In the memory of

Mitra Bahadur Rai

The publication entitled "Collection of Abstracts of Dissertations, submitted to Central Department of Geology" to be launched on the 23rd of April, 2001, will be a commemorative issue to our student, Mitra Bahadur Rai (M.Sc. 056/057).

It has been a year since the sad accident, which took our good student forever. I present my deepest condolences to the departed soul and his bereaved family.

I hope similar publications will continue in the department and such stimulating endeavours of the students will help the department to flourish.

Prakash Chandra Adhikary
Head,
Central Department of Geology,

Contents

Prologue

23rd April 2001

Dear Friends,

This "Collection of Abstracts of Dissertations" is just our attempt to catalogue the numerous dissertations that have so far been submitted to the Central Department of Geology, Tribhuvan University, Nepal. Although, there have been a multitude of dissertations submitted so far, we present here only a collection of few. This can be attributed to the redundancy and as well as the shortness of time in the preparation of this publication.

This inaugural issue is being presented as a commemorative issue in the memory of our friend, Mitra Bahadur Rai. His untimely death passes a year, today. Through this small attempt of ours, we hope to rekindle the good, lovable and friendly disposition of Mitra, that we have missed so much.

We hope that publication will receive continuity in the future, with much betterment and momentum.

Students of M.Sc. (Batch 1999-2001)

Basanta Devkota, Dev Krishna Shrestha, Ghanashyam Neupane, Govinda Ojha, Gyanendra Gurung, Kamala Kant Acharya, Kameshwor Yadav, Mahesh Thapa, Navaraj Neupane, Nirma Shrestha, Paresh Pandey, Prakash Dhakal, Rajesh Dunghana, Suchita Shrestha, Suhana Mool, Sunil Kumar Dwibedi, Suresh Prasad Khanal, Uddhab Mahato, Ujjwalla Bajracharya, Yadav Dhakal, Zakaria

This publication can be available on the internet at the URL `http://geocities.com/geologyofnepal/`

Electrical Resistivity Measurement in Physical Models of Sand and Cement

Basnet, Krishna Bahadur
42 pp.
July 1997 (2054)

Electrical resistivity methods were carried out on the models of sand and cement to know the electrical behaviour. Himal Cement, an ordinary Portland cement was mixed with the sand of different grain sizes at an ratio of 1:2 and 1:3 to make different models. The resistivity of the models was measured by using DDR2 resistivity meter and an ABEM Terrameter SAS 3000 C (more sensitive than the former) upto 28 days inside the laboratory. After that the models were brought to the ground and then resistivity was measured using pole-pole electrode spread.

It is known that resistivity, grain size and time duration of setting of models are interdependent parameters. The sand used in the study was of grain sizes 2 - 4.75 mm, 850 µm – 2 mm and 150 - 60 µm. The increase in the time duration increases the resistivity of the models of the sand of certain grain size at fixed sand/cement ratio. Similarly, the resistivity is increased with the increase in the grain size. When the models harden with the the time, the resistivity is also increased. The statistical treatment of the data obtained has shown that these parameters described above give strong relationships between each other and the best fit lines give the strong estimator of one variable with respect to the other variable of each four model.

Pole-pole spread is good for local scale resistivity measurements to know the effects of the models. The apparent resistivity pseudo-sections of different models show the similar patterns for each model. Although the models were more conductive than the ground, maximum current was concentrated there and current density increased and the models offered the high resistivity due to the resistivity paradox. Two low resistivity zones separated the high resistivity zone in the model. The sections show the effect of distinct effect of the model and also of the electrode arrangements.

Detailed Paleomagnetic Study of Durbing Formation, Lesser Himalaya, Dang Area

Soma Nath Sapkota
81 pp., illus ., photos
June 1994

Paleomagnetic investigation is carried on red sediments sampled from 12 sites in Northern Dang, Lesser Himalaya. The initial natural remanant magnetization (NRM) intensities of the specimen show a wide range 0.152 ~ 8.3 mA/m with the majority in the order of 3.5 mA/m. Due to high coercive forces of the remanance carrier. AF cleaning method was not capable of cleaning the secondary components so only progressive thermal demagnetization method was adopted. Demagnetization results were analyzed with the help of vector diagrams and stereographic projection.

Except the specimens from site SrO5, SrO6 and DB18 show a stable demagnetization behaviour and yield univectorial component of magnetization . This stable component was carried out by hematite. The mean directions after tilt correction are;
Reverse polarity D = 192.0^0, I = -23.1^0, K = 29.5, a_{95} = 8.2^0
Normal polarity D = 16.3^0, I = 16.3^0, K = 23.2, a_{95} = 14.2^0

The mean normal and reverse polarity directions are statistically anti-parallel and therefore pass the reversal test. Better grouping of directions after tilt corrections indicates a positive fold test. Therefore, remnant magnetization residing in hematite is most probably of detrital origin.

The combined (normal polarity and reverse polarity inverted to normal) in situ mean direction is D = 11.0^0, I = 29.5^0, K = 8^0, a_{95} = 13.2^0 where as tilt corrected, D =187^0, I = 21.2^0, K = 28.5^0, a_{95} = 7.0^0.

Paleo-latitude calculated from corrected mean directions is 10.9 ± 2.6^0 N. The probable age of remnance acquisition is interpreted to be Upper Eocene to Middle Oligocene (45 Ma to 29 Ma).

The study area underwent 31.7±10.9 westward rotation together with 2000±285 km northward motion since the acquisition of this primary remnance. These rotational and translational motions area presumably related to the collision of India with Eurasia and its gradual northward movement.

Geology of Kakani - Sheopuri Area, Central Nepal with special reference to Petrography

Bhattarai, Bhakta Raj
46 pp., illus., maps

The Sheopuri area is seperated from the Kathmandu basin by the Kolphu fault and its eastern extension by the Sunkosi fault. The Sheopuri gneiss is composed of pelitic, psammitic and siliceous crystalline schists intercalated by calcareous schists. These schists are converted into granite injection gneisses of lit part lit type with numerous small pegmatite dykes and stocks. The injected material area is very large in amount, especially in Kakani.

There is the presence of different mineralogical compositions such as of granite (tourmaline granite, Hornblende granite, Biotite granite), gneisses (Biotite gneisses, 2 mica gneiss, calc-gneiss), migmatite (agmatite, ptygmatic, gneissic), pegmatite, quaternary deposits.

Kakani Sheopuri area is highly affected by non-uniform metamorphism. There are mainly three types of rocks, migmatites, calc-gneiss, and gneiss. They must be syngenetically related because of being placed closely and might have simultaneously metamorphosed, although the pressure and temperature conditions are different. High-grade metamorphic rock, i.e. migmatite is situated to the granite body and followed by Biotite gneiss, two mice gneiss and calc-gneiss. That means the temperature is higher near granite body and gradually decreases towards the migmatite, Biotite gneiss, two-mica gneiss and calc-gneisses respectively.

Geology of the Kharidhunga Magnesite Mine area, North-East of Kathmandu Valley, Lesser Himalaya.

Dahal, Ranjan Kumar
80 pp., illus.
1997

The rock of Kharidhunga Mine Field area, north-east of the Kathmandu valley, have been stratigrafically divided into seven local formations, namely Pakhar, Sigre, Dhading Danda, Sildhunga, Gotang Khola, Mude geneiss and Kharidhunga Formations. Calcareous member of the Kharidhunga Formation have been named as the Orind Magnesite Bed. First four rock formations belongs to Nawakot Complex and the remainning into Kathmandu Complex (StÖcklin, J. and Bhattarai, K.D., 1977). Surfacial loose deposits of the area is classified from older to younger as Balephi Boulder, Thumpakhar, Dandapakhar, Boche, Rolekharka and Dangdunge Formations, of which Terraces of Dandapakhar to Dangdunge formations represent Holocene retreating glaciers. Structurally the area is disected by the Tauthali Thrust. The Pheda Khola and Ghatte Khola Faults has largely modified the landscape and deflected micro-scale hydrography. The cohesiveness and plasticity of soil of the area increased with their geological age.

Engineering Geological Study of the Katari-Okhaldhunga Road between Km 11+500 and Km 28+000, Eastern Nepal, Lesser Himalaya

Aryal, Arjun
72 pp.
June 1997

The engineering geological study of the Katari-Okhaldhunga Road between Km 11+500 and Km 28+000 was carried out. The road alignment passes through NW of Udaypur District, north of Katari Bazaar, from Patna Bhanjyang to Lapse. The area exhibits diversity in altitudes.

The area exhibits the Lesser Himalayan metamorphic rocks and gneisses. The area consists of the rocks of the Kunchha Formation, Nourpul Formation, Dhading Dolomite and Benighat Slate of the Nawakot Complex and Raduwa Formation, Bhainsedobhan Marble, Kalitar Formation, Chisapani Quartzite, Kulekhani Formation, Markhu Formation, and Tistung Formation of the Kathmandu Complex. Intrusions of gneisses obliterate the rocks of the Bhimphedi Group of the Kathmandu Complex. Main Boundary Thrust, Main Central Thrust, Sunkosi Thrust and Mahabharat Synclinorium are the major structures of the area.

The area comprised mainly of residual and colluvial soil. Soils are mainly coarse grained and sub-rounded to angular grain shape. Rock strength varies with weathering grade. The rock discontinuities are almost dry.

The road alignment mainly passes through the Mahabharat Range. The rocks proximal to the Main Boundary Thrust are highly crushed. In the are, gullies are of high gradient (more than 40 degrees at some places) and carry high bed load.

The numerous landslides at Km 14+000 was determined by the method of slices. The factor of safety is 0.9 in partially saturated condition (suppose). The Lapse landslide between Km 28+000 is a rockslide and is controlled by the rock structures. It is a typical wedge failure and factor of safety determined by using stability charts for friction only shows the probability of failure of the slope.

Urban Geology of Kathmandu

Poudyal, Ram Sharma
ii., 69 pp., illus., maps
1988

Urban geology of the Kathmandu Valley deals with the information on the geology, geo-technical characteristics, construction materials, geological constraints, seismicity and environmental conditions. Kathmandu is situated over a thick sequences of lacustrine sediments and the underlying bedrocks are limestone, slates, quartzites and metasandstone of Phulchowki Group and Group of the Kathmandu Complex (Pre-Cambrian to middle Paleozoic age). There are five classification of valley plain terraces such as T1, T2, T3, T4 and flood plain. The main soil types of these terraces are sand, silty clay and intermixed soil of inhomogeneous nature.

The typical type of foundations used in the is the continuous type of foundation for construction. Raft and Pile foundation are also used, but only in only rare cases. The surrounding mountains around Kathmandu have a good source of construction materials, such as limestone, slates and marbles.

The major geological hazards are flood hazards, earthquake hazard and as well as slope instability, in some cases. The area is seismically active, for Kathmandu is bounded by active faults of the Himalayas such as the Main Boundary Thrust (MBT) and the Main Central Thrust (MCT). Several faults in the valley are also quite remarkable.

Paleomagnetism of Dyke Rocks of the Ampipal Massif, Lesser Himalaya, Central Nepal

D.P Adhikari
vi., 70 pp., illus.
May, 1993

Paleomagnetism has been carried out on the suite of basic and ultrabasic dyke rocks, and low grade metasedimentary rocks from the Ampipal area, the Lesser Himalaya, Central Nepal. The initial natural remnant magnetization (NRM) intensities of the specimens show a wide range, varying from 2×10^{-7} emu/cc to 8.2×10^{-3} emu/cc with the majority in the order of 10^{-3} emu/cc. Progressive demagnetization of the NRM was made by the application of alternating field (AF), thermal (Th) and by their combination (AF - followed – Th) methods. Demagnetization results were analyzed with the aid of vector diagrams and stereographic projections. In many instances, AF and Th treatments are limited up to 80 mT and 570° C respectively.

Most of the specimens show a stable demagnetization behavior and yield univectorial component of magnetization. From about 28 % of the specimens no stable magnetic directions could be obtained. From the dyke rocks two separate stable magnetization directions were distinguished: a low – temperature (LT) direction carried by pyrrhotite and a high – temperature (HT) direction carried by titanium – poor magnetite. The titanium- poor magnetite component has reverse polarity (foliation corrected: D = 203.1°, I = 0.2°, k = 34.5, $á_{95}$ = 9.7°) while the pyrrhotite component has both normal and reverse polarity and the combined (normal polarity and reverse polarity inverted to normal) corrected mean is: D = 24.5°, I = 6°, k = 64.2, $á_{95}$ = 12.4°. The mean normal and reverse polarity directions are “statistically antiparallel”, therefore pass the reversal test, and show pre – folding origin as evidenced by the positive fold test. Both directions are interpreted to indicate the primary thermoremanent magnetization (TRM) acquired perhaps during initial cooling of the dyke rocks.

The combined (normal polarity and reverse polarity inverted to normal) in situ direction of the magnetization vector of the dyke rocks is: D = 17°, I = 24.3°, k = 6.6 $á_{95}$ = 19.5°, whereas the foliation – corrected mean is: D = 23.4°, I = 1.4°, k = 41.3, $á_{95}$ = 7.7°. The corrected mean inclination corresponds to an equatorial paleo-latitude (0.7 ± 3.8° N) of acquisition and the most probable age of remanence acquisitions to between 54 and 49 Ma (Early – Middle Eocene).

The low – grade metasedimentary rocks of the Kunchha Formation (Late Precambrian) exhibit stable LT normal direction (foliation – corrected: D = 24.7°, I = 8.1°) residing in pyrrhotite. This direction is similar to the LT direction of the dyke rocks, and hence represents the similar remanence age. So, it is interpreted to represent secondary remanence acquired most probably related to a thermal effect of dyke rocks emplacement or regional folding and metamorphism or their combination.

It is suggested that the study area did undergo a large – scale (3024 ± 420 km) northward motion since acquisition of this stable primary remanence at equatorial latitude. The mean declination on the other hand deviates eastwards by 40 ± 8.6°, which is interpreted in terms of clockwise rotation of the Ampipal area relative to the stable India since the time of remanence acquisition. These rotation and translation were presumably related to the collision of India with Eurasia and its gradual northward movement to Asia.

Collection of Abstracts of Dissertations

Engineering Geologic Studies of the Landslides in the Kulekhani Catchment, Central Nepal, Lesser Himalaya

Manandhar, Suman
130 pp., illus.
2000

Owing to natural calamities in the past few years, there has been a vast reduction of gross storage capacity of Indra Sarowar, the reservoir of the Kulekhani Hydropower. Unprecedented rainstorm of July 19-21, 1993 was accountable for the floods and landslides.

The study attempted to identify the mechanism and causes, to apply engineering geologic and geo-technical studies in rock and soil slides, to analyze the slope stability of the major landslides and to determine the safety factor of the wedge failures and soil slides. This was done through detailed investigation which includes geologic mapping, study of landslides, engineering geologic and geo-techincal studies and preparation of slope, landslide distribution and land use maps. Several tests such as Point Load Test, Schmidt hammer test, particle size analysis and Atterberg limit measurements were computed. A computer software, Spheristat was used for slope stability analysis and a Swedish method was used to determine the safety factor of wedge failures.

There were more than 300 large and small scale slides in the catchment, which include, debris slide, debris flow, rockslide (plane and wedge failures), rock fall, rock topple, soil creep and rotational soil slide.

The methods used to describe the stability of a slope are based either on the limit equilibrium of the limit state analysis. The shear strength parameters such as cohesion (c) and angle of friction (f) used in most soil slope analysis area based on either total stress of effective stress. The transnational soil slides (SL-1, and SL-2) at Horticultural Farm, Daman had stability numbers 0.19 and 0.108 respectively. For circular failure (SL-3), Swedish circle method (method of slices) was used and a factor of safety was calculated to be 0.66. Similarly, Bishop analysis gave the result of 0.89 (factor of safety).

Besides this, probabilistic analysis was done for circular failure. The ratio of moment capacity, M_C, to the moment demand, M_D is the factor of safety, which in many cases is a function of both c and f values (Lee et al., 1983).

The stability analysis of Bhotekhoriya landslide was complex. Both plane and wedge failures were observed. Wedge failure analysis showed the factor of safety was1.57. Similar type observed in the Khanigaon landslide and factor of safety was calculated (F=1.22). Lekhalitol and Tasar (T-2) landslides were determined as plane failure while Tasar (T-1) landslide was found to be toppling

Radial Vertical Electrical Soundings to detect Underground Tunnels and Cavernous Fissures around Davis Fall, Chorepatan, Pokhara Valley, Western Nepal.

Pandit, Rajesh
viii., 88 pp., illus.
1996

The typical intermontane basin is filled with Quaternary deposits brought mostly from the Annapurna Range by the Seti River. The problems of subsidence and failure; sinkhole development; formation of underground tunnels, caves and development of tension cracks are encountered in many places of the Pokhara Valley. The Electrical Resistivity (RVES) method is employed to delineate such features such as underground caves and tunnels.

The results of RVES have clearly reported not only of the presence of cavernous fissures and disturbed subsurface, but also the intensity and degree of caving at different depths within Pokhara. It was seen that the caving developed dominantly along NE-SW direction and also found to widen at greater depths. Thus, RVES is quite a reliable tech-

nique method in detecting such subsurface features.

The sounding survey indicated the unevenness in the type of sediments within each layer. Apparent Resistivity also indicated the fact that the distribution of sediments is not uniform both in vertical and lateral direction. These methods show sites of possible caving in certain areas.

Engineering Geological and Geophysical Investigation in the Agra Khola Basin, Central Nepal: A Case Study on the Landslide disaster of July 19-21, 1993

Poudyal, Tika Ram
117 pp., 34 figs, 16 plates
August 1995

The landslides and floods in the Agra Khola basin brought a huge economic loss. An unprecedented rainstorm during 19-21, 1993 in the catchment and subsequent floods and landslides caused a heavy loss of lives, properties and damages to the infrastructures in the area.

The major types of slope movement during the disaster are Debris Slides, Soil Slides, Plane Rock Slides, Debris Flow, and deep seated rotational slides. The landslides frequented on slope directions of rock discontinuities that area parallel to the natural slope of the hill. The frequency is high in Kulekhani Formation, which is represented by alternation of quartzite and phyllite.

Engineering geological and geo-technical data collected during the detailed study in the field are incorporated in the landslides determined the geo-technical details and properties of subsurface rocks and soil. The safety factor for Chisapani landslides was calculated to the quite stable.

Engineering Geological Studies of Landslides Induced by Disaster of July 19-21, 1993, the Agra Khola Basin, Central Nepal Lesser Himalaya

Thapa, Prem Bahadur

The Agra Khola basin lies in Central Nepal and occupies parts of the Makwanpur and Dhading districts. It is bounded by the latitudes 27°45' and 27°36' N, and the longitudes 84°58' and 85°7' E. The Agra Khola is the main draining river in the study area, which joins with the Mahesh Khola at Mahadevbesi. The Major tributaries of the Agra Khola are the Chalti Khola and Liti Khola. The altitude of the study area ranges from 600 m at the confluence of Mahesh Khola and the Agra Khola to 2509 m at the peak of Chisapani village. The study area is highly dissected and exhibits rugged topography in the south whereas it is smooth in the north. The streams flowing in the area form steep valleys and a few deep gorges.

High intensity rainfall of 19 - 21 July 1993 triggered off a large umber of mass movements in the Agra Khola basin of Central epal. It caused a heavy loss of human lives, property, and infrastructure. Landslides are distributed mainly in the upper part of the watershed especially in the vicinity of Chisapani, Chaubas, Dandabas and Chhap. Mass movements were rockslides, soils slides, and complex failures. 51 percent of mass movements are soil slides and 18 per cent are rockslides. Among the rockslides, 4 percent are deep-seated rotational slides. The large deep-seated rockslides were common on the north-facing dip slopes, whereas shallow slides were observed on the counter dip slopes and area occupied by granite. Soil slides occurred on slopes that were either deeply weathered or covered by colluvium and /or residual soils of thickness ranging form one to six metres. Types of material involved in the landslides are mainly soil. Maximum numbers of landslides were found in the Kulekhani Formation and at natural slope angles of 25°-45°. The mass moved out of landslide from the steep slopes of mountains that constituted a huge amount

of sediments and riverbed rises up to 5 m from the previous bed level. The upper catchment of the Agra Khola and the Chalti Khola down to their confluence are the main hazardous zone.

Groundwater Conductivity Measurements for the Study of the Gokarna Landfill Site and other Areas on the Bank of the Bagmati River, Kathmandu, Nepal

Tripathi, Ganesh Nath
2000

This dissertation works deals with the frequency domain electromagnetic techniques used to measure terrain conductivity at low induction numbers. This technique has been used predominantly in North America, particularly Easter Canada, now increasingly in Europe. The techniques are being used more widely because of its broad range of application, portability and ease of use of the instrument. This method is mainly applied to engineering and environmental studies.

This method was used to study the effect of near surface material to the material lying at greater depth. The material at or near the surface is found to be the controlling factor of conductivity effects from the depth. This method was also applied for the study of Gokarna landfill site. With the help of this method, the edge of the subsurface drain of the landfill site was determined. The study shows that the leachate migrated towards southeast, northwest and near the east of the site. The northwest direction represents prominent direction of subsurface drain. These highly contaminated liquids (leachate) can cause potential contamination of local potable water supplies. This study proves the applicability of electromagnetic methods in abandoned landfill sites to identify the boundary of the landfill and the subsurface drain of leachate.

Engineering Geological Studies in the Kulekhani Watershed and the Tribhuvan Highway (Between Km 30+786 And Km 38+559) with Special Emphasis to Landslide Distribution and Jointing Pattern

Dhar, Mahesh Singh
2000

The Kulekhani Watershed is one of the most important regions of Nepal, as the headwaters of the watershed operate two vital electric power stations (i.e. the Kulekhani I and the Kulekhani II). This hydropower project is only one of its types, as the reservoir of this project is an artificial lake, also known as the Indra Sarowar, which is constructed by damming the Kulekhani River in the SE corner of the watershed. The watershed is mainly affected by sedimentation, gulley erosions, and slides. Owing to these problems the study was confined within the watershed boundary of 126 sq km, including the geological condition, landslide distribution pattern, joining pattern of the area, and engineering geological studies along the Tribhuvan Highway.

Geologically, the area lies in the Lesser Himalaya of Central Nepal. In the study area, only the rocks of Kathmandu Complex exist. Quartzite, schist, metasandstone, phyllite, marble, and granites are well exposed in the area. The main structural feature of the area is the large synclinal mega-structure, the Mahabharat Synclinorium, in which the Chitlang Formation lies as the core.

Landslides are frequently observed in the area. One of the objectives of the study is to determine the type of landslide distribution pattern in the area. According to the Morishita Spread Index, the landslide distribution pattern in the area is of cluster type. Such type of distribution points out that the landslide distribution pattern in the area is independent or lithologies and also indicates that the new landslides will occur in the near by regions of the earlier landslides. This observation has great significance for landslide predication and control. In the study area, the landslides are mainly concentrated along the gullies

and the streamsides. Therefore, according to this theory, there are greater chances of recurrence of slides in such place in the future.

Next objective of the study is to study the jointing pattern of the study area. For this, joints were measured at different 46 locations randomly within the watershed boundary. The study showed that the joints are one of the major factors responsible for the instability. The main joint set in most of the location strikes NE – SW. The beds and the foliations in the area are dipping towards NE. Consequently, the NE facing hillslopes are affected by plane failure while SW facing hillslopes are affected by toppling. The greatest principal stress (s_1) direction is towards NE (38^o).

The engineering geological studies along the highway between km 30+786 and 38+559 showed that the segment mainly passes through the safe zone except at the places where it is crossed by the gullies. Haphazard excavation of rock along the road should be stopped. At some places, improper construction of the retaining structures have added more load and thus acted adversely. Therefore, a proper construction of the retaining structures is recommended.