaya and other natural hazards may also occur. So development of our nation and for infrastructure development we can't ignore our geological condition. We have to develop our country in our environment friendly manner in which the role of geologist is very important.

ACKNOWLEDGMENT

I would like to express my gratitude to our respected teacher Dr. Tara Nidhi Bhatrai and our geology department for the inspiration and providing an opportunity to write article and publish them. Also I would like thank our editorial team for their suggestion and support to publish it. At last I wish to have such kind of opportunity in coming future.

REFERENCES

- Dahal, R.K.,(2006) *Geology for Technical Student*, Bhrikuti Academic Publications, Kathmandu, Nepal, 756p.
- Gansser,A., (1964) *Geology of the Himalayas*; Interscience Publishers, John wiley and sons, London, 289p.
- Hagen, T., (1969) *Report on the geological survey of Nepal, V.1, preliminary reconnaissance*: Denkschriften der Schweizerischen Naturforschenden Gesellschaft, Mcmoires de la societte Helvetique des Sciences naturelles, Zurich, v.86, 185p.
- Jackson, M., Bilham R. (1994) Constraints on Himalayan deformation inferred from vertical velocity fields in Nepal and Tibet. *Journal of Geophysical Research* 99(B7) 13,897-13,912

Le Fort, P., (1975) Himalaya: the collided range: Present knowledge of the continental arc. *American Journal of Science* 275A, 1-4

Seeber, L., Armbruster, J., G., (1981) Great detachment earthquakes along the Himalayan arc and long term forecasting, *Earthquake prediction- An International review Maurice Ewing Series 4. American Geophysical Union*, pp. 259-277.

Upreti, B., N.,(1999) An overview of the stratigraphy and tectonics of the Nepal Himalaya, *Journal of the Asian Earth Science* 17 (1999), pp. 577-606.

USGS (1999) Understanding plate motion, [online] URL: <http://pubs.usgs.gov/publications/text/understanding.html> [1 Nov 2015]

Dahal R.K., 2006, *Geology of Nepal*, [online], Available:

www.ranjan.net.np/ranjan/index.php/resources/geology-of-Nepal [1 Nov 2015]



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Born in Gokarneswor Municipality, ward no.12, Jorpati, Kathmandu. Having Passed SLC from Shanti Adarsha Secondary School, Jorpati and then completed intermediate level from NIC higher secondary School, Dillibazar, Kathmandu. I was in dilemma for further study and then I know about Bachelor degree in Geology through my brother as he suggested me to get admission in Tri- Chandra Multiple Campus. Though I had seen campus but had not visited so it was fun visiting it for the first time with one of my school friend as he also admitted in same college for another subject. We really had good time visiting Ghantaghar and college premises that day.

Being introduced to new subject and new environment i.e. student's number as well as it was hard to adapt the college rules as we needed to go to different department to study our related combination. It was really taking time to make friends but slowly Geology was becoming interesting as I found really good friends. As time passes I found Department of Geology is really different from other subject Departments because of systematic teaching style and free from other disturbances which really attracted me more on geology.

My hobbies are playing and watching football, cricket. I like reading and listening to novels. The best book I have gone through is "the mistakes of my life" by Chetan Bhagat published in 2008 which shows how youth people handle their life, their views and perception. But the best book I have gone through is "china harayeko manche" by Haribansha Acharya. It shows one can lead their aim oneself but on one hand luck favour to those who are hardworking and dedicated to their work. I found physical geology more interesting from 1st year as I get chance to know many more things about earth outer structures, its origin and different land features. Fieldwork to kakani (Ranipauwa) was very much helpful to our theory as we got clear view on field that was missing in our class or book.

From 2nd year petrology was really interesting as I got chance to know different types of rocks found on earth and their origin, occurrence, mineral composition and formation was highlight of the geology. Fieldwork to Chobar was very helpful too as we cleared the confusion on myth related to the formation of Chobar gorge that being touted as Manjushree cut southern side of chobar hill which was full of water unfolding truth behind it as it was formed due to continuous action of water to limestone bed as proof we saw many pot holes in limestone rocks formed by disintegration of limestone beds. Similarly 3rd year was good as Geology of Nepal attracted me more which was very much interesting. But the tour to Malekhu was great time which not only shows how we work on field but also help to get more knowledge on geology which was main reason behind selecting Geology as major subject in 4th year. During 4th year study, geological mapping exercises attracted me a lot. It was an indispensable 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 now, but also 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 competent geologist in 10 years' time.

Need of Geophysical exploration in Nepal

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Abstract: Geology is the branch of science which deals with the study of earth science. Geology being major backbone to the civil engineering projects there must be involvement of geo-scientists or geologists in such civil engineering projects which could be highly benefitted for the site selection for such bigger civil engineering projects. But there is need of geophysical exploration methods to understand various physical properties concerning with rock and soil and also measure the propagation of shock waves and conductance through earth material that could be beneficial for the design and performance of civil engineering projects. All the desired queries about how to reveal the information about subsurface geology could be answered after reading this article.

Key Words: *Sub-surface Geology, Geophysics, Exploration, Engineering Projects, Development*

1. BACKGROUND

Geophysics in broad sense is the application of physics to investigate the earth. Applied geophysics concerned with investigating the earth crust and near surface to achieve practical aims. It is highly mathematical subject with full appreciation of more advanced data processing and interpretation techniques do require a reasonable mathematical ability. An alternative method of investigating subsurface geology is, of course, by drilling and provides information only at discrete location. Though geophysical surveying sometimes prone to major ambiguities or uncertainties of interpretation, provides a relatively rapid and cost effective means of deriving areally distributed information on subsurface geology. Nepal is geologically different and complex with five different tectonic zones having distinct lithology, structures and history. So in order to conduct the engineering projects geophysical exploration is really needed in Nepal.

2. OBJECTIVES

- To understand use of different geophysical exploration methods depending upon operative physical properties to which method is sensitive.
- To emphasis the importance of geophysical exploration in context of Nepal
- To understand the values of geophysical survey in order to minimize the cost of the project.

3. METHODOLOGY

Information were collected through the secondary data sources like books, article, journal reports, and websites then finally presented as an article.

4. RESULTS AND DISCUSSION

Geophysical methods are useful in determining a variety of the physical properties of rocks and soil. Of greatest value for engineering applications are those methods that measure the propagation of the shock waves and conductance of the electrical current through earth materials. These are the seismic and electrical methods of geophysical exploration, respectively. (Johnson and Degraff, 1988: 317)

Geophysical methods of exploration provide an indirect source of information about the subsurface. The typical uses in civil engineering application are to supplement data gained through surface mapping and shallow drill holes and to provide a bridge between test data obtained from small samples in the laboratory with in situ conditions at a site. Calculation of the depths to the bedrocks between drill holes and determination of the in situ influence of the discontinuities on the rock mass physical properties compared to an intact sample in the laboratory are examples of the more common examples. Surface and down hole applications of seismic and electrical methods currently are in use for engineering purposes.

The importance of geophysical exploration as a means of deriving subsurface geological information should be appreciated by any practicing geoscientists. Natural field methods utilize the gravitational, magnetic, electrical, and electromagnetic fields of earth, searching for local perturbation in these naturally occurring fields that may be caused by concealed geological features of economic interest. Whereas artificial source involves the generation of local electrical or electromagnetic field which is analogous to natural fields. As well as generation of seismic waves whose propagation velocities and transmission paths through the subsurface are mapped to provide information on the distribution of geological boundaries at depth. Natural field methods can provide earth properties to a greater depth whereas artificial methods are more detailed and better resolved picture of the subsurface geology. (Kearey, Brook and Hill, 2002: 3-4)

A wide range of geophysical surveying methods exists which may be used in air or sea that are listed in table.

Some application of geophysical exploration

- Geophysical methods are often used in initial search for metalliferous mineral deposits usually uses electromagnetic and air borne magnetic surveying.
- Routine reconnaissance of continental shelf areas are often includes simultaneous gravity and seismic surveying.
- Geophysical exploration usually takes place in number of stages. For example in the offshore search for oil and gas, an initial gravity reconnaissance survey may reveal the presence of sedimentary basin that is subsequently explored using seismic methods.
- For exploration of igneous and metamorphic terrains for the near surface, irregular ore bodies being source of metalliferous minerals are carried out by using electromagnetic and magnetic surveying methods.
- Explorations for underground water supplies are usually carried out by electrical surveying i.e. resistivity methods.
- Many of the principles of earthquake seismology are applicable to seismic surveying.
- The exploration defines subsurface conditions that influence the siting, design and performance of the project.

Table 1: Geophysical Methods

Methods	Measured parameter	Operative physical property
Seismic Reflection surveying Refraction surveying	Travel times of reflected and refracted seismic waves	Density and elastic moduli, which determine the propagation velocity of seismic waves
Gravity	Spatial variation in the strength of the gravitational field of the earth	Density
Magnetic	Spatial variations in the strength of the geomagnetic field	Magnetic susceptibility and remanence
Electrical Resistivity Induced polarization Self-polarization Electromagnetic Radar	Earth resistance Polarization voltages or frequency dependent ground resistance Electrical potentials Response to electromagnetic radiation Travel times of reflected radar pulses	Electrical conductivity Electrical capacitance Electrical conductivity Electrical conductivity and inductance Dielectric constant

4.1 Why is geophysical exploration needed in Nepal?

Nepal is geologically divided into following five major tectonic zones from south to north respectively.

4. Indo-Gangetic plain
2. Siwaliks zone
3. Lesser Himalayan Zone
4. Higher Himalayan Zone
5. Tibetan -Tethys Zone

These zones extend approximately parallel to each and differ in their lithology, structure and geological history. Each zone is characterized by its own lithology, structures and geological history. These zones are separated by several active and passive thrust (like MBT, MFT, MCT and STDS) passing along the zone. (Upreti, 2002: 8-9)

Similarly Nepal is one of the richest countries in water resources. The country is intricately dissected by numerous big and small rivers originating within and beyond the Himalaya. So geologically Nepal is very different and much more complex. This may be one of the reasons behind difficulty in carrying out bigger developmental activities in our country as involvement of geologists in such developmental activities are yet not practiced as in other developed countries. So geophysical exploration is needed in order to investigate the detailed information regarding sub-surface geology, which may result in carrying out developmental activities easily as geology of area is clearly known as well as minimize the cost of the bigger project.

Similarly Nepal being a developing country engineering project and practices are not yet concerned to geologists. So geology of the area is unknown which may result in collapsing or damaging of the foundation in near future. Not only this, site selection for hydropower project, tunnel, multistoried buildings and road construction require subsurface geology in order to make it run for longer time which can be achieved through the geophysical exploration which shows useful information concerning soil and rock quality obtained from recorded refracted velocities.

Nepal being deprived of using its own mineral resources for which geophysical exploration would be best option for investigating the metalliferous ore bodies which may help in extracting the mineral which can be economically useful to the country enhancing economy of the country. For the extraction of several metallic and non-metallic minerals for which mining is required which can be done only after having information about subsurface that would be obtained with the help of geophysical methods. It would be best option for the development of mining in Nepal.

So, geophysical exploration is very much needed to the country like Nepal who is dependent to other nation for fuel. Nepal can solve even fuel crisis like nowadays by investigation and exploration of fossil fuel (oil, gas and coal) throughout the country by the geophysical exploration methods.

4.2 Limitation of Geophysical exploration

- Methods require contrast in physical properties.
- Non-uniqueness i.e. every methods investigate the subsurface geology.
- Direct modelling: calculate the result of the specific structures.
- Inverse modeling: determine the causative structure from observation.
- Usually ambiguous; e.g. small shallow body vs. large deep body.
- Resolution is determined by the wavelength of the signal seismic in km and radar in cm
- Noise prevents recovery of the low amplitude signal e.g. Wind, traffic, water pumps, i.e. indirect methods.
- It may leads to environmental pollution as well as lead to some natural hazard like collapsing of the used areas and landslides.

5. CONCLUSION

Geophysical exploration indeed is the best option as drilling being an expensive method of revealing detailed information about subsurface geology. So for the country like Nepal where role of geology and geologist slowly flourishing needs much more geophysical exploration which helps to understand the subsurface geology which can be useful to engineers for carrying out the developmental activities as per the geology of the area. The main benefit of geophysical exploration is the best site selection for the engineering project to be carried out so that there could be no much problem during the time of development. So geophysical exploration are very much needed to Nepal in order to minimize the cost of bigger engineering project.

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At first I am grateful to my college Tri Chandra College for giving me the opportunity to study 4 year B.Sc. (Geology). I am grateful to Dr. Tara Nidhi Bhattra for all kind of inspiration to write an article. I would like to thank all the members of editor board for their valuable comments, advices and inspiration to write. Similarly I would like to thank all others teachers of Geology Department and my colleagues to encourage me to write the article.

REFERENCES

- Johnson, R.B. and Degroff J.V (1988) Delhi, Sunny Offset Process
- Kearey, P., Brook, M. and Hill, I. (2002) An Introduction to Geophysical Exploration, John street, London: Blackwell Science Ltd
- Upreti, B.N. (2002) Geology of the Nepal Himalaya



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Me Rabin Gautam student of Geology born in Khewan- 4 Taplejung I completed my SLC from Mount Mechi Secodary School from Kuldhara-2 Ilam and +2 from GEMS Institute of Higher Education dhapakhel lalitpur. I came to know about graduate degree in the field of BSC majoring in geology from my brother at Tri Chandra collage, Ghantagar Kathmandu Nepal. My first day experience in Tri Chandra collage is awesome as I feel that I am a part of that collage which is oldest of all collages in Nepal.

From first day of my collage I start attracting in the field of geology as it explain about our own planet and behind all of that I was amazed that my country Nepal is geographically diverse and in geological past it was the part of deep ocean.in BSC first year I was attracted in historical geology which explain about life in geological past and climate by explaining fossils found and other evidence. On later classes I was mostly attracted by subject about 'Geology of Nepal' which explain about how Nepal landform comes in this present mountaineer condition from land inside the deep ocean. I was also interested in the field of mining and engineering geology so I started learning deeply in those fields and I am thinking of majoring one of this field in further study.

So experiencing day to day Climatic condition I would like to present an article on the topic 'climate change and its impact on living beings.

Climate Change and Its Impact on Living Beings

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Abstract: Time is the part of two consequent events, which leads different phase of changes in the history of the earth. The major changes are coded in the different geological indicator, among which climate change is most important event on earth. So, in this article I focused about climate change and its impact on living beings and its consequences. The main aim of this article is to realize changing climatic condition, its causes, impact on livestock and present and future of life on earth.

Key Words: *climate, impact, depletion, human impacts*

1. BACKGROUND

1.1 Climate change

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as "global warming".

Mostly climate change impacts on living beings. Literally global warming make various effect in climate and brings different ice age in geological past and those ice age make different impact on life.

Life affects climate through its role in the carbon and water cycles and through such mechanisms as: evaporation, transpiration, cloud formation, and weathering.

Examples of how life may have affected past climate include:

Glaciation 2.3 billion years ago triggered by the evolution of oxygenic photosynthesis, which depleted the atmosphere of the greenhouse gas carbon dioxide and introduced free oxygen.

Another glaciation 300 million years ago ushered in by long-term burial of decomposition-resistant detritus of vascular land-plants (creating a carbon sink and forming coal).

Termination of the Paleocene-Eocene Thermal Maximum 55 million years ago by flourishing marine phytoplankton, reversal of global warming 49 million years ago by 800,000 years of arctic azolla blooms

Global cooling over the past 40 million years driven by the expansion of grass-grazer ecosystems.

Climate change in detail

1.2 Global warming makes adverse effect on oceans life too

1.2.1 Marine problems: climate change

The marine environment is already registering the impacts of climate change. The current increase in global temperature of 0.7°C since pre-industrial times is disrupting life in the oceans, from the tropics to the poles.

Marine species affected by climate change include plankton - which forms the basis of marine food chains – corals, fish, polar bears, walruses, seals, sea lions, penguins, and seabirds.

The Intergovernmental Panel on Climate Change predicts a further rise of between 1.4°C and 5.8°C by the end of the century. Climate change could therefore well be the knock-out punch for many species which are already under stress from overfishing and habitat loss.

The key impacts of climate change on the marine environment are...

1. Coral bleaching
2. Stormy weather
3. Rising sea levels
4. Decreased mixing
5. Acidic oceans. (Millstein S, 2015)

1.3 The impact of climate change on human health

WHO has identified five major health consequences of climate change they are:

First, the agricultural sector is extremely sensitive to climate variability. Rising temperatures and more frequent droughts and floods can compromise food security. Increases in malnutrition are expected to be especially severe in countries where large populations depend on rain-fed subsistence farming. Malnutrition, much of it caused by periodic droughts, is already responsible for an estimated 3.5 million deaths each year. Second, more frequent extreme weather events mean more potential deaths and injuries caused by storms and floods. In addition, flooding can be followed by outbreaks of diseases, such as cholera, especially when water and sanitation services are damaged or destroyed. Storms and floods are already among the most frequent and deadly forms of natural disasters.

Third, both scarcities of water, which is essential for hygiene and excess water due to more frequent and torrential rainfall will increase the burden of diarrhoeal disease, which is spread through contaminated food and water. Diarrhoeal disease is already the second leading infectious cause of childhood mortality and accounts for a total of approximately 1.8 million deaths each year.

Fourth, heatwaves, especially in urban “heat islands”, can directly increase morbidity and mortality, mainly in elderly people with cardiovascular or respiratory disease. Apart from heatwaves, higher temperatures can increase ground-level ozone and hasten the onset of the pollen season, contributing to asthma attacks.

Finally, changing temperatures and patterns of rainfall are expected to alter the geographical

distribution of insect vectors that spread infectious diseases. Of these diseases, malaria and dengue are of greatest public health concern. (Chain Margarat 2008)

1.4 Can human can be Extinct

1.4.1 The Holocene extinction

Earth

Is Earth in the midst of a sixth extinction? Yes, says a study published in Science Advances.

By conservative estimates, researchers determined that in the last century, species have died out 100 times more quickly than would be expected under normal geological conditions. Co-author Paul Ehrlich says that if the extinction continues, “our species itself would likely disappear early on.”(Millstein Sheath 2015)

Some pictures are related to climate change and its impacts on living



Fig : Related to global warmaning (source:Simpleboklet)

2. CONCLUSION

So in my conclusion climate change bring adverse effect on life and bring challenge in human civilization in near future. Human also is one of the causes of climate change on earth. So to bring normal condition in climate human should play vital role in decreasing global warming. Above mention all request can be met by human only so we human should make hand on hand to solve it any way. By the act of climate change every living beings existent comes in danger .Climate change also impact on birds, animals and fishes in their migration. Our climate is changing, both naturally and due to human exploitation. There is already undeniable evidence that animals, birds and plants are being affected by climate change and global warming in both their distribution and behavior. Unless greenhouse gas emissions are severely reduced, climate change could cause a quarter of land animals, birdlife and plants to become extinct.

Climate variability and change affects birdlife and animals in a number of ways; birds lay eggs earlier in the year than usual, plants bloom earlier and mammals are come out of hibernation sooner. Distribution of animals is also affected; with many species moving closer to the poles as a response to the rise in global temperatures. Birds are migrating and arriving at their nesting grounds earlier, and the nesting grounds that they are moving to are not as far away as they used to be and in some countries the birds don't even leave anymore, as the climate is suitable all year round.

A sea level rise of only 50cm could cause sea turtles to lose their nesting beaches - over 30% of Caribbean beaches are used by turtles during the nesting season and would be affected. The already endangered Mediterranean Monk Seals need beaches upon which to raise their pups and a rise in sea level could there could damage shallow coastal areas used annually by whales and dolphins which need.

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I would like to thank Tara Nidi Bhattarai sir to provide me this opportunity to write an article on geo world magazine. I also like to thank editor board 2069 to help me out in summing this article. So I would like to thank all of my friends who help me in various ways to write this article. Thank you !

REFERENCES

Margaret, C, 2008,'impact of climate change on human health'. Statement on media centre 2008.4.7

Millstein. S, 2015 "Earth's mass-extinction?"

Online: Available from: https://en.wikipedia.org/wiki/Climate_change[2015.11.3]



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I was born in Dharan, ward no-8, Sunsari. I did my schooling from Araniko Memorial Boarding School, Dharan. I was keen interested in science and technology, so joined +2 in Crimson Int'l College, Baneshwor, Kathmandu. And I joined my bachelor in Tri-Chandra College, Ghantaghar Kathmandu.

Being a part of Tri-Chandra College and studying geology was not my intention. Every science student has a desire to do B.E or MBBS. Even though I was not as bright student in my entire schooling career but also as a desire and crave for science was always in my mind which I did it later on. But suddenly a friend of my school came in contact, which he entirely changed my mind for studying Geology in Tri-Chandra College and thought not to do B.E. so I came to know about the geology and its importance in our nation. I was very attracted to the course and the scope of Geology so I got admitted in Tri-Chandra College.

The learning and reading process was very different, as it was a government college.

First two years was completely hard for me, I was not able to cope the teaching and the understanding. The studying process in compare to private college and institution varies a lot, that's the reason, why I was not able to perform well. Gradually I became to become the part of the college and started making friends. All the students who were studying geology became good friend of mine. Eventually the field portion of this particular subject is the interesting, mainly practical based knowledge is important for this subject so annually field is organized. But one of my memorial field trip is of 3rd year. In which we came to learn each and every portion till we have learnt past 3 years. The knowledge provided in book and the practically done are two different things. From that day we were able to know the true color of geology and its working styles.

Concluding the facts above and also based on my own wisdom. I would expect to be a good geologist future ahead. Finally, I would like to show gratitude to our teachers who are always there to help us in any condition and my entire friends who are always with me and provided the support.

The Principles of Remote Sensing

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Abstract: Remote sensing is the technique to observe the earth surface or the atmosphere from the space using satellites i.e. space borne or from the air using aircrafts i.e. air borne. It uses a part or several part of the electromagnetic spectrum. It records the electromagnetic energy reflected or emitted by the earth's surface. The amount of radiation from an object is influenced by both the properties of the object and the radiation hitting an object. In remote sensing various kinds of tools and devices are used to make electromagnetic radiation outside the range from 400 to 700 nm visible to human eye. This paper starts with the overview of remote sensing and explains the principles of remotely sensed data collection mechanism.

Key Words: Remote sensing, radiation, electromagnetic spectrum, transmission

1. BACKGROUND

Remote sensing refers to the obtaining information about areas at the earth's surface without being in direct contact with the object or area. Reading newspapers, watching car driving in front of you are all remote sensing activities. Most sensing devices record information about an object by measuring an object transmission of electromagnetic energy from reflecting and radiating surfaces. This technique allows taking images of the earth surface in various wavelength regions of the electromagnetic spectrum (EMS). One of the major characteristics of remotely sensed image in the wavelength region represent reflected solar radiation in visible and near infrared region of electromagnetic spectrum, others are the measurement of the energy emitted by the surface i.e. the thermal infrared wavelength region. The energy measured in the microwave region is the measure of relative from earth's surface. Where the energy is transmitted from the vehicles itself. This is known as active remote sensing. Since the energy source is provided by the remote sensing platform. Whereas the system where the remote sensing measurements depend upon the external energy source. Such as sun are referred to as a passive remote sensing system.

2. OBJECTIVE

Remote sensing is a multi-disciplinary science which includes various kinds of disciplines such as optics, spectroscopy, photography, computer, electronics and telecommunication, satellite launching etc. All these technologies are integrated to act as one complete system in itself, known as Remote sensing system. There are number of stages in remote sensing process and each of them is important for successful operation.

3. Stages in Remote Sensing

- Emission of electromagnetic radiation, or **EMR** (sun/self- emission),
- Transmission of energy from the source to the surface of the earth, as well as absorption and scattering,
- Interaction of **EMR** with the earth's surface: reflection and emission,
- Transmission of energy from the surface to the remote sensor.
- Data transmission, processing and analysis

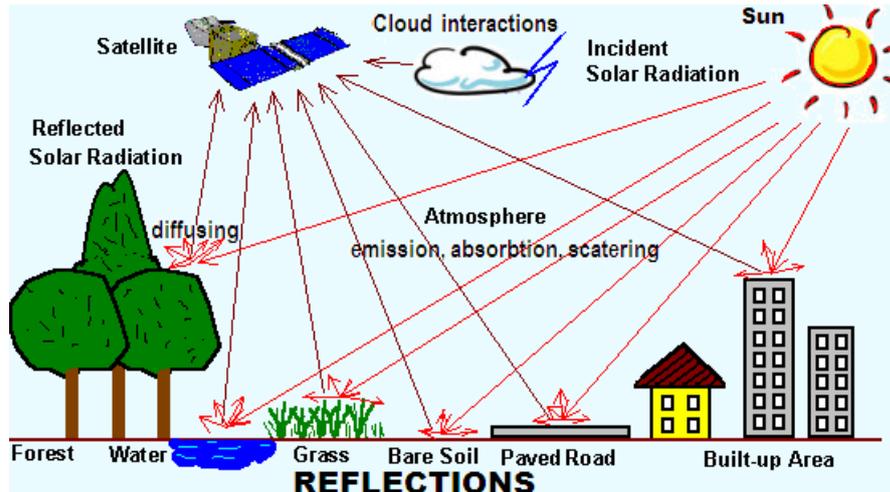


Fig: Process of remote sensing (Picture credit: Vitaliy Pavlenko and Viktor Speransky)

What we see.

At temperature above absolute zero, all objects radiate electromagnetic energy by virtue of their atomic and molecular oscillations. The total amount of emitted radiation increases with the body's absolute temperature and peaks at progressively shorter wavelengths. The sun, being a major source of energy, radiation and illumination, allows capturing reflected light with conventional (and some not-so-conventional) cameras and films. The basic strategy for sensing electromagnetic radiation is clear. Everything in nature has its own unique distribution of reflected, emitted and absorbed radiation. These spectral characteristics, if ingeniously exploited, can be used to distinguish one thing from another or to obtain information about shape, size and other physical and chemical properties (Curran, P.J. 1985)

3.1 Types of Remote Sensing

Remote sensing can be either passive or active. ACTIVE systems have their own source of energy (such as RADAR) whereas the PASSIVE systems depend upon external source of illumination (such as SUN) or self-emission for remote sensing.

3.1.1 Interaction of EMR with the Earth's Surface

Radiation from the sun, when incident upon the earth's surface, is reflected by the surface, transmitted into the surface or absorbed and emitted by the surface (Fig. 2). The EMR, on interaction, experiences a number of changes in magnitude, direction, wavelength, polarization and phase. These changes are detected by the remote sensor and enable the interpreter to obtain useful information about the object of interest. The remotely sensed data contain both spatial information (size, shape and orientation) and spectral information (tone, color and spectral signature) (Lillesand *et al* 1993)

3.1.2 Interaction with the Atmosphere

The sun is the source of radiation, and electromagnetic radiation (EMR) from the sun that is reflected by the earth and detected by the satellite or aircraft-borne sensor must pass through the atmosphere twice, once on its journey from the sun to the earth and second after being reflected by the surface of the earth back to the sensor. Interactions of the direct solar radiation and reflected radiation from the target with the atmospheric constituents interfere with the process of remote sensing and are called as "Atmospheric Effects". The interaction of EMR with the atmosphere is important to remote sensing for two main reasons. First, information carried by EMR reflected/ emitted by the earth's surface is modified while traversing through the atmosphere. Second, the interaction of EMR with the atmosphere can be used to obtain useful information about the atmosphere itself. (Elachi, C. 1987).

The solar energy is subjected to modification by several physical processes as it passes the atmosphere, viz.

- 1) Scattering; 2) Absorption, and 3) Refraction

4. CONCLUSION

Remote sensing technology has developed from balloon photography to aerial photography to multi-spectral satellite imaging. Radiation interaction characteristics of earth and atmosphere in different regions of electromagnetic

Spectrum are very useful for identifying and characterizing earth and atmospheric features.

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REFERENCES

Curran, P.J. 1985. Principles of Remote Sensing. Longman Group Limited, London

Elachi, C. 1987. Introduction to the Physics and Techniques of Remote Sensing. Wiley Series in Remote Sensing, New York.
http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_1_e.html

Lillesand, T.M. and Kiefer, R.1993. Remote Sensing and Image Interpretation. Third Edition John Wiley, New York.



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I was born in Kalbhairab V.D.C, ward no.7 Dailekh, I completed school level from West Wing School, Lubhoo, and Laltipur. I had dreamed of studying Science and become scientist. Accordingly I joined Capital College and Research Centre, Kathmandu as my +2 high school. I was good in my studies in schools so, my parents suggested to study MBBS. I spent my one year in preparing for medical entrance, unfortunately I couldn't succeed. After then I came to know about Geology in Tri-Chandra Campus from my brother studying there. When I first visited Tri-Chandra Campus, Ghantaghar attracted me a lot because it was something I have read in history book but have never visited before. I explored every department and talked about the college with teachers and the students there. Also, I played basketball on the same day. On the first visit I was excited to study Geology in the college.

I had learnt a good lesson from my one year loss after +2 so, I decided to focus on my study, and obtain good marks. So I paid good attention to geology classes, visited teachers and elders to clear my doubts. I used to spend most of my time in library reading books. I found the geology department as best department in the college and teachers very helpful. Every students studying geology in the college have keen interest on studying geology and so do I.

I have completed my first three years. In these years geology department took us for field visit in Kakani, Chobhar and Malekhu in first, second and third year respectively. In these three years I found geology as an interesting subject. So I selected Geology as major subject in forth year.

Global Warming In Relation To Geology

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Abstract: The Earth is the home we live. Different geological processes are occurring on Earth, which modifies it. Now a days global warming has become a prominent topic to research. The article deals with the Earth's average temperature from its formation till date. The pattern of climate change in the Earth is discussed below. The article focus on the relation between Earths's temperature and the geological processes. It aims to find probable geological hazards that might result from global warming.

Key Words: *global warming, geology, climate, challanges*

1. BACKGROUND

We know the Earth as a single dynamic system, billions of years old, which are not in equilibrium. Geology is a scientific discipline that routinely works backward through significant periods of time to evaluate Earth's natural process. Our disciplines brings both data and interpretation to the debate of the past history and climate, greenhouse gases and global temperature behavior. Geology also brings to a debate collection of drivers including tectonism, volcanism, topography, glaciations, denudation, and evolution of biota, the hydrologic cycle, carbon sequestration and interaction between geologic and astronomic events.

The sedimentary rock reflects numerous sea level changes, atmospheric compositional changes and temperature changes, all of which attest to climate variation. The variation in climate has occured in all time scale and has been continuous. Research on present global warming has been very important so, scientist today called for wide ranging researches into whether more volcanoes, earthquake, landslide and tsunami could be triggered by rising global temperature under global warming. The figure shows the climate change in geological time scale.

The Earth's Climate In Past

The earth was formed about 4.5 billion years ago. It is difficult to say exactly the earth's daily weather but we know a lot about what the earth's climate was like way back then because of clues that remain in rocks, ice, trees, corals and fossils. The clues tell us that the earth's climate has changed many time before. There have been times

When most of the planet was covered in ice and there have also been much warmer periods. Over at least the last 650,000 years temperature and carbon dioxide level in the atmosphere have increased and decreased in a cyclical pattern. Also there have been several cycles of glacial advance and retreat with the abrupt end of the last ice age about 7000 years ago marking the beginning of the modern climate era and of human civilization (Crowell et al 1999). Hence, understanding of earth's climate in past is necessary, as the geological records contains abundant evidence of the ways in which Earth's climate has changed in the past. Also the evidence is highly relevant to understanding how it may change in future and the likely impacts of anthropogenic carbon emission.

Global Warming

The Global warming refers to the increase in earth's average surface temperature. The greenhouse gases are major factor in increasing earth's temperature. Gases like carbon dioxide, methane, water vapor, ozone in earth absorbs and emits infrared radiation and hence warms lower atmosphere and surface. Clouds also affect the radiation balance through cloud forcing similar to greenhouse gases. Solid and liquid particles known as aerosols produced by volcanoes and humans made pollutants are thought to be the main cause of dimming. They exert the cooling effect by increasing the reflection of incoming sunlight. Soot may either cool or warm Earth's climate system depending on whether it is airborne or deposited. Atmospheric soot directly absorbs solar radiation which heats the atmosphere and cools the surface. Solar activity and variation in Earth's orbit are also responsible in changing Earth's temperature. The current warming trend is of particular significant because most of it is very likely human induced and proceeding at a rate is unprecedented in the past 1300 years.

Evidence of Rapid Climate Change

Earth's orbiting satellites and other technological advances have enabled scientists to see the big pictures, collecting many different types of information about our planets and its climate on global scale. This body of data collected over many years reveals the signal of changing climate. Evidences of rapid climate change are listed below

- Sea level rise: Sea level is rising nearly 17 cm in the last century and the rate in last decade however is nearly double that of the last century.
- Global temperature rise: Most of the warming has occurred since 1979s with the 20 warmest years having occurred since 1981 and with all 10 of the warmest years occurring in past 12 years.
- Warming oceans: The oceans have observed much of this increased heat with the top 700m of ocean showing warming of 0.302 degree Fahrenheit since 1969.
- Shrinking of ice sheet: The Greenland and Antarctic ice sheet have decreased in mass. Data from NASA's gravity recovery and climate experiment show Greenland lost about 152 cubic kilometer of ice in between 2002 and 2005.
- Declining Arctic sea ice: Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades.
- Glacial retreat: Glaciers are retreating almost everywhere around the world including the Alps, Himalayas, Andes, Rockies, Alaska and Africa.
- Decreased snow cover: Satellite observation reveals that the amount of spring snow cover in the northern hemisphere has decreased over the past five decades and the snow is melting earlier.

Geological processes responsible for Global warming

There have been enormous changes in the surface of the earth with continent moving, mountain range growing and eroding away and the area covered by oceans and by sea growing or shrinking. The composition of the atmosphere has also changed as a result of biological and geophysical process, including the storage of carbon in ocean floor. In addition, there have been changes in solar output in the earth's orbit and earth-sun geometry. All of these changes affect climate at both the global and regional scales.

Volcanoes can spew vast amount of ash, Sulphur, carbon dioxide and water into upper atmosphere, reflecting sunlight and sometime cooling the Earth for couple of years. But too many eruptions too

close together may have the opposite effect and quickens global warming. Volcanic aerosols provide a catalyst for CFC's to depletion of ozone, hence fluctuate temperature (Berner et al 1994).

Climate linked geological changes may also trigger "methane burps" the release of a potent green house gas. Currently stored in solid form under melting permafrost and the seabed, in quantities greater than all the carbon dioxide in our atmosphere.

Effect of global warming

Evidence from geological record is consistent with the physics that shows that adding large amount of carbon dioxide to the atmosphere warms the world and leads to higher sea levels and flooding of low lying coasts greatly changed patterns of rainfall, increased acidity of the ocean and decreased oxygen level in sea water.

Experts say global warming could affect geological hazards such as earthquakes because of the way it can move large amounts of mass around the earth's surface. Melting glaciers and rising sea levels shift the distribution of huge amounts of water which release and increase pressure through ground. The pressure changes could have ruptures and seismic shifts more likely. Research from Germany suggests that the earth's crust can sometimes be so close to failure that tiny changes in surface pressure brought on any heavy rain trigger quakes. Tropical storms, snowfall and shifting tides have been linked to shift in seismic activity. Hence quakes, volcanic eruptions, giant landslides and tsunamis may become more frequent as global warming change the earth's crust.

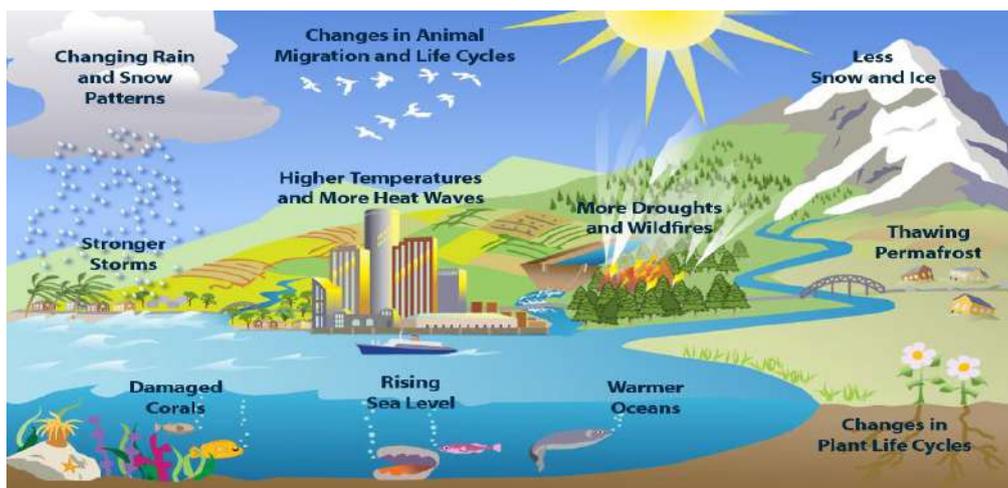


Fig: Global warming with relation to Geology (source: Learning geology)

CHALLENGES

Earth's climate is changing and we humans are mostly to blame. By releasing green house gases into the air we have made Earth's green house effect stronger causing warming. The increased use of fossil fuel to run our economy has result large amount of carbon dioxide in our atmosphere. Also, climate skepticism seems strongest among geologists closely linked to mining and fossil fuel industries. It is said, " It is difficult to get a man understand something when his salary depends upon his not understanding it." Hence, Global warming has become the most challenging to control.

Role of Geologist

A geologist is a scientist who studies the solid and liquid matter that constitutes the Earth as well the process and history that have shaped it. Geologist has significant role in modeling the impacts through the research into paleoclimate. They can analyze, how climate changes will impact on several key

areas like Groundwater, Coastal flooding and erosion, Disasters etc and what can be done to adapt or mitigate or reduce the impacts within these areas. Disasters ranging from flood and drought to earthquake and tsunami are not altogether understood. Research indicates as increase in the unpredictability of rainfall in terms of intensity and duration, the frequency of extends droughts and flood.

Geologist also have key role in ensuring that the decisions made in this field on the basis of good science should help both ecosystem and human. Climate change adaptation and work in communities to build resilience should be done on the basis of a thorough understanding of the area and science otherwise they would increase vulnerability and do more harm than good. Climate change should be kept in its proper context, alongside the various other hazards and vulnerability that communities face.

CONCLUSION

Changes is constant inevitable and interesting, humankind must embrace change rather than fear it. Possible geological hazards were alarming enough but just one small part of a scary picture if man made carbon dioxide emission were not stabilized within around the next few years. Also adaptation to the change that continually occur on our planet required flexibility, planning and acceptance of the Earth's system. Hence, slowing global warming won't happen overnight. However according to IPPC, by taking steps today we could prevent some of the more catastrophic impacts of warming in future.

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I would like to express my gratitude to our respected teacher sir, Dr. Tara Nidhi Bhattarai for the inspiration to write an article. Initially, finding the best topic was difficult and latter on, I enjoyed writing about Global warming. For this, I would like to remember my friend Sadikshya Mainali, who motivated me in writing this article.

REFERENCES

Berner R, 1994 3 Geocarb IIA Revised model of atmospheric CO₂ over phanerozoic time: American Journal of Sciences, V.291 ,P. 56-81

Crowell, John C. ,1999, Pre-Mesozoic ice ages: Their bearing on understanding the climate system, Geological society of America memoir P. 192, 106



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I was born in Kathmandu. I completed school level from Indradhanush Boarding High School. I wanted to study science so I joined Classic College International for +2 level study. After then I started entrance preparation for BSc. Ag. When I was attending several seminars and counseling classes many counselor gave advice on different subject. I realized geology unique and interesting subject. I was dreaming about career in Geology. At the mean time I was unable to enroll myself in BSc Ag.

During my childhood, I used to participate in Quiz competition and one question was like sure “Which is the second richest country in water resources?” answer was obvious Nepal. We also used to study that electricity is obtained from running rivers. I got surprised if Nepal is rich in water resources then why we all Nepalese are facing load shedding. This question often strikes my mind and was curious. I got keen interest to grab actual knowledge about it. I was wandering about Bachelor degree on geology in Nepal and found Tri-chandra College, as right institution. I bought syllabus and course of study and knew Geology as the fascinating subject. Study of earth, mineral resources, mining, geological hazards, structures, rock types and many other topics are included in it. So I was delighted knowing that I made best decision by enrolling myself in Department of Geology.

The first lecture was of Tara Nidhi Bhattarai sir. His interactive nature, rules, regulation, diary writing, assignments all these encouraged me day by day. I found Department of Geology as the best department in college, with unique system of teaching. My mind and heart both said; Yes, I have to do my best for being a good geologist also I have to labor hard and give my 100%.

The most unforgettable moments are Kakani, Chobar field excursion on 1st and 2nd year respectively. Along Malekhu-Dhading on 3rd year made me think practically about field knowledge and its implementation on theory knowledge. The supportive and familiar nature of all teachers and co-cooperativeness of all colleagues. Hence, these became the most unforgettable moments of three years. Meeting all renowned professor and lecturer of geology department was honorable. I’m expecting the same support from all teachers and friends. I know, geology can be one of the pillars in developing the nation so I choose it as major subject in 4th year, and I’m doing my best with all courage, labor and following rules and regulation that I should maintain to be geologist indeed.

Hydropower In Nepal

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Abstract: Nepal is the second richest country in water resources. Hydropower is the power derived from the energy of falling water or fast running which is harnessed for useful purposes. The perennial nature of rivers and the topography provide suitable condition for development of some of the world's largest hydroelectric project in Nepal. Though hydropower is one of the major advantages of Nepal but its development is extremely challenging. The challenges are related to technical, economic, social as well as political problems in Nepal. Due to seasonal storage of water, development activity is altered. Hence, proper site selection, plan and implementation should be made to develop the hydropower project in Nepal.

Key Words: *hydropower, development, topography, water resources, challenges.*

1. BACKGROUND

Hydropower is a very important part in the total volume of electricity generation worldwide and the greater share of renewable energy. Worldwide represents approximately 24% of energy production. Its development was introduced all over the world during 19th century. It became the source of generating electricity. But in 20th century hydropower used most exclusively in conjunction with the modern development of hydroelectric power. Crag side in Northumberland was the first house powered by hydroelectric in 1878 and the 1st commercial hydropower plant was built at Niagara Falls in 1879. If we talk about hydropower development in Nepal, Pharping Hydropower is first hydropower project of Nepal and second of Asia. The construction of plant commenced in 1907 and was commissioned in 1911 as Chandrajyoti Hydro-electric power station.

2. OBJECTIVES

- To provide knowledge of hydropower development in Nepal.
- To illustrate the probable hydropower projects in Nepal.
- To list the running power plants with their capacity.
- To enlight the role of geology in hydropower development
- Identify the problems in completion of the project.

3. METHODOLOGY

Available secondary sources such as books, documentary, article 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 website. For the format of the article was provided by the Department of Geology, Tri-Chandra Campus. Finally all the collected materials were presented systematically in the form of an article.

Development

Nepal is rich in hydro-resources with one of the highest per capita hydropower potentials in the world. The hydropower system in Nepal is dominated by run-off river project. 8, 18,900Ha of total water surface area is present in Nepal, including rivulets and tributaries totaling about 45,000km in length, Nepal is 2nd richest country in inland water resources. The estimated theoretical power potential is approximately 83,000MW. Though 83,000MW of hydropower potential is estimated but 45,610MW of economic feasible potential has been identified combining 114 power plant projects. In this estimate specific discharge was used to account for the spatial variation of the flow in various stream network. This is due to high spatial variation in rainfall over the country (Adhikari, D, 2006).

Table 1. Existing Hydropower plant in Nepal

River Basin	Name	Capacity in MW
Bagmati	Kulekhani I	60
	Kulekhani II	32
	Jhimruk	12.3
Koshi	Panauti	2.4
	Sunkoshi	10.5
	Indrawati	7.5
	Khimti	60
	Bhotekoshi	36
Kankai	Piluwa	6.2
Narayani	Trishuli	24
	Devighat	14.1
	Gandak	15
	Marsyangdi	69
	Middle Marsyangdi	70
	Andhi Khola	5.1
	Chilime	20
	Kaligandaki	144
	Modi	14.8

Source: NEA (Nepal Electricity Authority)

Different hydropower are under construction like Gamgadi 0.4Mw, Heldung 0.5Mw, Rairang 0.5Mw, Upper Modi 14Mw, Khudi 3.5Mw, Mailung 5Mw. The country hopes to bring about hydropower development through three strategic consideration. These include building up large scale storage projects, medium-scale for meeting national needs and small-scale projects for local communities.

Operation

The most typical type of hydropower uses a dam on a river to store water in a reservoir. Water released from the reservoir flows through a turbine, spinning it, which in turns activates a generator to produce electricity. But hydropower doesn't necessarily require a large dam. Some hydropower plant just used a small canal to channel the water through a turbine. Thus, the main component of hydropower are dam, the power house that contains the mechanical and electrical equipment and the water ways (Harvey, A.1993).

Geological Risk

The completion risk of any hydropower projects falls mainly on geological conditions. It is the major factor to determine the relevant time, its budget and capacity of the project. Many geological investigation and drilling studies are under taken during project preparation. Different secondary geological structures like Fault, Joints are to be considered during selection of construction site. Since geological environment are not static and changes in geological and regional level. The most common project risk affecting the long term productivity and life of a hydropower dam is the accumulation of the sediments trapped behind the dam in the reservoir. In order to reduce the geological risk, geological investigation should be as complete as possible to obtain full knowledge of the site more accurately. In complex geological structures, in order to obtain an appropriate design prior to construction it is advisable to dig the affected parts with the purpose to clarify possible doubts about the appropriate type of foundations. Also, design must be based on real information, not theoretical data or those taken from limited resources.

Hydrological Risk

The hydrological risk primarily comprises drought risk, which can significantly affect hydropower generation. Since hydropower uses hydraulic force of water to spin its turbine in order to generate the electricity, so in this sense water is its fuel. Normally the project design energy is based on several years' hydrological data; the risk of any deviation is considered minimal.

Challenges in Project Development

Hydropower is considered as a major natural advantage of Nepal but its development has been extremely challenging. Nepal's power supply and demand pattern has noticeable seasonality characteristics of imbalance in the form of power shortages dry-months and surpluses during wet months. Besides, the dams are extremely expensive to build and must be built to a very high standard. The high cost of dam and operation of it needs decades to become profitable. Construction activities of dams may cause flooding of large area resulting serious geological damage and natural environment destruction. If proper site is not selected for building dam it may block the progress of river causing flow of water uncontrolled which hampers the neighbor countries too. Last but not the least challenge is construction activities alter the natural water table. For the implementation of plan and achieving the target relating to the power development of cost effective small and medium sized projects to meet domestic demand on affordable price, encouragement of private sectors investment in hydropower development and power distribution on competitive basis. All these steps may overcome the probable problem of hydropower construction.

4. CONCLUSION

The hydropower potential of Nepal is huge and the sustainable hydropower development becomes the key to make the Nepal's economic growth scenario brighter. Hydropower is continuously renewable electrical energy source, non-polluting i.e. no heat or noxious gases are released. It has no fuel cost and with low operating and maintenance cost is essentially inflation proof. Hydropower station offers reliable and flexible operation. Hydropower station efficiencies of over 90% have been achieved making it the most efficient of the energy conversion technologies. Hence, the acts and regulation should be made to support the environment as well as the hydropower development efforts so that environment and development go together, especially when it comes most important natural resource development endeavors of the nation.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to our respected sir DR. Tara Nidhi Bhattarai and all the faculty member of Department Of Geology for their continuous efforts for making me capable to study geology and to write this article. Also I'm thankful to all friends as well as editorial board for their valuable comments and coordination to write this article; hope for the support in upcoming future too.

REFERENCES

Adhikari,Deepak 2006 "Hydropower and Government Policy", The Rising Nepal, March 14, 2006.

Nepal Electricity Authority, Various Issues,"Vidyut" Nepal Electricity Authority, Kathmandu, Nepal.

Harvey, A.1993, Micro-hydro design manual-a guide to small-scale water power schemes, Intermediate Technology Publications, London.



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I was born in Tulasi-2, Danusha. I did my schooling from Midland English Boarding School, Battisputali and completed intermediate level (+2) from V.S Niketan College, Minbhawan. When I came in to 3rd year of Bachelor I found that Geology more interesting and research type so I got enrolled in this subject. I am fully solicitous to become a good geologist.

I love reading Novels the best book I have gone through is “The Alchemist” by Paulo Coelho. I began my book reading campaign through this book which gives me hectic feedback on my soul to lead life a good way. Second book I found more interesting is “You Can Win” by Shiv khera. Next book that’s in by bucket list is “Theory of everything” by Stephen Hawking. “I never think of the future. It comes soon enough” as said by Albert Einstein gives me Goosebumps to work harder each day. No matter what the circumstances are you should always work harder. Anyone who has never made a mistakes has never tried anything new” is another famous quote said by Albert Einstein keeps me to try new thing and explore it. Lack of confidence won’t tend you to go up higher there should be strong heart to carry on and to lead your life to success. I prefer more on unique talent to leave a new trial to success

Starting my campaign on further study in Tri-chandra I was so unhappy by behavior of student inside class and different political issues. Though there wasn’t such case in Geology. After supportive guidance from seniors I moved forward and experienced a new way of learning. My journey till day was like a burgeon itself and in single word I define awesome.

I have captured many special moments in department of geology. The most special moment was in Malekhu field work where I got chance to realistically view geology and added a delicious flavor to my geology learning campaign. Till date I have found geology prodigious. But my field of interest is in engineering geology. Many kinds of construction and designing engineering structures takes to prolific way in environment.

Currently I am studying B.Sc 4th year on geology major. For me, geology is passion that courage me to work harder to become a good geologist.

Rapid Urbanization Impact on Bagmati River

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Abstract: Bagmati River is one of the principal river of the Bagmati basin (ca.3640sq.km) in Kathmandu valley. The river fed by springs and monsoon rainfall originates in the north of Kathmandu valley and drains across the Mahabharat range to the Gangetic plain. The cities area like Kathmandu undergoing rapid development and in modern context high rate of urbanization (land use) making it impenetrable for storm water leading to groundwater fluctuation. Also the high population producing immense pressure along Bagmati River to noxious pollution. The study is aimed for analyzing the effect of rapid urbanization of Bagmati River with their cause effect relation by human impacts

Key Words: *bagmati, urbanization, population, groundwater, pollution*

1. BACKGROUND

Bagmati River has its origin in Bagdwar from the southern slope of Shivapurilekh, North of Kathmandu basin at an altitude of about 2650m and flows straight to south-west cutting Mahabharat range (Sharma, 1977).starting from Mahabharat Range in North it flows down to the plains of Nepal in the south and merges into the Ganges in India.total length 196km and catchment area of the river is 3610sq.km which is 2.25% of total area of Nepal (shanker&Kiran, 1976). The drainage system of Bagmati River seems quite remarkable. The major tributaries of Bagmati River are Bishnumati, Dhobikhola, Manohara, Tukucha and Nakhu khola.Nowadays population of Kathmandu valley increasing in an immense order and so the pollution in the Bagmati River. Increasing population has high rate of effect on holy sacred River Bagmati. Unwanted mixing of sewage, dung and throwing non-biodegradable wastes made this river stagnate. The dissolved oxygen in this river before 50 years and now has massive difference. Apart from this, due to the immense land sealing, it is hard to recharge the ground water resulting into low water table and thus decrease in the water level in the river.

2. OBJECTIVES

The main objectives of the study are listed below:

- To observe the present activities of people living along bank side of Bagmati River a living parameter
- To observe how the rapid urbanization is taking place along river periphery a non-living parameter.
- To know what impacts are hampering river on its discharge and other like dissolved oxygen percentage.
- To compare its past and present scenario and to sort out future plan for maintaining river.

3. METHODOLOGY

Past report and articles were studied before going to field for observation. Different kinds of research done on past helped in information gathering related to our study. Field observation was carried out by different methodologies like questionnaire method, interaction and interpretation among people living nearby river mainly along the bank side. Photographs were taken along the bank of the area.

4. FIELD INVESTIGATION AND DATA COLLECTION

4.1 Construction work

Present scenario along bank side of Bagmati river shows the high rate of construction work. Increase population and illegal shift of people along river bank for their livelihood. Rapid rate of urbanization along River side, interruptible way of constructing road and other developmental related work. Nearby construction of factory, industries and triggering rate of mixing dung, sewage in river. Construction of Cemetery along Pashupatinath area and diversion along river side blocking its drainage system. (Rajbhandari, A. S. 2012).

4.2 High pollutants in river

The Bagmati River faces a number of serious environmental and ecological changes. Uncontrolled discharge of untreated wastewater and solid waste into the River from nearby industries, factories Hospitals and other places. Mixing of Non-biodegradable wastes such as plastics, metals into the River. Triggering down of deforestation rate tremendously decreased the amount of dissolved oxygen in Bagmati River and so the aquatic habitat inside the river system. Dissolved oxygen in River along Tilganga side is 4.2mg/l and having oxygen saturation near to 43%.

4.3 Positive development along river side

As conducted by government and peoples effort major activities of cleaning and sanitation through the river system. Waste water treatment plants, construction of proper dams, renovation along River side etc. Educating nearby peoples about importance of River and proper management of it through different programs. Afforestation along river bank.

5. RESULTS AND DISCUSSION

Rapid urbanization rate and the pollution of Bagmati River shows that this two are directly related. Kathmandu being in highly developed district has been a continuous source of attraction to people all over the Nepal a factor of high population and desperately high pollution of River. Unmanaged wastes and uncontrolled mixing of chemical from local industries, hospitals etc have been major issues in past and increasing day by day. Illegal livelihood of people along bank side has deteriorated the beauty of the River. Unmanaged construction of diversion along river has disturbed the drainage pattern diverged its natural flow and inviting high risk of seasonal flood.

Bagmati being a holy sacred River is now a highly contaminated river of Nepal. Such River has got high power of feeding people living in Kathmandu city and other neighboring cities people's. Major effort on replenishing the River to its beauty is necessary to be implemented. To control the pollution inside and outside of the River proper legislation related to Bagmati has to be implemented in near future like illegal sand mining and management of people living along bank side of the River in proper way is vital. Proper engineering construction of Bridge is vital. (Shakya, L. and Tiwari, S.R.2014).

6. CONCLUSION

Kathmandu city being highly populated is suffering rate of encroachment of the river territory by formal and informal communities. This has resulted extensive waste generation ultimately reaching the river premises. Lack of legislation on proper river management has shifted river into sick state. Seasonal flooding and high chances of other natural calamities are near to the future through this river. Therefore for replenishing of Bagmati River with beauty and free from pollution, the traditionally existed green buffers need to be restored with the involvement of the local communities. Water flowing through this River can become an important source for people living in Kathmandu city. Effective legislation on dynamic way shall necessary to be implemented.

ACKNOWLEDGEMENT

I would like to thank Head of Department of Geology Dr. T.N. Bhattarai for providing me such opportunity to explore some new kind of research, I believe his actions provide me with unique opportunity to gain a wider breadth of experience while I am on Graduate level. Finally, and most importantly, I would like to than the local people communities and different agencies for their positive support without whom I wouldn't had gone so far on to write this article.

REFERENCES

- Rajbhandari, A. S. (2012). Impact of Bagmati River Corridor Development on Local land Use and Environment, Dissertation, Department of Civil engineering, Tribhuwan University Kathmandu.
- Shakya, L. and Tiwari, S.R.(2014). Impacts of Land use changes on Bagmati River presented at the Proceedings of IOE Graduate Conference, Kathmandu, 2014



Year of Admission: 2069

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I was born in Barahathawa V.D.C, Ward no. 04, Sarlahi District. I attended Kalpavriksha Secondary School, Barahathawa-04, Sarlahi, and completed +2 from Universal College, Maitidevi, and Kathmandu.

Firstly, my intension was to study Engineering in Pulchowk Campus, IOE; but I remained unsuccessful to achieve my goal, and then I decided to study Geology in Tri Chandra College which was my second option. I was inspired to study Geology from my uncle, so regardless of my interest I got enrolled in first year. As I was not so interested in this science my first and second year just passed away simply. But after two weeks field visits in Malekhu, I was little bit interested in this science. I found geology nature friendly and so I started wondering and thinking about this science deeply, and with a great enthusiasm I took oath to be fully devoted towards geology and study it very hard, no matters how or what my career becomes...

The best Novel I have gone through till that time was ' SHIRISH KO PHOOL' written by Parijat and published by Sajha Prakashan. This novel has no hard lesson, but it teaches what love is, and that love has no boundary, does not see age and sex if it is spiritual. Similarly, the best novel published by foreign writer I have read till that time was ' THE 3 MISTAKES OF MY LIFE ' by Chetan Bhagat. This novel tells that nothing comes easy in a turbulent city. To realize our goals, we have to face it all-religious politics, calamities, unacceptable love and, above all, our own mistakes...' Life will have many setbacks. People close to you will hurt you. But you don't break it off. You don't hurt them more. You try to heal it. It is a lesson not only we, but our country needs to learn.'

The most unforgettable moment during my first year was to get encountered with a girl who remained just acquaintance for me. But inspired I to read English novels... and also my friends were too good to me. They insisted me to read some good English books. And now, reading novel has become my hobby.

The matter that has astonished me is how rock study reveals the secrets of the earth, and thus I am inquisitive towards geological science. However, I want to become a governmental officer by being a good geologist, and I want to work for the betterment of the nation.

Present Status of Geology of Nepal and its Applications

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Abstract: Lying in lap of mighty Himalayas, Nepal is blessed with diversified nature, bound in the tapestry of unity. Nepal has sharp physiographic and climatic contrasts despite its small area. This journal attempts to appraise the present nature of geology and its application in Nepal. The subject of this text is geology, the science that pursues an understanding of planet Earth. Throughout its long existence Earth has been changing. Geology is a science that seeks to expand our knowledge of the natural world and our place in it. If we could have good knowledge in geology and can understand its applications properly, a lot of improvements could be done in a sector of sustainable development.

Key Words: *geology introduction, importance, applications, government*

1. BACKGROUND

Geology, from the Greek geo, “Earth” and logos, “discourse.” It is the science that pursues an understanding of planet Earth. Geology is perceived as a science that is done in the out of doors, and rightly so. A great deal of geology is based on observations, measurements, and experiments conducted in the field. But geology is also done in the laboratory. It requires an understanding and application of knowledge and principles from physics, chemistry, and biology. Geology is a science that seeks to expand our knowledge of the natural world and our place in it. To understand Nepal geology is challenging because Nepal geology is a dynamic body with many interacting parts and a complex history. Throughout its long existence Nepal has been changing. Nepal is divided into four major zones viz. The Terai, Sub- Himalaya (Siwalik), the lesser Himalaya, Main central Thrust zone, the higher Himalaya, and the Tibetan-Tethys.

2. OBJECTIVES

- a) To know what is Geology & know about present status of geology of Nepal in brief.
- b) To know the area of applications of geological science.
- c) To make knowledge about geoscience applications in sustainable development in contest of Nepal etc.

3. METHODOLOGY

Book, internet, and my own basic knowledge are the sources of this journal. The most is my own efforts on the basis of my understandings. Nevertheless I have discussed about this journal with some of my friends too. However, the study is totally based on the secondary data like journals and internet, no any direct field investigations were done.

Tectonostratigraphic division of Nepal Himalaya

Heim and Gansser (1939), and Gansser (1964) divided the rocks of the Himalaya into four tectonostratigraphic zones that are characterised by distinctive stratigraphy and physiography. From south to north, these are the Sub Himalayan, Lesser Himalayan, Greater Himalayan, and Tibetan Himalayan zones.

Terai: It is a rich, fertile and ancient land in the southern parts of Nepal. In Nepal it is the Nepalese extension of the Indo-Gangetic Plains; The Plains get their names from the rivers Ganges and Indus. The vast alluvial plains of the Indo-Gangetic Basin evolved as a foreland basin in the southern part of the rising Himalaya, before breaking up along a series of steep faults known as the Main Frontal Thrust (Gansser, 1981). It comprises several sub-basins and all of them are quite shallow towards the south, but rather deep in the northern sections.

Sub-Himalaya (Siwalik): This Sequence borders the Indo-Gangetic Floodplain along the Himalayan Frontal Fault and is dominated by thick Late Tertiary mollassic deposits known as the Siwalik that resulted from the accumulating fluvial deposits on the southern front of the evolving Himalaya. In Nepal, it extends throughout the country from east to west in the southern part. It is delineated by the Himalayan Frontal Thrust (HFT) and Main Boundary Thrust (MBT) in south and north respectively. The youngest sediments on the top are the conglomerates, and the sandstones and mudstones are dominant in the lower portions. This zone is the 10 to 25 km wide belt of Neogene Siwaliks (or Churia) group rocks forming the topographic front of the Himalaya. It rises from the fluvial plains of the active foreland basin, and this front generally mapped as the trace of the Main Frontal Thrust (MFT). The Siwaliks Group consists of upward-coarsening successions of fluvial mudstone, siltstone, sandstone, and conglomerate. The Siwaliks Group in Nepal is composed of three units that are known as lower, middle and upper members.

Lesser Himalaya: It lies in between the Sub-Himalayas and Higher Himalayas separated by the Main Boundary Thrust (MBT) and the Main Central Thrust (MCT) respectively. The total width ranges from 60–80 km. The Lesser Himalayas is made up mostly of the unfossiliferous sedimentary and metasedimentary rocks; such as shale, sandstone, conglomerate, slate, phyllite, schist, quartzite, limestone and dolomite. The rocks range in age from Precambrian to Miocene. The geology is complicated due to folding, faulting and thrusting and are largely unfossiliferous. Tectonically, the entire Lesser Himalayas consists of two sequences of rocks: allochthonous, and autochthonous-parautochthonous units; with various nappes, klippe and tectonic windows. The Lesser Himalaya thrust over the Siwaliks along the MBT to the south, and is overlain by the allochthonous thrust sheets of Kathmandu and HHC along the MCT.

Main Central Thrust Zone: It is the single largest structure within the Indian plate that has accommodated Indian-Asian convergence. It extends for nearly 2500 km along strike and has been the site of at least 140 and perhaps more than 600 km of displacement Heim and Gansser (1938) defined the MCT in Kumaon based on the difference in metamorphic grade between low to medium-grade rocks of the Lesser Himalaya and higher-grade rocks of the Greater Himalaya. However, the fault originally defined by is not the MCT, but a fault within Lesser Himalaya rocks (Valdiya, 1980; Ahmad et al., 2000). This misidentification symbolizes the challenge that workers have faced in locating the MCT. The metamorphic grade within the Lesser Himalaya increases towards the MCT and at higher structural levels

Higher Himalaya: This zone extends from the MCT to Tibetan-Tethys Zone and runs throughout the country. This zone consists of almost 10 km thick succession of the crystalline rocks, commonly called the Himal Group. This sequence can be divided into four main units, as Kyanite-Sillimanite

gneiss, pyroxenic marble and gneiss, banded gneiss, and augen gneiss in the ascending order. The Higher Himalayan sequence has been variously named. The High Himalayan Crystalline units (HHC) (Bollinger et al., 2004) are mainly composed of kyanite- to sillimanite-grade gneisses intruded by High Himalayan leucogranites at structurally higher levels. Throughout much of the range, the unit is divided into three formations. In central Nepal the upper Formation III consists of augen orthogneisses, whereas the Middle Formation II are calcisilicate gneisses and marbles, and the basal Formation I are kyanite- and sillimanite bearing metapelites, gneisses, and metagreywacke with abundant quartzite. The gneiss of Higher Himalayan zone (HHZ) is a thick continuous sequence of about 5 to 15 km. The northern part is marked by North Himalayan Normal fault (NHNF), which is also known as the South Tibetan Detachment system (STDS). At its base, it is bounded by the MCT. The protolith of the HHC is interpreted to be Late Proterozoic clastic sedimentary rocks deposited on the northern Indian margin.

Tibetan-Tethys: It generally begins from the top of the Higher Himalayan Zone and extends to the north in Tibet. In Nepal these fossiliferous rocks are well developed in Thak Khola (Mustang), Manang and Dolpa area. This zone is about 40 km wide and composed of fossiliferous sedimentary rocks such as shale, sandstone and limestone etc. The area north of the Annapurna and Manaslu ranges in central Nepal consists of metasediments that overlie the Higher Himalayan zone along the South Tibetan Detachment system. It has undergone very little metamorphism except at its base where it is close to the Higher Himalayan crystalline rocks. The thickness is currently presumed to be 7,400 m (Fuchs, Widder and Tuladhar, 1988). The rocks of the Tibetan Tethys Series (TSS) consist of a thick and nearly continuous lower Paleozoic to lower Tertiary marine sedimentary succession. The rocks are considered to be deposited in a part of the Indian passive continental margin (Liu and Einsele, 1994).

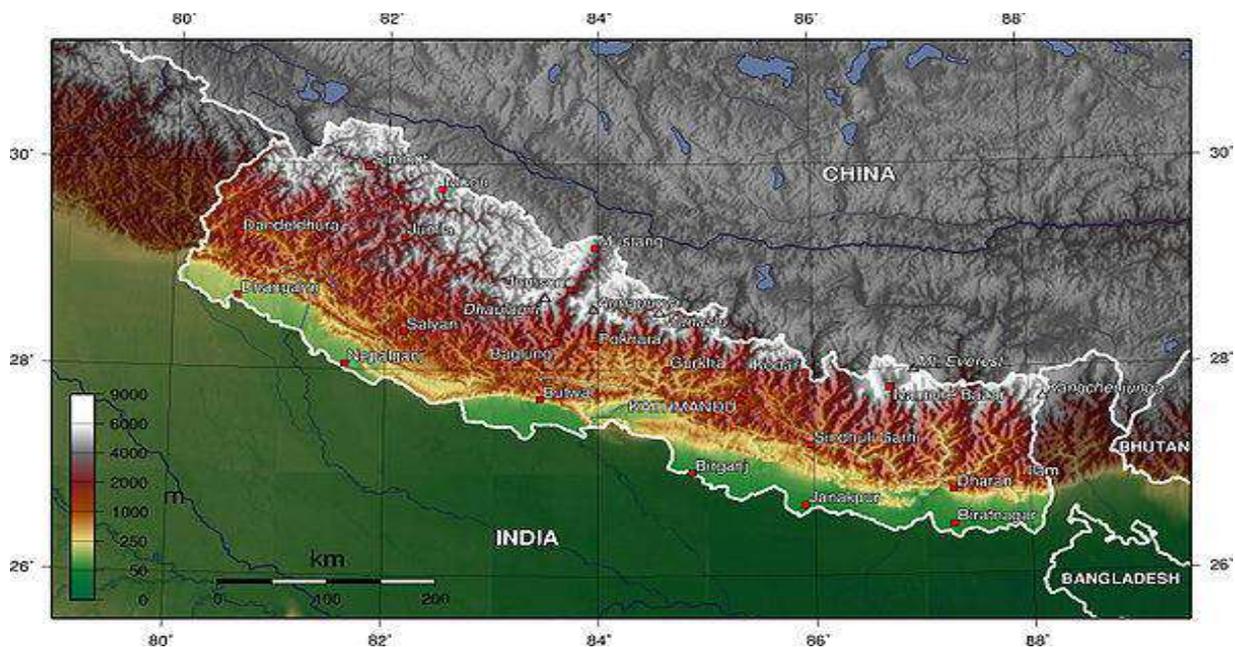


Fig-1: Topographical map of Nepal.(Outline of Nepal from Wikipedia)

Applications of Geology:

- Geology is applied in various Engineering sectors in Nepal.
- Geoscience is applied in hydro powers.
- Geological science is applied in medicine fields.

- Geology is broadly applicable for ground water discharge.
- After all, every sustainable developmental projects need knowledge of geoscience.

4. RESULTS AND DISCUSSION

In my view Geology of Nepal is very tough and hard in comparison to other countries. In a small land locked country Nepal, different geological zones can be found. However Nepalese has got more to understand geoscience in better way. More chances and more possibilities are here to develop this science and take the nation on the path of development.

5. CONCLUSION

It is necessary to understand geology of Nepal in detail. And geoscience knowledge should be applied in the developmental works. For this, more emphasis should be given from government side. Till now, it is seen that government has not been so serious towards this science. Also knowledge about geology must be put into daily practices. Common people should be made aware about this science, and for this academic education could be the best way. Geoscience plays great role in the development of the country, and for the developing country like Nepal, it is the most.

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I express my heartfelt gratitude and sincere appreciation towards my dear sir Dr. T.N. Bhattarai for inspiring and providing this golden chance to write this article. And I am very much grateful to Department of Geology and Geoworld Students' Magazine, and my all dear teachers, and classmates who directly and indirectly supported me. Thank you.

REFERENCES

Tarbuk, Lutgens and Tasa: An introduction to physical geology, tenth edition (January 20, 2010)

Geology of Nepal-Wikipedia, the free encyclopedia, [Online], Available:[https://en. Wikipedia.org/wiki / Geology_of_ Nepal](https://en.wikipedia.org/wiki/Geology_of_Nepal)



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I was born in Deurali VDC, ward number 9, Ghotpani village, Ramechhap. But right after my birth, my family moved into Kathmandu city and that's where I grew up. I studied in Bhanubhakta Memorial Higher Secondary School, Panipokhari, and Kathmandu and completed 10+2 from Canvas International College, Basundhara, and Kathmandu. After that I joined Tri-Chandra Multiple Campus for my Bachelor's degree. I wanted to study Biology and I found out from a friend that Geology could be a suitable combination to go along with it. I was quite excited to find out that our classes would be held right next to the historical Ghantaghar.

The best Nepali book that I have read up to now is "Jaya Vudi" by Bhairav Aryal and published by Bhairav Puraskar Guthi, Nepal. It is a great satire towards the negative aspects of our society. Also, another great book by a foreign author that I have read is "The Hitchhiker's Guide to the Galaxy" by Douglas Adams and published by Pan Books, London. It is a wonderful book for readers interested in fiction and humor like me.

As I studied Geology, I was very intrigued by it and decided to specialize in it rather than in Biology. While the theories were interesting, the practical and field works were challenging as well as a lot of fun.

Apart from studying, my hobbies involve music; composing and singing and sports. I also hope to someday publish some books in the comedy genre.

I believe that little knowledge is a dangerous thing. Therefore I aspire to be an expert in a particular field of geology (which I haven't decided yet) in 10 years' time from now.

Crisis in Armala: Land Subsidence

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Abstract: Since November 2013, the village of Armala located in the Pokhara valley has been facing land subsidence problems. The ground of the area can be divided into upper fertile gravel and sand layer and lower calcareous silt layer. Infiltration of excessive amount of water into the silt layer caused dissolution and as a result sinkholes were formed and this process is still ongoing. Therefore, the government needs to act immediately and relocate the people of the area otherwise this situation could turn into a major crisis.

Key Words: *armala, land subsidence, crisis, government, relocation.*

1. BACKGROUND

It is no secret that Nepal is a tremendously complex country with regards to geology. This, as a result, has produced some remarkable features in Nepal such as the great Himalayan Mountains, the smooth Terai plain, many beautiful valleys and many other geological formations. On the other hand, this complexity is also the cause of many hazards; landslides and land subsidence being the most common ones. Recently, one particular village has been troubled greatly by subsiding lands; Armala.

Armala is a village lying North of the beautiful city Pokhara in Kaski district, Gandaki zone (Fig. 1). 'A sinkhole first appeared in Thulibeshiphant in Armala of Kaski on November 19, 2013' (Koirala, 2015). Since then, several sinkholes have been formed causing the destruction of properties and displacement of many families. The problem is more apparent during the monsoon season. The root of the problem lies within the geology of the area.

Pokhara valley is an intermountain basin, the floor of which is, formed by quaternary deposits resulting from repeated debris flow and associated glacial lake outburst flood originating from the high mountain areas in the north (Yoshida and Upreti, 2014: 33). These sediments are rich in calcareous silt and sand. About 14000 years ago, an incident of glacial lake outburst flood, carrying highly calcareous silt, in the Seti River caused the damming up of the Kali River resulting in the formation of a lake and allowing the silt to settle down on the ground of present day Armala (Dahal, 2013). With the passing time, the lake dried up and debris flows and landslides deposited gravel and sand making the land suitable for cultivation. Slowly, people started settling down and the land was converted into paddy fields.

Land subsidence is not a new thing in Pokhara valley given its geological setting, but the rate and frequency of formation of sinkholes in Armala is quite alarming. More than 50 families have already been affected, having to relinquish their houses and land, and there is no sign of this problem stopping anytime soon. Because of it, Armala is currently facing a major crisis.

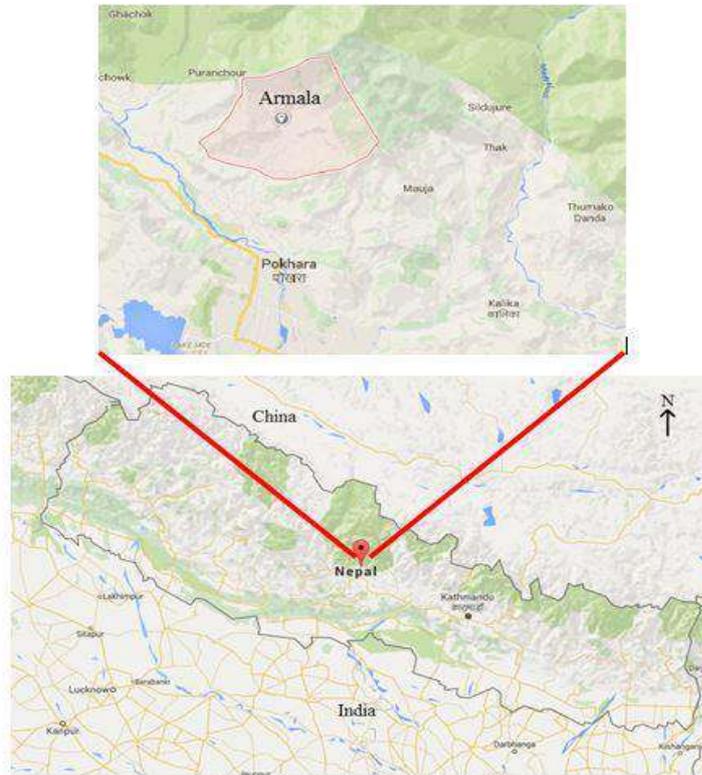


Figure 9. Armala shown via Google Map. Scale 1.5cm=50km

2. OBJECTIVES

The scope of this phenomenon is quite big and it has opened avenues for various lines of investigations. This article was prepared with the following objectives in mind:

1. To understand the reason behind the formation of sinkholes in the area.
2. To estimate the threat posed by land subsidence.
3. To determine possible mitigation measures.

3. METHODOLOGY

This article is prepared chiefly through literature review method. Some books and mostly online articles were consulted to gather the required information. Some data were also collected first hand by conducting a short field survey in the related area.

4. FIELD INVESTIGATION AND DATA COLLECTION

A short jaunt was held in 14th March, 2015 to observe some sinkholes in the fields of Armala. However, it was not a detailed survey and only some sinkholes were observed in a short period of time.

5. RESULTS AND DISCUSSION

The main area affected by subsidence used to be a natural drainage into the Kali river. But human activities disrupted the natural flow of water forcing it to infiltrate the upper soil layers rather than flowing over it. This tremendously increased the amount of groundwater in the area allowing it to flow beyond the gravel and sand layers and reach the calcareous silt layers below. Thus, while the water flowed underground towards Kali River, it slowly dissolved and eroded the silt leaving behind

voids. As the voids grew in size, the upper coarser layers collapsed having no support underneath and thus forming sinkholes.

The sinkholes are numerous and of varying size. Water can be clearly seen flowing at the bottom of the holes showing the high degree of saturation (Fig. 2).



Figure 10. A sinkhole as observed in March, 2015

This phenomenon has already caused the destruction of many houses and many people have lost cultivable land. Still, there is no sign that it will stop anytime soon, in fact new sinkholes are still forming. Therefore, the people living here and their properties are still under risk.

Some steps had been undertaken to solve this problem. The government tried refilling the holes but new ones developed adjacent to them as the water changed its course underground. A channel was also constructed to allow the water to flow through it rather than flowing into the ground but its depth was not sufficient (Dahal, 2013). The only practical solution at the moment seems to be to relocate the people of the area and to try to find an alternative course for draining the water from that area. Bioengineering can be applied to reduce the amount of water infiltrating the soil.

6. CONCLUSION

It's already been two years since land started subsiding in Armala and it is still ongoing. The government needs to step up to the plate and immediately take measures to relocate the people. The people also need to be made aware of the situation because when it all started, they were worshipping gods to stop the land subsidence. They also ignored the advice given by the authorities to stop planting paddy. In fact, this area had already been declared unsuitable for constructing houses. So, the people need to cooperate and the government needs to act now otherwise this crisis will prove to be fatal for the people of Armala.

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude towards Dr. Tara Nidhi Bhattarai for providing motivation, guidance and inspiring me to write this article. I would also like to thank my friends who helped me complete this article by providing valuable suggestions.

REFERENCES

- Dahal, R.K. (2013) *Causes of sink holes in Armala, Pokhara*, [Online], Available: <http://www.ranjan.net.np/ranjan/index.php/resources/armala-land-subsidence> [5 November 2015].
- Koirala, B. (2015) Sinkholes unleash terror among locals in Pokhara, [Online], Available: <http://thehimalayantimes.com/nepal/sinkholes-unleash-terror-among-locals-in-pokhara/> [18 July 2015].
- Yoshida, M. and Upreti, B.N. (eds) (2014) *Guidebook for Himalayan trekkers*, provisional 2nd edition, Hashimoto: Field Science Publishers.



Year of Admission-2069

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I was born in Phulk-2, Tehratur. But I spend my school in Sunsari. My schooling starts from Depot higher secondary English boarding school Dharan-16 and completed my slc from shreeSharbajanik higher secondary school which is very well known school of that place. After completion of slc, I completed my intermediate from Dhankuta Multiple Campus. After intermediate I moved to Kathmandu for my further studies. I tried for engineering course but I couldn't get succeeded. To give continuity of my further study I was admitted to Tri-Chandra College but I had no any idea for the selection of subject so, I consult to my seniors they advised me to choose geology, statistics and math. I get knowledge about mineralogy, crystallography, petrology, structure geology, sedimentology, economic geology, hydrology, geomorphology, engineering geology and many more during these four years study. These helped me a lot to know the geological evidence, facts, formation of earth, effects of and presentation of hazards, etc. Engineering geology is my keen interest.

Considering all the above facts mentioned based on my own wisdom and dedication the subject matter I would expect to be a competent engineering geologist on coming 10 years. If my dream comes true and would able to contribute as a engineering geologist for my country, Nepal.

The best book I have gone through is Jeevan Kaada Ke Phool by Jhamal Kumari Ghimire. The heart touching part of this book is her struggle for learn, live, and to be a good writer. She faced very hard situation and had done very hard labour to learn basic level of study is unbelievable and unforgettable.

Geology is a field oriented subject and time spend during our field work in Malakhu with our respected teachers and friends is unforgettable. It is a good opportunity to gain knowledge practically in front of eyes and to analyse their importance was really a great achievement for me. The field work like route mapping, individual mapping, and method of working and objectives of working was really very much interesting. Also the lecture of dedicated professors and the supportive friends made my field work period memorable. Besides, these the inspiration lectures of professors in geology depart everytime made unforgettable.

Relationship between Geology and Agriculture

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Abstract: This article describes the relationship between geology and agriculture. Earth is heterogeneous body and geology of different area is so vast different. This article answers that what is impact of geology and geological structure associated with agriculture. Also, the knowledge of geology helps in whole agriculture and its system. In these days mostly we applied modern technology and methodology to increase the ability to cultivate crops and it influenced the successes of civilizations. Geological knowledge of cultivated area is too much important to remediate hazards like landslide, sinkhole, rockslide, volcanic effects, floods, etc.

Key Words: *agriculture, geology, soil, hazard*

1. BACKGROUND

Geology is an earth science comprising the study of earth and materials which it is composed and the processes by which they change. Geology gives insight into the history of earth by providing the primary evidence for plate tectonics, the evolutionary history of life and past climates. Geology is important for minerals and hydrocarbon exploration and exploitation, evaluating water resources, understanding of natural hazards the remediation of environmental problems and for providing insights into past climate. Geology is overall study of earth material.

Agriculture is a cultivation of animal, plant, fungi and other life forms for food, fibre, biofuel, medicinal and other products used to sustain and enhance human life. Agriculture was the key development in the rise of sedentary human civilization whereby farming of domesticated species created food surpluses that nurtured the development of civilization. We used soil and water resources basically for agriculture. Soil is the foundation of agriculture and mostly we study about soil in geology. Also, geology of particular area affect badly in agriculture. Throughout human activity, our relationship with soil has affected our activity to cultivate crops and influenced the success of civilization. Thus relationship between humans, the earth and food sources affirm soil as the foundation of agriculture. Human use and management of soil and water resources have shaped the development, persistence, decline and regeneration of human civilizations that are sustained by agriculture. Soil and water are the essential natural resources domesticated animal and plant-based food production system. So, engineering of soil and ground water or any water resources which is essential for agricultural irrigation system is necessary to know for durable development of agriculture. Also geomorphology and soil type of agricultural area affects in agriculture system. For example-properties the ability of soil to grow crops in terai is more than hilly side and mountainous area.

2. OBJECTIVES

- To know the relationship between geology and agriculture.
- To study the effects of geology on agriculture.

3. METHODOLOGY

All the data were collected from secondary sources such as books, articles, national and international journals. The data were collected through various other means as through variety of websites and internet. For attractive format of the article, the materials from The Department of Geology of Tri-Chandra Campus are used. Finally, all the collected materials are prescribed systematically in the form of article.

4. RESULTS AND DISCUSSION

4.1 Relationship between geology and agriculture

Geology is the study of earth including the history and origin of rock and soil of which the earth is made further it also can be defined as science which comprise the study of solid earth. Soil is formed by weathering rocks and all weathered rock cannot produce fertile soil. Mostly, soft type of rock like pyrites, gypsum, and calcite weathered quickly and gives useful soil for agriculture purpose. So, types of rocks also play an important role to form fertile soil. We study about properties of soil in detail in geology.

Geology of agriculture area also gives some idea about occurring of possible geological hazards like landslides, rock flow, debris flow, volcanic products etc which directly related to agriculture. The geology of an area changes through time as rock unit are deposited and inserted and deformation process changes their shape and location. Rock Unit are first emplaced either by deposition onto the surface or intrusion into the overlying rock. Deposition may occur when sediments settle onto the surface of the earth and later convert into sedimentary rocks, or when as volcanic materials such as volcanic ash or lava flows to meet the surface.

After the initial sequence, rock has been deposited, the process start to weathered rock onto small fragments various rock forming. The materials left over after the rock stroke down combined with organic materials creates soil. The soil is the foundation of agriculture. The property of well weathered soil and other is different.

More preciously, geology of particular area refers to earth materials rocks (soil formation), evolutionary history, drainage pattern, geological structure which affect to agriculture. For example-production rate of irrigated area, fertile land and other area is different.

Soil and water are essential natural resources for our domesticated animal and plant based food production system although of fundamental importance today, agriculture is the relatively recent human innovation that spread rapidly across the globe only 10000 to 12000 years agoduring the agricultural revolution. This short, yet highly significant period of time, represents less than 0.3% of the more than four million years of human evolution as pedal hominids and ultimately homo sapins. In many cases, stressed, declining civilizations adapted or re-emerged into new or similar complex culture. Through such fluctuations, we have remained dependent on a relatively small number of crops and animal species for food and on integrated soil water systems that are essential for production.

Agriculture sustains and decline our modern lives but it is often disruptive of natural ecosystems. This is especially true for plant communities, animal population, soil system and water resources and essential task in human effects to sustain and improve human well-being. Although, agriculture is essential for human food and stability of complex societies. Our social evolution has accelerated since the agricultural revolution takes place synergistically with human biological evolution as we have dependent on domesticated plants and animals grown purpose fully in highly managed soil water system.

In this way geology of cultivated area were changed respectively due to cultivation many forest area become a cultivated land. Deforestation, conventional agricultural system and lack of geological knowledge of agriculture occurred many geohazards.

4.2 Soil-The foundation of agriculture

Soil is formed by different geological processes like leaching, eluviation, podsolization, etc. Basically, when rock undergoes weathering soil is formed. Soil is made up in part of finely ground rock particles, grouped according to size as sand and silt in addition to clay, organic material such as decomposed plant matter.

Each component and their size play an important role in agriculture. For example-the largest particles sand determine aeration and drainage characteristics while the tiniest sub microscope clay particle are chemically active binding with water and plant nutrients. The ratio of these size determine soil type: clay, loam, clay-loam, and silt-loam and soon. In addition the mineral composition of the soil humus (organic material) also plays an important role in soil characteristics and fertility of plant life.

Soil which have organic materials is more fertile and sandy and gravel loam are not so fertile. Fertile soil has following properties:

- 1) It reaches in nutrients necessary for basic plant nutrition including nitrogen, phosphorus and potassium.
- 2) It contains sufficient minerals (trace element) for plant nutrition including boron, chlorine, cobalt, iron, manganese, magnesium, molybdenum, sulphur and zinc.
- 3) It contains soil organic matter that improves soil structure and soil moisture retention.
- 4) Soil PH is in the range 6.0 to 6.8 for most plant but some prefer acid and alkaline conditions.
- 5) The range of microorganism that support plant growth.
- 6) It often contains large amounts of top soil.

The irrigation of water is very important to maintain soil fertility and filth and for using more soil depth by the plants. When soil is irrigated with high alkaline water unwanted sodium salt build up in the soil which would make soil draining capacity poor, then the root of plant cannot penetrate deep into the soil for optimum growth. So, water used in irrigation purpose should be clean. Also, all the cultivated area cannot be irrigated. Due to geological impacts, irrigational water is not available everywhere, everyplace. So, ability of agricultural product must be different in different geological region.

4.3 Agricultural hazards and its management

The soil which is first eroded is typically the organic and nutrient enriched surface layer which is highly beneficial for plant growth. Thus, the primary on-site outcome is reduced crop yield as only the less fertile sub-surface layer remain. Soil erosion also pollutes adjacent streams and waterways with sediments, nutrients, and agrochemicals creating serious off-site impact. Historically, conventional agriculture has accelerated soil erosion to rates that exceed but of soil formation. Erosion is often accelerated by agricultural practises that leave the soil without adequate plant cover and therefore exposed to raindrop splash and surface runoff or wind (Singer and Munns, 2006).

Steep terrain, vulnerable soils, heavy rainfall and earthquake activity make large parts of Asia highly susceptible to landslides. The significance of landslides is set to increase in the coming year as a result of population growth, expansion of infrastructure, and increased forestry and agricultural activity in the region. Landslides cause environmental damage of forests and agricultural resources by removing topsoil,

blocking rivers and increasing downstream sedimentation. Scientific studies confirm the crucial role of trees and forests in preventing landslides not only by reinforcing and drying soils, but also in directly obstructing smaller slides and rockfalls. However, the role of trees and forests in the case of deep-seated landslides or in extreme events is unlikely to have any effect. Landslides are a growing hazard in Asia and it is important for policy-makers to understand when, where and how trees and forests are useful in reducing landslides. So, deforestation due to agricultural purpose is one of the most important to occur landslides. And earthquakes being a other helping factor to occur landslides. By the effect of repeated quakes many land has fractured and when water we use as irrigation purpose is inter in this fracture and causes landslide.

5. CONCLUSION

In conclusion it can appear that agriculture and geology are interrelated. Geology of cultivated area also plays an important role to produce crops, and the geological knowledge is also essential for sustainable development of agriculture. Due to modern agricultural system, the rate of production is increase but everywhere it is not environmental friendly. So, ecosystem is changes day by day and it affects the geology of that area. Also, many geological hazards can influenced and can loss many crops and cultivated area, to protect it from possible geological hazards, geological knowledge is essential.

Earth is heterogeneous body and geology of different area is off-course different and we can't grow crops using same method and technology, we have to apply several methodology and technology in several region. Due to different geology, the agricultural technology for hilly and mountainous region and ability of soil to grow crops is more.

ACKNOWLEDGEMENT

I would like to express my respected sir Dr .Tara Nidhi Bhattarai for the inspiration to write. Also, I would like to thank my friend as well as the chief editor Suman Bhattarai and also all the editorial board for their valuable comments and inspiration to write this article. I would like to thank my other teachers and my colleagues for the support and hope to get it again and again.

REFERENCES

Singer and Munns, (2006) Soils: An Introduction, 6th edition



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I was born in Lucknow, India. I completed my schooling from Sagarmatha Higher Secondary Boarding School, Beltar, and Udaypur and completed my +2 from Banu memorial College, Birathnagar, Morang.

Knowing information about geology from elder, I admitted in Bachelor level for B.Sc at Tri-Chandra Campus. When I attended first lecture classes of Geology in first year, I was quiet interested and inspired from the teachings of the teachers of geology department.

The most unforgettable and interesting moments during my study was field work to malekhu, during 3rd year because I got chance to learn any things and made many friends.

With all the all the comments mentioned above I would like to thank to my colleagues and teachers who helped me in every aspect of learning. Finally I would like to thank the editorial board for providing the opportunities to mention few words.

Status and Conservation of Lowland Terai Wetlands in Nepal

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Abstract: Known as "Simsar" in Nepal, wetlands are those areas which lie between the land and deepwater and remain waterlogged or submerged under water, seasonally or throughout the year. Generally the land is so muddy that one cannot easily walk over it, and water is so deep that one can neither swim nor get drowned. River floodplains, shallow margins of lakes and reservoirs, shallow and seasonal ponds, islands in rivers, deepwater paddy fields, and sea-coasts are typical examples of wetlands. Wetlands are essential for the free ecosystem services that they provide to the human community. The most obvious are maintenance or improvement of water quality, groundwater discharge and recharge, erosion control, flood protection and flow stabilization, storm dampening, healthy ecosystem functions, soil building, foodchain production, nutrient cycling and biogeochemical processes, habitat for wildlife, sites for research and environmental education, cultural heritage, open space preservation, aesthetics, tourism and recreation.

Key Words: *simsar, foodchain, biogeochemical, tourism*

1. BACKGROUND

They are also important because attention has been turned recently to using wetland systems and the plant species occurring therein as bio-energy sources and also for use in pollution abatement projects to filter sewage, agricultural runoff, leachate from landfills, and acid mine drainage mitigation (Brooks, 1989; Oliver and Hill 1998). It is the constellation of these and other functions and values that the wetlands are recognized as the 'Kidneys of the landscape' or called as 'biological supermarkets'. Unfortunately, the wetlands are being degraded today mainly due to pollution from sewage and industrial effluents, and from overexploitation of resources. The wetlands are rapidly disappearing because of the general notion that they are waterlogged and unproductive lands which harbour disease-carrying insects, pests and poisonous snakes. They are drained and/or filled for agriculture, human settlements and industries besides being rapidly silted due to large scale deforestation in surrounding areas, and they are also being dried up in many places as rivers are dammed and channelized for the generation of hydroelectricity and other purposes. James, A. and J. Hubbick 1969. Studies on some high altitude lakes in the Hindukush Himalaya. *Verh International Verein Limnology* **17**: 362-372.

2. OBJECTIVES

The main objective of this are mentioned below

- To recognize and formulate the laws.
- To conserve and distinguish the problems and solving them.

3. METHODOLOGY

This article is prepared chiefly through literature review method. Some books and mostly online articles were consulted to gather the required information.

Wetland types

Nepal extends along the Great Himalayan Range between the latitudes 26°20' N to 30°27'N, and longitudes 80°04'E to 88°12'E, covering a distance of 885 km (from east to west), average width of 193 km (from south to north), and estimated area of 147181 sq km. The elevation of the country rises from 60 m, mean sea level in the southern Terai to the crest of the Himalaya (the home of perpetual snow) reaching up to 8848 m at Mt. Sagarmatha (Everest) in the north. About 70% of the country is drained by four major river systems originating in the higher Himalayan Zone: Sapta Koshi in the eastern part, Sapta Gandaki (Narayani) in the central part, Karnali in the western part and Mahakali in the far-western part of the country. Several medium size rivers originate in the midland zone or in the Mahabharat range (Rapti, Bagmati, Kamala, Kankai, Tinau, etc.) whereas small rivers mostly seasonal in character originate from the Siwalik (Churia) ranges and dissect the Terai plain. Nepal has only freshwater wetlands. The Department of Agriculture Development (1992) has estimated that wetlands occupy 743563 ha or roughly 5% of Nepal's total land area (Table 1). (Department of Agriculture Development 1992.)

Wetland Types	Estimated Area(ha)	Percent
Rivers	395000	53.1%
Lakes	5000	0.7%
Reservoirs	1380	0.2%
Marshy Lands	12000	1.6%
Village Ponds	5183	0.7%
Paddy Fields	325000	43.7%
Total	743563	100.00%

Table 1. Estimated area of various wetlands in Nepal (DOAD 1992)

The country has approximately 6000 rivers and rivulets, including permanent and seasonal rivers, streams and creeks (WECS 2002). The major river systems - Mahakali, Karnali, Gandaki and Koshi - originate in the high altitude snow covered mountains and are 'permanent' in nature. On the other hand, rivers/rivulets originating in Siwalik/Terai are seasonal in nature and major water flow exists only during the monsoon (mid-June to October). All the rivers of Nepal drain into the Ganges River System in India through the Terai region, giving rise to ox-bow lakes or ponds and floodplains. The lentic water-bodies are classified as glacial, tectonic and ox-bow types depending on their geological origin. The lakes that occur above 3500 m, msl are mostly of glacial origin. They are generally moraine dammed, but some like the Thulagi glacial lake of the Manaslu area are dammed by an ice body (Hanisch et al. 1998). The largest glacial lake is Rara (1036 ha) located at an altitude of 3000 m, msl, followed by Shey Phoksundo (452 ha) and Tilicho (4919 m., msl; area 40 ha) lakes. Lakes and ponds of mid-hill and mountain regions (below 3000 m, msl) of Nepal are considered tectonic in origin and are thought to have been created in depressions caused by land subsidence. The famous lakes of Pokhara valley - Phewa, Begnas, Rupa, Khaste, Dipang, Gunde, Kaalpokhari and Maidi belong to the tectonic category. Mostly the ox-bow lakes and ponds occur in the Terai plain of Nepal plant succession. Marshes are extensive near the streams and rivers of the Terai floodplains.

General Biodiversity

Wetlands are crucial for the conservation of both migratory species as well as several globally threatened biodiversity in Nepal, in addition that they support many species of flora and fauna including the endemics. In terms of flora, it is believed that 25% of the countries estimated 7000 vascular plant species are wholly or partially wetland dependent (Joshi and Joshi 1991). Nepal's wetlands also hold several species of wild cultivars and wild relatives of cultivated crops, including four species of wild paddy - *Oryza granulata*, *O. nivara*, *O. officinalis* and *O. rufipogon* - and two species of wild relatives of paddy - *Hygrorhiza aristata* and *Leersia hexandra*. The globally threatened bird species that are wetland dependent include: (a) Critically endangered: Pink-headed duck (*Rhodonessa carryophyllacea*); (b) Endangered: greater adjutant (*Leptoptilos dubius*), and lesser florican (*Sypheotides indica*), and (c) Vulnerable: Baikal teal (*Anas formosa*), swamp francolin (*Frankolinus gularis*), Baer's pochard (*Aythya baeri*), grey pelican (*Pelecanus philippensis*), Sarus crane (*Grus antigone*), Indian Skimmer (*Rynchops albicollis*), black-necked crane (*Grus nigricollis*), lesser adjutant (*Leptoptilos javanicus*), and band-tailed fish eagle (*Haliaeetus leucoryphus*). The key globally threatened mammals in Nepal that are wetland dependent include:

(a) Critically endangered: Pygmy hog (*Sus salvanius*); (b) endangered: Gangetic river dolphin (*Platanista gangetica*), wild water buffalo (*Bubalus bubalis*), greater one-horned rhinoceros (*Rhinoceros unicornis*), elephant (*Elephas maximus*), and tiger (*Panthera tigris*); and (c) Vulnerable: Indian smooth-coated otter (*Lutrogale perspicillata*), common otter (*Lutra lutra*), fishing cat (*Prionailurus viverrinus*), and barasingha (*Cervus duvaucelii*). Among the wetland dependent globally-threatened reptiles of Nepal are: (a) critically endangered: Bengal roof turtle (*Kachuga kachuga*); (b) endangered: three-striped roof turtle (*Kachuga dhongoka*), elongated tortoise (*Indotestudo elongata*), and gharial (*Gavialis gangeticus*). (Ambasht, R.S, 1971)

Threats to wetlands

There are a number of threats to wetlands in Nepal. These can be broadly categorised as habitat destruction and degradation, loss of ecosystem integrity, and depletion of species abundance and diversity. The human population (nearly 30 million) of Nepal has a growth rate of 2.5% per year. Since 81% of the population is engaged in agriculture, demand for the modification of wetlands to agricultural land, particularly paddy fields, will continue to increase, placing additional pressure on wetlands. Further, as wetlands are relatively inexpensive compared to farmland, they are often the favoured sites for reclamation for industrial use or housing in urban areas. Many of the wetlands of Terai region have no perennial source of water and they depend solely upon the monsoon rains. The draining of these wetlands, often by high-powered pumps to provide irrigation or harvest fish, leads to rapid drying out when at best they undergo vegetation changes and at worst are encroached upon for grazing or reclaimed for agriculture. The higher than average population growth rate in the Terai districts, stemming largely from high levels of immigration, has resulted in increasing pressure upon wetlands and forests that have become increasingly degraded and fragmented. This fragmentation has the effect of reducing previously extensive populations, especially of mammals and large reptiles, into genetically isolated subpopulations, many of which now risk falling below the threshold of population viability. [IUCN (The World Conservation Union), 2004]

4. CONCLUSION

Nepal has several legal and institutional arrangements relevant to wetland management. These include the Constitution of Nepal (1990), Nepal Treaty Act, Local Self Governance Act, Forest Act, Water Resources Act., Electricity Act, National Parks and Wildlife Conservation Act, Aquatic Life Conservation Act, Soil and Watershed Management Act, Environment Protection Act, etc. Recently, National Wetland Policy (2003) has been formulated to manage wetlands in participation with local people and community. However, insufficiency of budgetary allocation, paucity of survey and research information for scientific management, apathetic and lethargic attitudes of the concerned officials, corruption and irregularity induced from various levels of the government and society, and above all, lack of people's participation frustrate the fulfillment of aims and objectives of all these noble management policies.

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First and foremost I would like to express my humble gratitude towards our respected teacher Dr. Tara Nidhi Bhattarai. It's been an honor to write something on the magazine. I would like to thanks to all the teachers of geology department and my colleagues who supported me in my college career. And lastly the editorial board of this magazines, who are my friends as well.

REFERENCES

Ambasht, R.S. 1971. Ecosystem study of a tropical pond in relation to primary production of different vegetation zones. *Hydrobiologia* 12: 57-61.

DOAD (Department of Agriculture Development) 1992. National fisheries development plan, 1992/93. Fisheries Development Division, DOAD, HMG/Nepal, Kathmandu.

Hanisch, D.M. 1998. The Thulagi glacial lake, Manaslu Himal, Nepal- hazard assessment of a potential outburst. In: Proceedings of 8th International Conference of International Association for Engineering Geology and the Environment (Eds. D. Monre and O. Hungr), 21-25 September 1998, Vancouver. pp: 2209-2215

James, A. and J. Hubbick 1969. Studies on some high altitude lakes in the Hindukush Himalaya. *Verh International Verein Limnology* 17: 362-372.

IUCN (The World Conservation Union). 2004. A review of the status and threats to wetlands in Nepal. IUCN/Nepal, Kathmandu.



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I was born in Shivamandir VDC ward no. 2, Kawasoti, Nawalparasi. I completed my secondary level education from Shree Shiva Higher Secondary School, shivamandir-3, Nawalparasi. Then I joined Apex Academy for higher secondary level education. After completing my +2 I prepared for engineering entrance examination for Pulchowk Engineering College but couldn't succeed so I joined Tri-chandra College, Ghantaghar, and ktm. Honestly speaking I had no idea about Geology at that time. I had heard from the leaders of student union that the environment of geology class is good and I would get chance to have a field visit every year, and it has wide scope so I chose GPM combination.

The best book I have gone through till now is Cheena Harayeko Manchhe, an autobiograohy, by Hari Bansha Acharya. The storyline of Cheena Harayeko Manchhe is about a simple god-fearing man who lost his Cheena (Horoscope). The autobiography depicts the author's childhood memories, fantasies and struggles he had to face during his adolescent years to become a famous and successful person. The best thing about this book is that it gives inspiration and courage to deal the problems that we face in our life and be a optimistic person.

I couldn't pay good attention to geology class during my first year because I was preparing for entrance examination and also doing ILETS for abroad study. But meeting new friends from different places and listening their failure stories of MBBBS and Engineering entrance examination was fun because I felt good that I am not the only one. In geology I had to study about the things and process that takes place in nature so I had more interest in geology rather than mathematics and physics. Kakani was our first year field visit where we observed differ types of rock and tried to identify them and also observed geomorphic features. I felt geology could be understood clearly in the field rather than in books and classroom. Our second year field visit took place at Chovar where we got to know idea about Brunton compass and its use in measurement of strike and dip. In third year we had 15 days long field visit where we got a chance to interact with our teachers closely and cleared all the doubts that we had in mind from first year. I felt the importance of team work and got to know my friends from near. I got the idea about mapping techniques, preparation of columnar section and use of map.

Now I am in the fourth year, final year of BSC, but I have a lot to learn about geology and I want to be the best geologist in the future.

Geological Relation with Sustainable Agriculture

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Abstract: World population depends on the agriculture products for their life. A sustainable agriculture practice only can meets the agriculture demands of growing population of rising world. For that there need to be a vital realationship between sustainable agriculture and geology. If better agriculture practice is done with respect to the geology, then it will be fruitfull to everyone.

Key Words: *agriculture, geology, sustainable, farming*

1. BACKGROUND

A productive and sustainable agriculture system is fundamental to the wellbeing of a nation and cornerstone of its development. The need for sustainable agricultural productivity over a long period of time calls for effective resource management practices including soil, water and nutrient management. To increase soil productivity, food production and food security, farmers have not only increase nutrient concentration, but also improve the structure of the soil and reduces soil losses.. Use of imported water soluble fertilizer is another management practice that can replenish soil nutrients. Agricultural nutrient inputs include manures, fertilizers and geological resources with the potential to enhance soil productivity. In most of Sub-Saharan Africa, more than 50% of populations rely on agriculture for their livelihood which generally contributes more than 30% of GDP. In Nepal economy is dominated by agriculture. In the late 1980s it was livelihood for more than 90% of population although approximately 20% of total land area was cultivable, it accounted for an average about 60% of GDP and approximately75% of exports. According to recent data available more than 70% of population depends on agriculture. All around of us we see hills and valleys, rivers, seas and coastlines, rock and soils. Increasing use of artificial fertilizers, insecticides, pesticides and other chemical is reducing the fertility of soil. So the soil nutrient, pH and soil structure should be increased using naturally occurring mineral as fertilizers which are application of Agro geology. Since geology deals with properties and types of rock, soil, groundwater, it is very important for sustainable agriculture.



Figure 11: Women transplanting rice (Available:loupiote.com)

Rocks for Crops

Naturally occurring nutrient providing rocks are mineral such as phosphate rock, nitrogen and potassium salts, as well as other nutrient providing rock increase the fertility of the soil and production of crops. Agricultural limestone and dolomite and various ground silicate rocks are included in agrominerals. Some of the natural geological resource are only moderately soluble in the short term but can release their nutrient content into the soil over long period of time. Agromineral include rocks and minerals that improve the physical status of soil. For example: perlite is used to enhance aeration in artificial growth medium in greenhouse. Vermiculite and zeolite are minerals able to store and release nutrients and moisture slowly and volcanic scoria and pumice and other rock is used as 'rock mulch' to reduce evaporation.

Agromineral and Farming

With the exception of nitrogen, all plant nutrient resources for farming system are of geological provenance. In natural system nitrogen is harvested from the air by legumes or through N-fixing organism and recycled in the soil. Other nutrient critical for plant growth like P,K,Ca,Mg,S and micronutrients are supplied by geological resources. Weathering of rocks, as well as organic input,atmospheric deposition and resedimentation of soil material eroded for upper slope supplies, most of the nutrients essential for plant growth.Under natural chemical condition the physical break up, chemical weathering and release rate of nutrients from minerals is not far enough to provide nutrients for annual crop production. In the past soils were given rest period to recover and naturally replenish after periods of cultivation and harvesting. But these fallow periods have been shortened in recent years or even abandoned due to increasing pressure on the land base.(Van Straaten, P. 2002)These days soil is given no rest, continuous cultivation however requires continuous replenishment of soil nutrients. It has been widely recognized that the removal of nutrients from soils through repeated harvesting, leaching, ran off, erosions are too high to retain enough soils nutrients in the soil for sustained crop production. The result are that soils are mined. Van der

poll(1992)Smaling et al.(1993,1997) and smaling(1995) presented nutrients balance of the cultivated land base in various parts of Sub-Saharan Africa.

Due to substantial cuts in external aid and fertilizers subsidies, many developing countries rely more and more on their own nutrient resource and it is important to know the indigenous agromineral resources available to support a viable and sustainable rural agricultural economy.

The best known Agro mineral are: 1. Saltpeter 2. Phosphate rocks 3. Guano minerals, complex P and N-bearing compounds 4. Potash 5. K-silicate

Agro geology

The use of rocks and minerals at low cost, locally available geological nutrient resource for agricultural development. Agro geology is broadly defined as geology in the service of agriculture; a study of geological phenomenon that influence the distribution and formation of soils, and the application of geological material in farming and forestry system as means of maintaining and enhancing soil productivity for increased social, economic and environmental benefits (Chesworth and Van straaten1993;Straaten and Fernandes 1995). Geologist find delineate and characterize the geological raw material that address those need and process engineer contribute by concentrating the agro mineral and transforming them into more plant available forms.. A close liaison between geologist, process engineers and soil scientist must be kept throughout the exploration, development process and testing, as is the active participation of extensive officers and farmers.

2. ENHANCING SOIL PRODUCTIVITY WITH MINERAL

Many of the problem of tropical agriculture originate in the nature of soil (Sanchez 1976).Tropical soil commonly have inhevenly low fertilizer. They hav been exposed to long periods of weathering, which results in highly depleted soils with low organic matter, and an overall low inherent fertility. Common tropical soil such as oxisols and ultisols are acid and have low N and P status. Over cropping and inappropriate use of fertilizer can accentuate the soil related problems and can result in poor soil productivity and low crop yields. Existing agro mineral resource inventories have been compiled in many countries but have concentrated many or large deposits. There are however many more deposits in the world that have not been developed, most of them being of medium to small size. (Sherwoo, S and Uphoff N. 2000)

3. IRRIGATION AND GEOLOGY

In some areas sufficient rainfall is available for crop growth but many area require irrigation and

Groundwater is important source for irrigation. From Ground water investigation geologist can

Help in agriculture through irrigation.

4. CONCLUSION

Rock such as potash, gypsum, limestone and dolomite are rich in nutrients and can be used as

Fertilizers, directly adding to the soil. One of the biggest challenge is replacing and increasing

Phosphate in the soil. Geologist can play an important role in identifying, mapping and utilizing Phosphate rich rocks. Rocks such as scoria and pumice can be used to help retain water in the Soil and rocks such as limestone and dolomite can be used to decrease the acidity the acidity of Soil, raising the pH...

ACKNOWLEDGEMENT

I would like to express my gratitude to Dr. Tara Nidhi Bhatatrai, associate professor of Department Of Geology, for the opportunity and inspiration to write this article. I would also Like to thank the editorial board for their suggestion and comments. Special thanks to all the Teachers and colleagues for their support and hope to get in the future in the same way.

REFERENCES

- Van Straaten, P. 2002, Rocks for Crops: Agromineral of sub Saharan Africa, ICRAF, Nairobi, Kenya
- Sherwoo, S and Uphoff N. 2000, Soil Health: research, practice and policy for a more Regenerative agriculture, Appl Soil Ecol 15: 85-97



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I was born in Rampur-4, Gandakidhik, Palpa. I completed my schooling from Bhu. Pu. Sainik Boarding School, Rampur and +2 from Capital College and Research Center (CCRC), Kathmandu. After completing my +2 course I joined engineering preparation classes. At that time I knew about geology and its aspect through my brother and got admitted in Bachelor Level for Geology at Tri-Chandra Multiple Campus. When I first visited Tri- Chandra Campus, Ghantaghar, I was amazed seeing the large no. of students but the teaching methodology attracted me a lot.

The best book I have gone through until that time was 'Cheena Harayako Manchhe' written by Hari Bansa Acharya which is autobiography. The book conveys a message that hardworking person can lead a life rather than the god fearing person who believes in horoscope. Similarly, the best book I have read, published by foreign authors is 'The Alchemist' written by Paulo Coelho where he follows a young Andalusian shepherd in his journey to Egypt, after having a recurring dream of finding treasure there.

At the starting, the first year course made me difficult to adjust in class but the teachers expressed the knowledge in quite simple language so that the hardest become the easiest to me. During second and third year Structural Geology and Geology of Nepal Himalaya respectively were the most interesting classes. Not only this, the field visit at Kakani, Chobhar and 15 days long visit at Malekhu were we learned through practical aspect made the theory learned clear. Finally in fourth year, taking Geology as major, Engineering Geology has become my first priority towards the study where we learn geology in engineering methodology. Gaining knowledge about Engineering Geology, it helps to know about the infrastructural development for the development of whole nation.

Lastly, I would like to thank Tri-Chandra Campus, Department of Geology and our professors and lectures for providing deep knowledge, to fulfill my dream to be a successful geologist.

The article that I am interested is presented below.

Glacial Lake Outburst Flood (GLOF)

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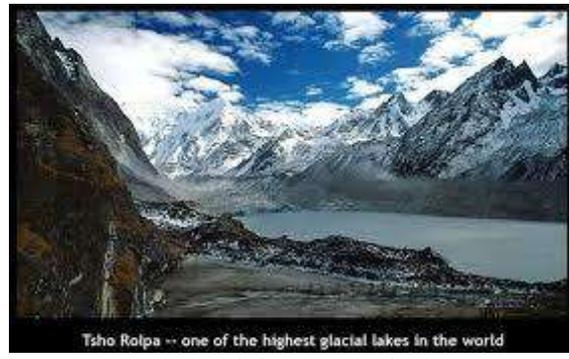
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Abstract: This article of glacial lakes and glacial lake outburst flood (GLOF) is conducted with the aim of knowing the causes of GLOF, developing recommendations for adaptation to, and mitigation of, GLOF hazards (potentially dangerous glacial lakes). The article is also intended to provide information about GLOF risk assessment methodology for GLOF risk management. Nepal Himalaya consists of higher mountains at high elevation and snow falls regularly to form glacier and glacier lakes. And many of them are at potentially risk level and the article also includes the GLOF events that have occurred in Nepal history and like to thank to all who encouraged me to write this article.

Key Words: *Glacier, mountains, avalanche, mitigation*

1. BACKGROUND

Glacier means the large sheet of ice which moves towards lower elevation due to the action of gravity. Glacier Lake is formed when the movement of block of ice melted is blocked by ice or due to the terminal moraines or may be due to the geomorphology of the movement path. When the blockage or dam formed explodes, then flood occurs which is called Glacial Lake Outburst Flood (GLOF). Thus GLOF refers to the flood occurred due to failure of the dam enclosing glacial lake formed by the glacier due to erosion of dam, 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.



*Figure 12 Glacier lake in Nepal
(Mikeldunham 2010)*

2. OBJECTIVES

Glacial Lake Outburst Floods being one of the disasters that causes the destruction of life and physical infrastructures. So, its study is important. The main objectives of the study are what the GLOF is, its causes and effects, how can we mitigate the effect of GLOF. Also the objective is to know the GLOFs events that have occurred in Nepal.

3. METHODOLOGY

The study mainly compromises the information obtained from websites, books and articles.

Causes

GLOFs occurs only when the dam which enclose the lake collapse. The main reason that help in collapse of dam are as follows:

- Due to increase in the pressure exerted by lake water by precipitation, melting of ice.
- Dam may fails due to active tectonic activities such as earthquake, volcano etc. around the lake area.
- If the wall contains ice block at the core of dam then dam fails due to ice melting.
- If the outlet of lake is blocked by some external agents or materials such as landslide.
- Drastic change in climatic condition also affects by melting of glacial ice, expansion and contraction in lake water and so on
- Some artificial activities such as blasting, use of explosives near the lake area also loose the dam strength.

Effects

GLOF is the natural disaster and is a catastrophic flood. The major effect of the GLOF is the destruction of the physical infrastructure present such as buildings, roads, bridges, hydropower stations etc. in the flooded area and loss of human lives.it also damage the man-made structures as well damage the fertile land and crops. However, the damage depends upon the type of flood hazard area, duration of flood, volume of water and its speed.

Preventive/Mitigation measures

GLOF can be prevented too much extent. Some of the measures that help in mitigating the effects of GLOF can be

- By making the sub discharges such as tunnel so that outlet should be equal or larger than inlet to reduce the volume of lake water.
- Around the lake area rock fall or landslide, ice fall and so on should be removed so that water pressure decreases which ultimately increases the dam strength.
- Decreasing the physical vulnerability, by shifting the residential areas and physical infrastructures towards the safe zone.
- Construction of GLOF hazard map.
- Study of the glacier and glacier lakes and their failure using geo-physical methods, aerial and satellite photographs, onsite observations and so on.
- Monitoring of lake storage volume, bottom of the lake, and dam strength.
- Establishment of early warning systems is essential: one related to communicating changes in water level in the lake with community participation, and another in the form of a mechanical system with sirens.
- GLOF risk reduction should be considered as a national as well as a local priority. (ICIMOD, 2011)

GLOF events in Nepal

In Nepal, many GLOF events had occurred regularly. Some of the GLOF events that occurred in Nepal are

Table 1: List of GLOF events recorded in Nepal

Date	River basin	Name of lake
450 Years ago	Seti Khola	Machhapuchhare
August, 1935	Sun Koshi	Taraco, Tibet
21 September, 1964	Arun	Gelaipco, Tibet
1964	Sun Koshi	Zhangzangbo, Tibet
1964	Trishuli	Longda, Tibet
1968	Arun	Ayaco, Tibet
1969	Arun	Ayaco, Tibet
1970	Arun	Ayaco, Tibet

3rd September, 1977	Dudh Koshi	Nare, Tibet
23rd June, 1980	Tamur	Nagmapokhri, Nepal
11th July, 1981	Sun Koshi	Zhangzagbo, Tibet
27th August, 1982	Arun	Jinco, Tibet
4th August, 1985	Dudh Koshi	Dig Tsho, Nepal
12th July, 1991	Tamo Koshi	Chubung, Nepal
3rd September, 1998	Dudh Koshi	SabaiTsho, Nepal

(After Thomas, K.J and Rai, S., 2005)

Not only this many other GLOF events had occurred in Nepal. Lastly, in May 05, 2012, GLOF event had occurred from the Annapurna and the Macchapuchre range which had killed many people.

5. RESULTS AND CONCLUSION

Nepal being a Himalayan country, at the higher elevation snow flows regularly and many glacial lakes are formed. Out of which some lakes are at potentially dangerous level. So, for the safety and to be preventive from GLOF events, its type, possible causes of collapse should be known so that the mitigation measures can be applied.

ACKNOWLEDGEMENT

First and foremost, I would like to show my gratitude to our respected teacher Dr. Tara Nidhi Bhattarai who had inspired us to write the article and also like to thank editorial board members for the valuable suggestion and re-correction of the article. This assessment wouldn't have been complete without the information that credited from reference books, websites so; in terms of information I have included in this article I will remain indebted to the related writer/author and publisher. And lastly, I would like to give thanks to all my teachers of Geology department and my colleagues for their wonderful support.

REFERENCES

ICIMOD (2011) 'Glacial Lakes and Glacial Lake Outburst Floods in Nepal', Kathmandu: ICIMOD

Thomas, K.J. and Rai, S. (2005) 'An Overview of Glaciers, Glacier Retreat, and Subsequent Impacts in Nepal', Nepal

Glacial Lake Outburst Flood, [Online], Available
(https://en.wikipedia.org/wiki/Glacial_lake_outburst_flood)



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As a quick introduction; I was born in Phasku VDC, Ward No.1, Sanghute village of Dolakha district. I had attended S.L.C level examination from Sai Shikshya Niketan High School and +2 from Universal College, Kathmandu. Initially, there was no hard and fast rule for me where to admit for the under graduation programme. However, one of my mentors, who taught me in the school level suggested me to join the Tri Chandra Multiple Campus with the combination of Geology. I had startling feeling when I joined the college. First the mass of the students and I, am very happy to be one of the student of first established college of Nepal but the management of college was very awkward to me.

Besides the education, I have a keen interest in mechanical workshop of electronic gadgets, playing guitar, visiting new places with my friends, hiking and to read the newspaper to follow up the present scenario of Nepal and the whole world. Geology was quite anonymous to me as this subject was not emphasized in the school level. After joining the Tri Chandra Multiple Campus, my vision to the geology subject was crystal clear. My first two year at this college enhanced smoothly. The field work of first year and second year became the foundation to me and rest of my friends too. Moreover, the 15 days field work at Malekhu motivated me and I came to know about how important the field work was to the students of geology. Nepal is complex in terms of geological structure and the formation of Himalayas. So, for me to be a good geologist, the field work was backbone, where I learnt to distinguish the rocks, formation and morphology of that area. Similarly, the field work at Butwal- Tansen area for 28 days was more fruitful to me because the geology of that area was more complex and I had good opportunity to learn more from the field work.

From my four years of learning, I came to know that geology is the backbone of my country. If we properly manipulate the broad field of geology it will be the boon for the country. In Nepal, geology subject is almost unknown to people. Hence, we need to promote this field, so that in near future we can apply our knowledge to develop the Nepal.

I am not more concern about what will happen to me after 10 years. However, from my childhood I want to be a good leader and somehow after choosing BSc in Geology I believe that I am one step closer to my dream. I hereby declare that I will serve my nation as an Engineering geologist.

Groundwater Management in Kathmandu Valley: An Overview

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Abstract: This article identifies some related facts, existing problem and management of groundwater in Kathmandu valley. Due to growing population, demand of water is rapidly increasing day by day. To meet water demand people exploit groundwater haphazardly. In Kathmandu valley there is absence of scientific management of groundwater. Unsustainable manipulation of water, nonexistence of research of availability of groundwater, rate of discharge and recharge is not monitored by any kind of authority sector. Groundwater depletion is seen in valley due to pollution on its near sources. Some study and article reported that there is drawdown of water level of groundwater due to over exploitation of it. By analyzing these points, there should be scientific and sustainable management and manipulation of groundwater in valley need to be implemented. Some content of this article will be suitable for stateholder and authority for sustainable use of groundwater in Kathmandu valley.

Key Words: *groundwater management, Kathmandu valley, manipulation, drawdown, depletion*

1. BACKGROUND

Groundwater is commonly understood to mean water occupying all the voids within a geological stratum. It is strategic resource due to its usually high quality and perennial availability. However, groundwater management all over the world often lacks sustainability as evidenced by falling water tables, dry wet lands and general deterioration of water quality. As groundwater cannot be rewarded artificially on large scale, sustainable management of this resource is necessary. The Kathmandu valley which nestles capital of Nepal is located in central part of the country in between 27° 32' 13"-27° 49' 10" N latitudes and 85° 11' 31" – 85° 31' 38" E longitudes. The valley is located at upstream of the Bagmati river basin, which is one of stressful basins in the country in terms of fresh water vulnerability to environment change (Pandey et al 2010).

Groundwater is an important source of water for communities and industries in valley. Unfortunately, uncontrolled extraction and use of groundwater and improper management of both solid waste and wastewater from urban centers have increased the vulnerability of groundwater to depletion and degradation. Groundwater basin in the valley covers almost half of the total watershed area. Driven by increasing population, urbanization and industrialization extraction of groundwater took sharp rise in the mid-1980s. The extraction is gradually increasing even today. Nearly half of the total water supply from the governments authentic operator, Kathmandu Upatyaka khanepani limited (KUKL) during wet seasons and 60- 70% during dry season is derived from groundwater sources (ICIMOD,2007).As, a result annual extraction is exceeding recharge; leading to tremendous depletion in groundwater levels.

Groundwater resources In Kathmandu Valley

Kathmandu valley covers three districts. Kathmandu, Bhaktapur and Lalitpur cities, is circular basin covering 650 sq. km. The valley is filled with thick succession of Late Pleistocene and quaternary unconsolidated sediments of fluvio-lacustrine origin. The sediments covers have thickness of 550m to 660m in central part of the valley (Shaky and Shrestha et al, 2013). They are arenaceous sediments (sandy), argillaceous (clay) and intermediate type arenaceous and argillaceous deposits.

According to sediments distribution Kathmandu valley floor is divided into three groundwater districts (Shakya et al, 2013) as shown in figure 1.

- I. Northern groundwater district (NGD)
- II. Central groundwater district (CGD) Age 200000 years
- III. Southern groundwater district (SGD)

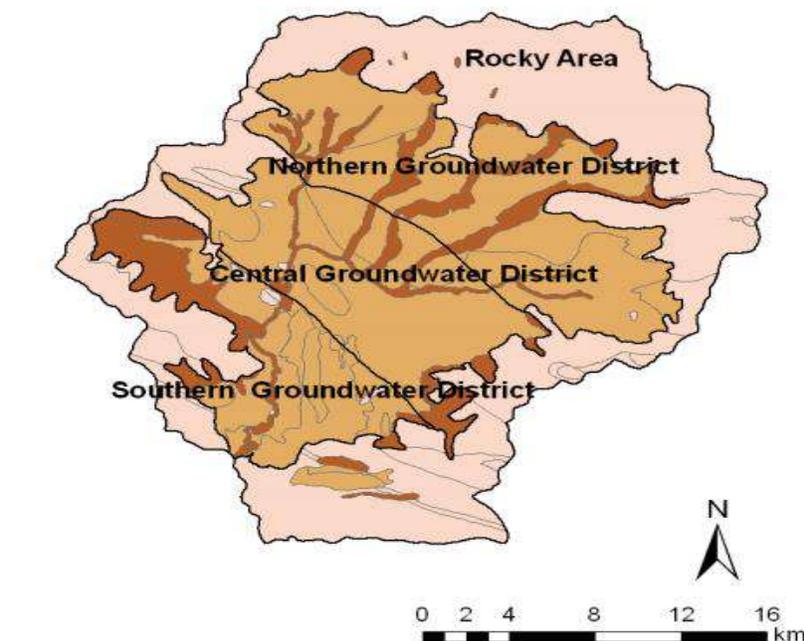


Fig 1: Geological formations and groundwater district of valley (Source: Soni M. Pradhanang)

2. OBJECTIVES

The objectives of this overview of article is to reflect the present scenario of manipulation of ground water in Kathmandu valley, groundwater depletion and degradation, quality of groundwater, demand of groundwater and management of groundwater.

3. METHODOLOGY

Information was collected through secondary source journals, books, related article and electronic media.

4. RESULTS AND DISCUSSION

In Kathmandu valley groundwater is manipulate basically for drinking water, industry and in some place for irrigation. KUKL use 50-60 of groundwater for the distribution of drinking water in valley. It shows that people are dependent of groundwater. Except KUKL water distribution people implant tube well, shallow tube well and deep tube well. Early 1980s people use tap stone and dug well for drinking water. But during manipulation of groundwater there is unmanaged extraction of groundwater, which is unwise and unscientific way of extraction. So, groundwater management is critical in valley because in some place there is one time reserve of water. Therefore, there is need of proper management of groundwater. Management of groundwater need, to meet water quality, water demand and its manipulation.

4.1 Water Quality, Degradation and its Demand

Quality of water is another factor for the management of groundwater. It can be used after lab treatment for drinking purpose and industrial use but can be easily use for irrigation. In, Kathmandu valley groundwater is more polluted in rainy season. It is extract from near Bagmati and its tributaries are more polluted than other part of valley. Dug well, hand pump, shallow tube well and deep tube well is less polluted in descending order of pollution. Recharge zone for Kathmandu valley is Gokarna which is less polluted but if not carefully monitored in near future recharge zone will be polluted. Several studies over different point of time report variation in groundwater quality in shallow and deep aquifers. Shallow aquifers is contaminated by E-coil and nitrates probably due to improper domestic and industrial waste management system and that in deep aquifer is contaminated of ammonia, arsenic, iron and heavy metals. Sewage is being discharged into rivers without pre-treatment. Some industries inject their effluents into the aquifer.

Day by day water demands is increasing rapidly with increasing population. But comparison to demand of water, only 40% is fulfilling by other sources and remaining water is exploiting through groundwater. The present demand in Kathmandu valley is 325 MLD (million liters per Day) but 90 to 140MLD of water is available for supply. Discharge of groundwater in valley is more than recharge.

4.2 Management of Groundwater in Valley

- Hydrogeological maps identifying aquifers, geological formations major groundwater resources need to be studied in detail.
- Along the geological formations quality and quantity of groundwater should be studied thoroughly.
- Regular monitoring of groundwater quality parameters must be done.
- Safe pumping rates must be determined.
- Reliable water supplies in Kathmandu valley from other sources need to be designed for sustainable use, which reduce need for groundwater pumping.

- Policy of groundwater act should be implemented.
- Controlling board should be made for the effective monitoring for groundwater.
- Sewage should be discharged only after pretreatment.
- Training center should be run for the groundwater technicians by government as well as private sector.
- Artificial recharge of groundwater.

Groundwater is valuable resource of the country, that's why it is needed to have a responsible government agency to protect it. Alternative source for supplement of water supply in Kathmandu valley, an appropriate technology is to be applied in the limestone terrain (Shakya et al, 2013). So, in Kathmandu valley there should be effective management of groundwater for the well sake of the population and its demand. But discharge is more than recharge of groundwater in valley, so alternative source should be explored. In valley artificial recharge of groundwater can be done in Monohara River. Therefore if right decision is not made in right time one day valley will face a big crisis of water. So, there should be scientific management of groundwater.

ACKNOWLEDGEMENT

I would like to express my gratitude towards editorial team for providing their valuable time. In, the same way my thanks go to senior Hydrogeologist Nir Shakya for his guidance and suggestions to complete this article. I would like to thank my friends who helped me directly or indirectly. And, finally my sincere thanks goes to Dr. Tara Nidhi Bhattarai who motivate and provide proper guidelines to write this article for Geoworld vol 7.

REFERENCES

ICIMOD (2007) Kathmandu valley environmental outlook: International center for integrated mountain development, hillside press (P) Ltd. Kathmandu

Pandey VP, Babel MS, Shrestha S, Kazama F(2010) vulnerability of fresh water resources in large and medium Nepalese river basin to environmental change.

Shakya N and Shrestha S R groundwater Resources in Nepal and role of GWRDB in its management, Department of Irrigation (DOI), proceeding of National Irrigation (2013)



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Born in Baletaksar V.D.C ward no.6, Harre village, Gulmi. I attended Shanti Adarsha Secondary School and completed +2 from Jaya Multiple Campus, Kathmandu. Knowing information about geology from Santosh Phuyal, my close friend, I admitted in Bachelor Level for B.Sc. at Tri-Chandra campus. Ghantaghar attracted me a lot because it was something I have read in history book but it was my first time I visited there. I was impressed a lot and took some photographs of Ghantaghar.

I admit that I could not pay good attention to geology class during my first year course. I was preparing for engineering but I could not be successful. Then only I started concentrating my study in geology course seriously. Although, I have learned many fascinating knowledge of Geology, I was much delighted to know that we could study the interior of earth and could also know the Mechanism of earth and study the common things in deep sense.

The most unforgettable moment during my first year was the moment with my friend Santosh who not only helped me to cover my classes that I have missed but also encouraged to go to library and study hard and he also provided me the books we should study to get information. He was in opinion that student life is for learning and we should not miss any opportunity to utilize the facility available at Tri-Chandra Campus.

While coming at the end of Second year course, I started liking Sedimentary petrology where I know very much about how the sediments go through several processes like erosion, transportation and deposition in sedimentary basin. Not only this, the rock cycle was something new and interesting. During my 3rd year my attention was towards geophysics, a subject that helped us in understanding the earth's internal structure and studies the interior part of earth easily. Besides I was equally enthusiastic to study Geology of Nepal Himalaya because this subject convincingly helped me to understand how the bottom of an ocean became the world's highest peak. Those facts encouraged me to select Geology as a major subject in my 4th year study. During 4th year study, geological mapping exercises tool to know how the rock types and geological structures are changing horizontally and vertically in area.

Considering the facts mentioned above and also based on my wisdom, I would expect to be a successful person in the field of Geology and could achieve my aims.

Sustainable Use of Ground Water

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Abstract: Ground water is the main source of water in today's context. It is known that everything has its own advantages and disadvantages. Ground water gives us a lot of benefits that it helped to balance environment and raise economy. Ground water is being used continuously in place of surface water due to unavailability of surface water, we cannot separate today's life without ground water. Ground water should be used in proper way and its haphazard use should be used and there should be wise and sustainable ways. There should be wise idea to utilize ground water and how to save it from adverse effects hazards. By analyzing this article people will be clear that ground water is our essence and also become aware to use it wisely in a sustainable way. Also it gives ideas about ground water and its areas and scopes.

Key Words: Ground water, sustainable, contamination, recharge and surface water

1. BACKGROUND

Groundwater is the source of nation's water resource. Groundwater supplies us with the water, we daily need and fulfill our daily activities. Approximately 25 percent of the earth's total fresh water supply is stored as groundwater while less than 1 % is stored as in surface water resources such as river, lakes, and soil moisture. The rest of fresh water supply is locked away in polar ice and glaciers. (Alley 1999a). In fact, until 1984; courts in Ohio held groundwater movement "secret" and "occult" (Cline 1984).

Ground water is the main essence of the people and it plays role in public health, the environment and the economy. In context of our country Nepal, surface water supplies are unavailable or inadequate, and groundwater is the main source of water supply. Ground water feeds streams and rivers especially during periods of drought. The agricultural industry uses ground water for irrigation. The nation's aquifers have been estimated to receive about one trillion gallons of recharge each day (Nace 1960) but the recharge rates vary greatly from regions to regions as well as within regions. In spite of large availability, many parts of our country are suffering from lack of water. 26 of 28 states agencies responding to a National Ground Water Association (NGWA) Survey perceive current or anticipate groundwater supply shortages at a state wide or local level in next 20 years. To be safe from hazard, it is important that we understand the factors to contribute to local, regional, or state wide groundwater shortages that can be implemented to promote a sustainable groundwater supply and what resources or tools are needed to implement the strategies successfully and in a proper way.

2. OBJECTIVES

- To get general idea about groundwater sustainability.

3. METHODOLOGY

The information was collected through various internet sources, related articles and books.

Factors that contribute Groundwater Shortages

Increasing population has direct impact on the balance of supply and demand on nation's groundwater resources. The largest census to census growth took place from 1990 to 2000 which accounted for an increase of 32.7 million people. The continuously increasing population hampers the availability of groundwater and it also uses it haphazardly and it hampers a lot to the people.

Many agents or aspect helps in contamination of groundwater. Agricultural chemicals impact ground water supply quality in many parts of country. Contamination of nitrate from fertilizers and animal waste is common. Naturally occurring constituents, such as arsenic, radium, or chloride render some groundwater unusable for drinking or other purposes without treatment. The impacts of groundwater contamination are still unknown understanding public health concerns and the realities and support of remediation techniques must be considered simultaneously when making public policy decisions.

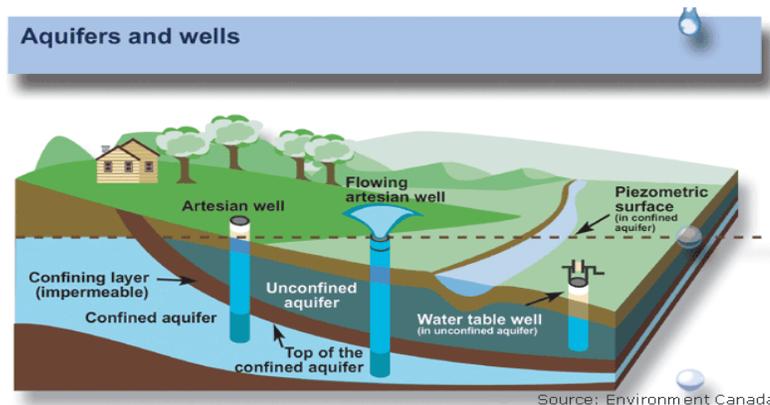


Figure 13 aquifers and wells (environment Canada)

Increasing efforts to protect and enhance in stream flow and aquatic ecosystem

Groundwater contribution to stream flow varies from small and medium sized streams estimates that between 40 to 50% is from groundwater seepage (Alley 1999). Surface water also provides a source of groundwater recharge. The potential for impacts to in-stream flows and aquatic ecosystem may in some cases, limit the amount of ground water available for extraction. Natural resources can't be used without any effects on them. so, we can make informed decisions and sustainable compromises.

Natural Ground water resource and recharge variability

Different geologic formations retain water differently. Sand and gravel formations have more pore space to store and release ground water. Precipitation will generally run off in areas overlain with tight soils or hard rocks, such as shale or granite. Fracture is dominated aquifers have low capacity to store ground water and an uneven distribution of permeable zones where wells can be completed.

In some areas of country, ground water currently being withdrawn entered the aquifer as recharge thousands of years ago.

Methods available to promote a sustainable groundwater supply

Ground water sustainability involves development and use of groundwater to meet both current and future beneficial purposes without causing an acceptable consequence.

1. Use sources of water other than local groundwater: Surface water may also be fully unavailable and allocated. In these areas additional alternate source of supply is being investigated or will be investigated in the future. Another idea is also increasing recharge to the groundwater system.

2. Use aquifers as reservoirs

In short term reduction is balanced in long term with replenishment, groundwater can be used much like a ground reservoir to store water for use when other sources are in short supply. On local scale some water utilities around the country use aquifer storage and recovery (ASR) wells to store water in an aquifer from an alternate source when an excess water is seasonably available.

Developing a groundwater sustainability strategies

Determining which methods or the combination of methods to imply in a particular situation to promote a sustainable groundwater supply generally should:

- Be made at local level where there is state, some government submit or an aquifer or groundwater basin level.
- Provide for meaningful community involvement
- Respect state water laws
- Comply with federal environment and public health goals
- Be based on sound scientific data and research.

4. CONCLUSION

Groundwater is the best alternative source of water resources. Ground water is the basic source of people's need rather than surface water and it should be consumed wisely. There should be proper use of ground water and use of fertilizers should be minimized so that ground water would be conserved. There should not be over use of ground water and sustainable use of ground water should be carried out. Policy and laws should be implemented in proper way and haphazard use should be stopped to protect environment.

ACKNOWLEDGEMENT

At first I am grateful to my college Tri Chandra College for giving me the opportunity to study 4 year B.Sc. (Geology). I am grateful to Dr. Tara Nidhi Bhattraï for all kind of inspiration to write an article. I would like to thank all the members of editor board for their valuable comments, advices and inspiration to write. Similarly I would like to thank all others teachers of Geology Department and my colleagues to encourage me to write the article.

REFERENCES

Alley, William M., Thomas E. Reilly, and O. Lehn Frank. 1999a. Sustainability of ground-water resources. U.S. Geological Survey Circular 1186. 7 p.

Arizona Department of Environmental Quality. February 2003. Arsenic master plan, executive summary. EQR 03-02. 1p.



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I was born in Okhaldhunga district, shared some of the childhood memories there and grew up in Kathmandu valley. I completed my schooling and college from VS. Niketan Education Foundation.

Throughout my life I have possessed a keen interest in Geology. I am in awe of the natural of the world. When I was young, I was mystified and enthralled by the sheer size of the peaks and the mountains. Questions such as, how did these formations come about, why are peaks called peak valleys called valleys etc., kept popping into my head. Because of this trip, I began to explore careers that may answer this question or allow investigation for related questions and I stumbled upon the Geosciences. During my school years I couldn't study geology much, I just got to build up a foundation of knowledge. On top of this, my personal study has given me a deeper understanding, and engaged me with a desire to learn more. I became particularly fascinated with the makeup of the earth. To further my understanding I wished to read Geology. So, I joined Tri-Chandra Multiple Campus.

Geology is a good field of study that doesn't get much respect from the average people. A lot of people have no idea what a geologist does. I often get asked by people "what can you even do with a geology degree" or "so you look at rocks all day.....wow." I simply smile back as I know action speaks more than words.

Most people, like myself do not enter college as a Geology student. Often they decide to study geology after taking the first Geology class. I was always interested in geology; however, I didn't start my college career as a Geology student. After taking the introduction lecture and lab I saw that I excelled at it and figured out it was for me. I could not have made a better choice. This field fits me.

Besides Geology, I do have keen interest in Mythology though haven't gone thoroughly through the testament of Bibles, Geeta, Koran and all. I love to watch cartoons no matter what my age is. I love listening to music; Hip-hop and R&B is the genre I prefer. I love listening to EMINEM the most because his music is one of the most powerful medium that affect my soul to the deepest levels. He is my source of inspiration and my role model. I also love football. Well, I never did play it actually but I love watching footballers chasing that one ball. I must say I am a diehard fan of BAYERN MUNCHEN.

This is a very competitive world, and what I believe is that the man is the sum total of reaction to the experiences; we are what we experience. Knowledge comes from academics and wisdom comes from experiences. I chase wisdom not academics. However, because I am a futuristic person I know that my life has a deep meaning and purpose my goals and aspirations motivate me to keep moving forward.

Throughout my varied educational and vocational background; studying Geology has always been my eventual aim, and I feel that the wide knowledge and experience I have gained has improved all my personal attributes which I believe will play an integral part in my studies of Geology. Looking beyond anything else, I want to pursue a career as a Geologist.

Ophiolites: The Founding Pillars of Plate Tectonics

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Abstract: This article contains the introduction of an ophiolite its occurrence as nappe or mélangé. Ophiolites consist of a distinctive assemblage of mafic to ultramafic rocks, which, in complete bodies, includes mantle peridotites, gabbros, plagiogranites, sheeted dikes, mafic volcanic rocks and minor sedimentary rocks. Sheeted dyke complexes are taken as evidence of extension in a seafloor-spreading environment. Complete sequences are very rare and most ophiolites consist primarily of peridotite, gabbro and basalt, typically with tectonic contacts. Although ophiolites are distributed along continental margins, their emplacement does not necessarily reflect final closure of the ocean basin in which they formed. Thus, several ophiolite belts may occur within a broad suture zone between continental blocks. Thus, ophiolites in the geologic record provide evidence primarily of subduction zone tectonics, not mid-ocean ridge spreading. Although they typically lie between continental blocks, their emplacement may predate final closure of the ocean basin in which they formed by many millions of years.

Key Words: *Ophiolite, ophiolite pulses, mélangé, mineralogy of ancient plate tectonics, ophiolite suit*

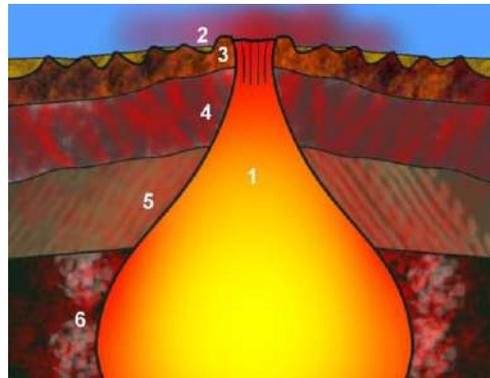
1. BACKGROUND

An ophiolite is a section of the Earth's oceanic crust and the underlying upper mantle that has been uplifted and exposed above sea level and often emplaced onto continental crust rocks. Ophio is Greek for *snake* and lite means *stone* from the Greek lithos, after the often-green-color rocks (spilites and serpentinites) that make up many ophiolites. The term ophiolite was originally used by Alexandra Brongniart for an assemblage of green rocks (serpentine, diabase) in the Alps; Gustav Steinmann later modified its use to include serpentine, pillow lava and chert ("Steinmann's trinity"), again based on occurrences in the Alps. The term was little-used in other areas until the late 1950s to early 1960s, with the recognition that this assemblage provided an analog for oceanic crust and the process of seafloor spreading. This recognition was tied to two events:

- The observation of magnetic anomaly stripes on the seafloor, parallel to oceanic ridges systems, interpreted by Frederick Vine and Drummond Matthews to represent the formation of new crust at the oceanic ridge and its subsequent symmetric spreading away from that ridge.
- The observation of a sheeted dike complex within the Troodos ophiolite (Cyprus) by Ian Graham Gass and co-workers, which must have formed by repetitive extension of crust and intrusion of magma, resulting in a formation consisting of 100% dikes with no older wall rocks preserved within the complex.

Moores and Vine concluded that the sheeted dike complex at Troodos could form only by a process similar to the seafloor spreading proposed by Vine and Matthews. Thus, it became widely accepted that ophiolites represent oceanic crust that had been emplaced on land. Their great significance relates to their

occurrence within mountain belts such as the Alps or the Himalayas, where they document the existence of former ocean basins that have now been consumed by subduction. This insight was one of the founding pillars of plate tectonics, and ophiolites have always played a central role in plate tectonic theory and the interpretation of ancient mountain belts. [(electronic)available:<https://en.wikipedia.org/wiki/Ophiolite>]



1. Axial magma chamber
2. Pelagic sediments
3. Pillow basalts
4. Sheeted basaltic dykes
5. Intrusive, layered gabbro
6. Dunite/peridotite cumulates

Figure 14 A simplified structure of an ophiolite suite(<https://en.wikipedia.org/wiki/Ophiolite>)

Ophiolite occurs as a nappe or as a mélangé (tectonic mixture of fragments). In collisional orogenic belts, ophiolites generally lie on older continental basement. In circum-Pacific orogenic belts, however, ophiolites generally lie on younger accretionary complexes.

2. OBJECTIVES

The main objective of this article is:

- To provide general idea about Ophiolites.
- To know about the formation and emplacement of ophiolite, their belts on the earth and ophiolites pulses.

3. METHODOLOGY

The information was collected through various internet sources, journals, related articles and books.

OPHIOLITES FORMATION AND OPHIOLITES EMPLACEMENT: Several studies support the conclusion that ophiolites formed as oceanic lithosphere. Seismic velocity structure studies have provided most of the current knowledge of the oceanic crust's composition. For this reason, a seismic study was carried out on an ophiolite complex (Bay of Islands, Newfoundland) in order to establish a comparison. The study concluded that oceanic and ophiolitic velocity structures were identical, pointing to the origin of ophiolite complexes as oceanic crust. The observations that follow support this conclusion. Rocks originating on the seafloor are of comparable chemical composition to unaltered ophiolite layers, from primary composition elements such as silicon and titanium to trace elements. Seafloor and ophiolitic rocks share a low occurrence of silica-rich rocks; those present have a high sodium and low potassium content. The temperature gradients of the metamorphism of ophiolitic pillow lavas and dykes are similar to those found beneath ocean ridges today. Evidence from the metal ore

deposits present in and near ophiolites and from oxygen and hydrogen isotopes suggests that the passage of seawater through hot basalt in the vicinity of ridges dissolved and carried elements that precipitated as sulfides when the heated seawater came into contact with cold seawater. The same phenomenon can be observed near oceanic ridges in a formation known as hydrothermal vents. The final line of evidence supporting the origin of ophiolites as seafloor is the region of formation of the sediments over the pillow lavas. They were deposited in water over 2 km deep, far removed from land-sourced sediments. Despite the above observations, there are inconsistencies in the theory of ophiolites as oceanic crust, which suggests that newly generated ocean crust follows the full Wilson cycle before emplacement as an ophiolite. This requires ophiolites to be much older than the orogenies on which they lie, and therefore old and cold. However, ophiolites were found to have undergone emplacement when young and hot by radiometric and stratigraphic dating: most are less than 50 million years old. Ophiolites therefore can't have followed the full Wilson cycle and are considered atypical ocean crust. [Moores E. M. and F. J. Vine (1971)]. There is yet no consensus on the mechanics of emplacement, the process by which oceanic crust is uplifted onto continental margins despite the relatively low density of the latter. All emplacement procedures share the same steps nonetheless: subduction initiation, thrusting of the ophiolite over a continental margin or an overriding plate at a subduction zone, and contact with air. (Ben-Avraham, Z. et al. 1982)

OPHIOLITES PULSES: Reported formation ages of ophiolites show three distinct peaks at about 750, 450 and 150 Ma, respectively (Fig:2). These are called ophiolite pulses. Each pulse corresponds to the period of worldwide magmatic event as represented by voluminous granite intrusions. Production rate of oceanic crust was distinctly high during the 80 and 120 Ma interval of Cretaceous time, as evidenced by wide area of the ocean floor formed in this interval. Magnetic reversals of the earth, which take place every million years, were unreasonably absent during this interval. These facts lead Larson (1991) to a hypothesis of super plume, a big plume of hot mantle which ascended from core/mantle boundary and erupted beneath the South Pacific Ocean during this interval, causing worldwide magmatic event. This interval corresponds to the latter half of the Mesozoic ophiolite pulses.

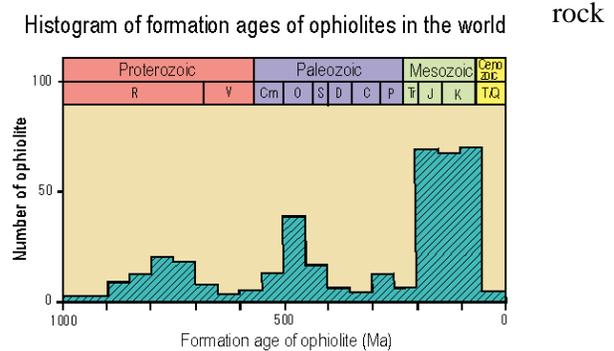


Figure 15: histogram of formation of ophiolites in the world after Ishiwatara 2007

OPHIOLITES BELT ON EARTH: Ophiolites issued by each pulse tend to form a particular ophiolite belt. Late Proterozoic (ca. 750 Ma) ophiolites are distributed in the Pan-African orogenic belt, early Paleozoic (ca. 450 Ma) ophiolites appear in the Appalachian-Caledonian-Uralian belt, and Mesozoic (ca. 150 Ma) ophiolites dominate the Alpine-Himalayan belt (Fig.3). However, the circum-Pacific orogenic belts bear ophiolites of widely varying ages, including at least two pulses (early Paleozoic and Mesozoic). This may be due to continuous, subduction-induced, accretionary orogeny that have taken place in the circum-Pacific areas from early Paleozoic to the present, showing contrast to the episodic, short-lived, collisional orogeny in the continental areas. Circum-Pacific ophiolites may be the best witnesses of the history of super plumes. (Ishiwatari, A 2001)

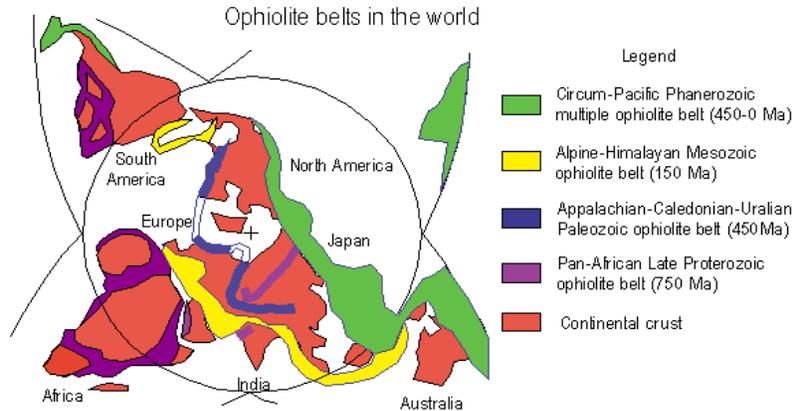


Figure 16: Ophiolites belts on earth after Ishiwatari, A (2001)

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Firstly, I would like to thank our chief editor Mr. Suman Budhathoki for his assistance and for his comments that greatly improved the article. I would also like to show my gratitude to my friend Pawan Katwal, seniors and also to the chief editor of Geo World Vol 5 Mr. Navin Thapa for sharing their pearls of wisdom with me during the course of this article. And also I am immensely grateful to my professor Dr. Tara Nidhi Bhattarai for his encouragement to write this article.

REFERENCES

Ben-Avraham, Z. et al. (1982) "The emplacement of ophiolites by collision," *Journal of Geophysical Research: Solid Earth* (1978-2012) 87, no. B5, 3861-3867.

Ishiwatari, A (2001) Introduction to ophiolites, Established 99/02/03, revised 01/11/24.

Kearey and vine (2009), *Global Tectonics*, Wiley-Blackwell A John Wiley & sons, Ltd, 3rd Ed.

Moore E. M. and F. J. Vine (1971), *Philosophical Transactions of the Royal Society of London*, 268A, 443-466

Ophiolites, Online available: <https://en.wikipedia.org/wiki/Ophiolite>



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I was born in Palungtar, Gorkha. I completed my SLC and +2 from Amar Janta Higher Secondary School. I decided to join bachelor's degree in Geology at Tri-Chandra Campus as per my sister's decision. I find myself wise and lucky to be a student of Geology.

I love Singing. It's more like a passion to me. I love listening to songs of various genre. They give me inner happiness.

These four years at Department of geology have been very interesting. The theory classes, the practicals and the field works are a good source to learn about Earth. They are very interesting. Considering the facts and according to my own wisdom. I would expect to be a reputed geologist in 10 years from now.

Geology and Its Scope

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Abstract: Geology is an earth science comprising the study of solid Earth, the rocks of which it is composed, and the processes by which they change. Geology can also refer generally to the study of the solid features of any celestial body (such as the geology of the Moon or Mars). Geology gives insight into the history of the Earth by providing the primary evidence for plate tectonics, the evolutionary history of life, and past climates. Geology is important for mineral and hydrocarbon exploration and exploitation, evaluating water resources, understanding of natural hazards, the remediation of environmental problems, and for providing insights into past climate change. Geology also plays a role in geotechnical engineering and is a major academic discipline

Key Words: *geology, geologist, scope, branches of geology, importance of geology*

1. BACKGROUND

The word geology is derived from two Greek word Geo, "Earth" and logos, "Discourse". It is the science that pursues an understanding of earth. Geology does not Focus just on rocks but all the processes that happen on the earth including erosion, earthquake, volcanoes, rivers, oceans, landslide as well long term evolution of earth's atmosphere, surface and life. Geology is the study of the Earth, the materials of which it is made, the structure of these materials and the processes acting upon them. It includes the study of organisms that have inhabited our planet. Geology also interact with other science Hydrology, mineralogy, and palaeontology.

From ancient time, study of earth science has great importance to understand the structure of earth and geological process of earth surface. The present world is suffering from different natural environmental problem to get rid from such problem. The study of geology is most important also the scarcity of oil and petroleum are almost run out due to continuous and non-renewable source of energy so to find out economically important oil, gas, coal by using geological mining knowledge of geology study is important. To solve the natural hazard and calamity the geology play vast role. The scope of geology is also far. The student who wants to study geology or wants to be geologist have great future and its scope able subject too.

2. OBJECTIVES

The main objectives of this article are:-

- To learn about Geology and the branches of Geology
- Relationship between the Geology and the Environment
- Activities of Geologist in present and at past.

- To know about the scope of Geology and the importance of Geology.

3. METHODOLOGY

Information were collected through secondary sources such as guide book, articles, website etc.

4. DISCUSSION

Geology is a multi-disciplinary subject, which includes study of mineral (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 (Palaeontology), the development of sedimentary strata (Stratigraphy). It is a field oriented, scientific discipline which investigates the properties of the earth and give the knowledge of rocks, minerals, mountains, earthquakes, volcanoes, rivers, glaciers, landslides and floods fall into this broad field.(Adams, F. D., 1938)

Branches of Geology

For studying the earth in detail, the subject of Geology has been divided into various branches as follows.

- Physical Geology:** Physical geology is deals with the natural processes which bring change upon the earth's surface.
- Petrology:** It deals with the origin, structure, texture and mineralogical composition of rocks.
- Mineralogy:** It deals with the minerals, their composition, characteristics, mode of occurrence and origin.
- Structural Geology:** It deals with the study of structures of rocks in the earth crust.
- Stratigraphy:** It is the science of the description, correlation and classification of strata in sedimentary rocks.
- Geomorphology:** It deals with the study of landforms.
- Palaeontology:** It is the study of plant and animals fossils that are found in the rocks of past geological periods.
- Crystallography:** It is the study of external and internal atomic form of the crystalline minerals.
- Historical geology:** It focus to understand the origin of earth and its development through time.
- Economic geology:** It deals with the study of minerals deposit, their mode of formation and occurrence etc.
- Engineering geology:** it deals with the application of geology knowledge in the field of engineering for the construction of dams, bridge, tunnels, building, roads etc.
- Hydrology:** It deals with the occurrence, distribution of groundwater and its movement.
- Geophysics:** It is the branch of geology which deals with the application of physics i.e seismology, meteorology etc.
- Geochemistry:** It deals with the chemical composition of earth, distribution and migration of various elements in the parts of the earth.
- Mining Geology:** It deals with the application of mining and extraction of minerals.

Geology and the Environment

Environmental Geology represents a vital link between the two more conventional fields of environment and geology. Environmental geology provides a means to appreciate and identify geological features that

could have short and long term consequences to the overall performance of all biological and physical environments. 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 minimising the treat 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.(Van Bemmelen, R. W., 1961)

What Does a Geologist Do?

Geologists work to understand the history of our planet. The better they can understand Earth's history, the better they can foresee how events and processes of the past might influence the future. Here are some examples:-

Geologists study earth processes

Many processes such as landslides, earthquakes, floods and volcanic eruptions can be hazardous to people. Geologists work to understand these processes well enough to avoid building important structures where they might be damaged. If geologists can prepare maps of areas that have flooded in the past they can prepare maps of areas that might be flooded in the future.

Geologists study earth materials

People use earth materials every day. They use oil that is produced from wells, metals that are produced from mines and water that has been drawn streams or from underground. Geologists conduct studies that locate rocks that contain important metals, plan the mines that produce them and the methods used to remove the metals from the rocks.

Geologists study earth history

Many geologists are working to learn about the past climates of earth and how they have changed across time. This historical geology news information is valuable to understand how our current climate is changing and what the results might be.

SCOPE OF GEOLOGY

Engineering Geology: A well-established interdisciplinary branch of Science and Engineering has a scope in different fields as outlined below:

- In Civil Engineering: Geology provides necessary information about the site of construction materials used in the construction buildings, dams, tunnels, tanks, reservoirs, highways and bridges is provide by Geology. It is most important planning phase, design phase and construction phase an engineering projects.
- 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, coals and oil shale are found in sedimentary rocks.

IMPORTANCE

- Geology provides a systematic knowledge of construction materials their structure and properties.
- Geology is significant in locating water supplies, building and highway placement and mineral resources such as gravel, stone, oil and mineral deposits.
- The knowledge of groundwater, 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 tunnelling, 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 harbour 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.
- Geological maps and sections helps considerably in planning many engineering projects.
- Geological features like faults, joints, beds, folds solution channels are suitably treated to increase stability of the structure.

5. CONCLUSION

The conclusion of this article is to provide the whole information about the geology and the geologists. The study of geology mainly concerns itself with the study of earth's origin, structure, composition and history and the nature of the processes. Geologists contribute their part to the nation through the discovery of new deposits of rocks and minerals of economic value. Geological field trip is one of the most important part of geology. Field sites are ideal places to observe different types of landforms, mineral, rocks and geological structures.

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REFERENCES

- Adams, F. D., 1938, The Birth and Development of the Geological Sciences. New York, 506p. (Dover reprint, 1954.)
- Van Bemmelen, R. W., 1961, The scientific character of geology, Jour. Geology 69, 453–46



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I was born in Pyuthan. I completed my SLC from Satya Secondary School and my intermediate from Gyan Jyoti College. Knowing information about Geology from my lovely brother, I admitted in bachelor level for B.Sc. at Tri-Chandra College.

The best book I have gone through until that time was “You Can Win” written by Shiva Kheda and published by Macmilan, India. It helps to change our attitude, and the book conveys a message that a person must have a great power to become success in life.

Considering the facts mentioned above and also based on my own wisdom, I would expect to be an Engineering Geologist in coming days.

Water Pollution

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Abstract: Over two thirds of Earth's surface is covered by water less than a third is taken up by land. The water we obtain from natural sources is not always safe to drink. It contains living and non-living impurities. As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, oceans, rivers, and other inland waters are being 'squeezed' by human activities –not so they take up less room, but so their quality is reduced. Poorer water quality means water pollution. As industrialization has spread around the globe, so the problem of pollution has spread with it. When Earth's population was much smaller, no one believed pollution would ever present a serious problem. Water pollution has many causes and characteristics. Usually, it means one or more substances have built up in water to such an extent that they cause problems for living beings.

Key Words: pollution, degradation, toxic, implementation, contamination

1. BACKGROUND

Water pollution has always been a major problem throughout the world, lacking suitable water used for drinking, farming, and agriculture. For the past several years, many countries have been affected by water pollution and it also affects the environment, agriculture and the society. If we don't do something and start acting together, then it might be a little too late. We all need to prevent further pollution and find ways to make it better.

2. OBJECTIVES

1. To identify, exchange and transfer knowledge, experience and existing good practices in water management between the partnership, both from more experienced partners to less experienced partners but also between various kinds of institutions (public authorities, knowledge institutes) that can all have their specific knowledge;
2. To jointly develop integrated master plans focused on the development of either new lakes or wetland areas and thus achieve better quality results;
3. To ensure the particle implementation of the master plans and identified good practices by jointly developing action and funding plans for each region, identifying the key steps to be taken and relevant funding opportunities.
4. To improve local and regional policies in the field of water management and other relevant policy fields, such as spatial planning in each region in order to pave the way to further water related climate change adaptation and future lake and wetland development/ nature regeneration and thus sustain the quality of the living environment for future generation.

3. METHODOLOGY

Firstly, we have to organize awareness programmer to the people about how we preserve the natural resources. All related information about water pollution was collected from different journal, article and different websites. Field investigation was also done.

4. FIELD INVESTIGATION AND DATA COLLECTION

With billions of people on the planet, disposing of sewage waste is a major problem. According to 2013 from the World Health Organization, some 780 people (11 percent of the world's population) don't have access to safe drinking water, while 2.5 billion (40 percent of the world's population) don't have proper sanitation (hygienic toilet facilities); although there have been great improvements in securing access to clean water (Hogan,2010).

Causes of water pollution

1. **Sewage and waste water:** Every day we cook, do laundry, flush the toilet, wash our cars, shower and do many things that use water. Think about how we use water in schools, hospitals and public places. This is very dangerous because they contaminate the environment and water bodies and bring many deadly diseases to us.



Figure 17 sewage and water (eSchooltoday)

2. **Septic tanks:** Every domestic (home) toilet is connected to septic tank usually located outside the house. Each time poop is flushed down the toilet, it goes into this tank, where the solid part is separated from the liquid part. Biological processes are used to break down the solids and the liquid is usually drained out into a land drainage system. From this stage, it can escape into the soil and nearby water bodies.
3. **Ocean and marine dumping:** Again, think of the rubbish we all make each day. Paper, waste, food waste, plastic, rubber, metallic and aluminum waste. In some countries, they are deposited into the sea. All these waste types take time to decompose. When these end up in the sea, they harm sea animals and cause a lot of water animal deaths.



Figure 18 ocean and marine dumping (eSchooltoday)

4. **Underground storage and tube leakages:** Many liquid products (petroleum products) are stored in metal and steel tubes underground. Other sewage systems run in underground tubes. Overtime, they rust and begin to leak. If that happens, they contaminate the soils, and the liquid in them end up in many nearby water bodies.
5. **Atmospheric:** Atmospheric deposition is the pollution of water bodies caused by air pollution. Each time the air is polluted with sulphur dioxide and nitrogen oxide, they mix with water particles in the air and form a toxic substance. This falls as acid rain to the ground, and gets washed into water bodies. (eSchooltoday ,2008)

5. RESULTS AND DISCUSSION

Nowadays, water pollution is one of the biggest concerns of both the public and different governments. The influences even destroy creatures' habitat and the influence cannot be changed in a long period of time and it may even be fatal.

6. CONCLUSION

Water pollution is bad and it's not good for people to drink the water that's polluted and for all organisms that need water to survive. There are millions of people that don't have good clean access to water and that they even have to drink the bad polluted water for them to survive³, sewage can cause water pollution along with the toxic chemicals from industrial business. To try to stop the water pollution cleanup your yard and make sure there is no garbage left anywhere around in the area you live like the streets and neighborhood.

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REFERENCES

ESchooltoday,(2008) your cool facts and tips on Water pollution (online)
[available on] <http://eschooltoday.com/pollution/water-pollution/causes-of-water-pollution.html>

Hogan, M.C.(ed.) (2010). "Water pollution." Encyclopedia of Earth. National Council on Science and the Environment, Washington, DC.

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