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Geological study in Tal - Talekhu section of Manang District along the Besisahar – Chame Road

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ABSTRACT

The section between Tal to Talekhu of Manang District lacks the detailed geological study. The geological mapping in the scale of 1:50,000 followed by the preparation of geological cross-section and lithostratigraphic column has been done in the present study. The studied area lies partially in the Higher Himalayan Crystalline and the Tibetan Tethys Sequence. The units of the Higher Himalayan Group from Tal to Talekhu consists mainly of vigorous to faintly calcareous gneiss, migmatitic gneiss, quartzite, granite, etc. They are named as the Calc. Silicate Gneiss and Paragneiss and the Orthogneiss and Granite units. The lowermost part of the Tibetan Tethys consisted of metamorphosed calcareous rocks containing silicates and feldspar, so this unit is termed as the Marble and Calc. Gneiss. The section is about 9 km in thickness and is highly deformed with presence of igneous rocks at many places.

Keywords: Geological mapping, STDS, Higher Himalaya, Tibetan Tethys

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INTRODUCTION

Geological study of an area provides a base for understanding the rocks and minerals of any region. In the Marshyangdi Valley of Central Nepal, studies had been done in areas near the Main Central Thrust, around Besisahar and Annapurna Regions, but some of the sections lack detailed geological study. Bordet et al. (1971), Fuchs et al. (1988), Dhital (2014), Parsons et al. (2016) studied and prepared the maps in regional scale. In this study, a focus is made on obtaining the detailed geological information in the section of Tal to talekhu along the Besisahar-Chame Sadak (Fig. 1). The study area is located in the latitude of 84012'20" to 84024'0" and the longitude of 28029'50" to 28034'30".

METHODOLOGY

The study included the study in the desk along with field work and laboratory works. Basic geological equipments were used in the field. The topographic maps of sheet numbers 2884 05, 2884 06 and 2884 10 in the scale of 1:50,000 were used to fill in the geological information. Thin sections were prepared in the laboratory of the Central Department of Geology, Tribhuvan University, Kirtipur. The geological maps and cross-section were prepared in ArcGIS 10.1 whereas the columnar section and location maps were prepared using Macromedia Freehand MX software.

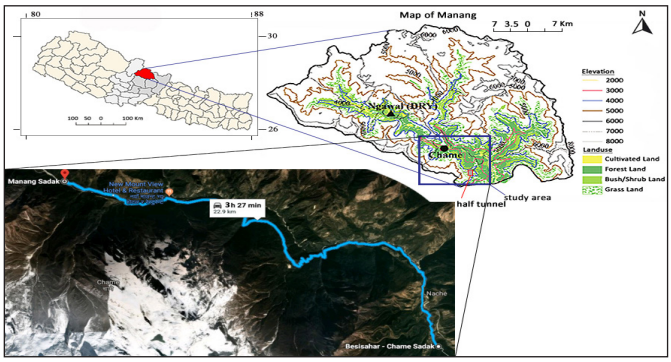

Fig. 1: Location of the study area. Source: Wikipedia (Map of Nepal), Map of Manang modified from Shrestha et al. (2014) and Google Maps

RESULTS

The geological study mainly concentrated in finding the lithological variations in the study area.

Lithostratigraphy

A geological map (Fig. 2) and a geological cross-section (Fig. 3) in the scale of 1:50,000 was prepared based on the existing topographic map. The area consisted of three distinct lithological units. One of them was from the Tibetan Tethys

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Sequence whereas the remaining two were from the Higher Himalayan Crystalline. Since, the study intended to establish the lithostratigraphy, the names of geological formations are given on the basis of their lithological dominance.

(a) Calc. Silicate Gneiss and Paragneiss

The lowermost unit of Higher Himalayan Crystalline in the study area consisted the dominance of calcarious silicate gneiss and paragneiss alongwith leucogranites, faintly calcareous migmatitic gneiss, schists. The chief minerals observed were quartz, feldspars, muscovite, biotite, calcite, etc. Tourmalines and garnets occurred at some places.

(b) Orthogneiss and Granite

Above the Calc. Silicate Gneiss and Paragneiss, the Orthogneiss and Granitic sequence was observed. This was recognized by the absence of calcareous nature in gneiss and presence of highly pronounced granite (granitic gneiss). Augen gneiss is also present in the unit.

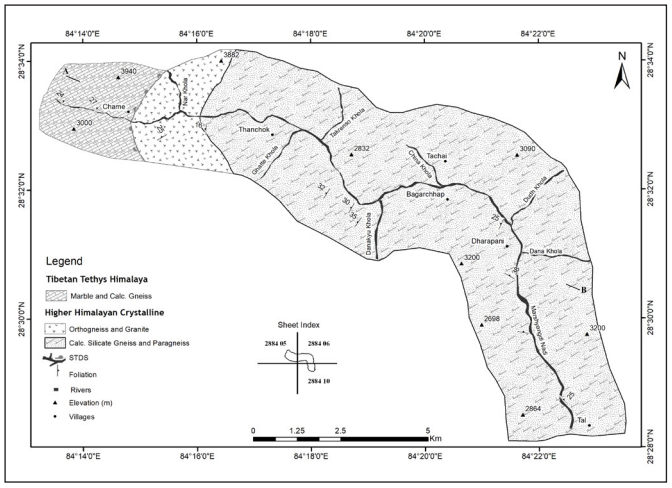

Fig. 2: Geological Map from Tal to Talekhu along the Besisahar-Chame road section.

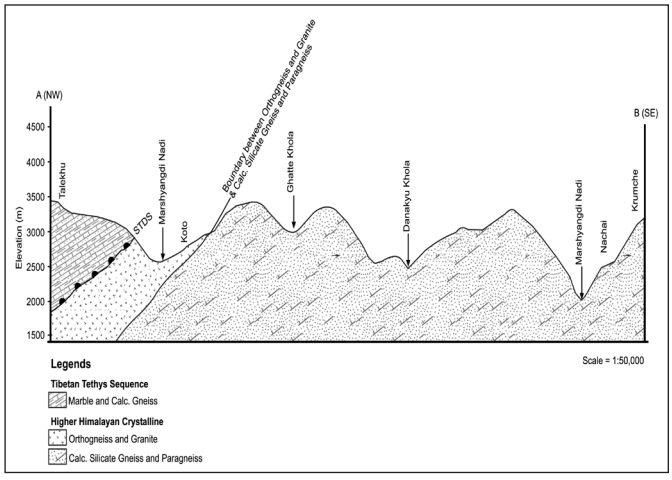

Fig. 3: Geological cross-section from A (Talekhu) to B (Krumche)

(c) Marble and Calc. Gneiss

The rocks in the north of Chame were reactive to dil. HCl. The petrographic observation also showed the presence of Calcite and Quartz dominantly. About a few Hundred meters North from Chame, the course crystalline marbles appeared. The sequence was thus placed in Marble and Calc. Gneiss Formation of Tibetan Tethys sequence.

The cross-section showed that the beds are gently north dipping. Mostly, the rocks are dipping towards north-west direction, however, the rocks near Dharapani and lower areas are dipping towards north east. Similarly, the stratiraphic column was prepared along the line B (bottom) to A (Top) as shown in Fig. 4. The lowermost unit of Higher Himalaya in the study area was about 6 km thik whereas the top most was about 1.5 km. The Marble and Calc. Gneiss of Tibetan Tethys Sequence was about 1.6 km thick.

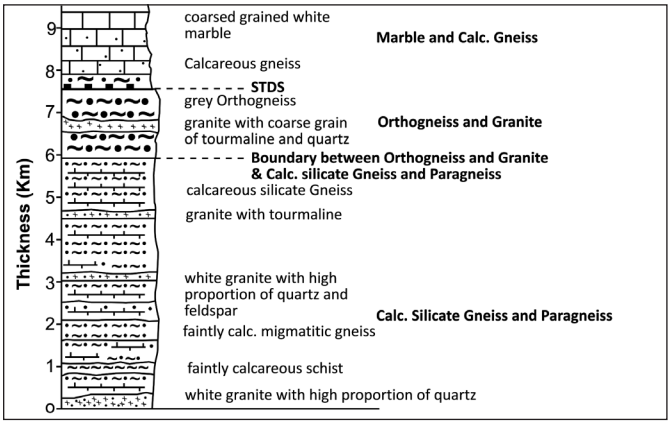

Fig. 4: Stratigraphic Column from Krumche (0 Km) to Talekhu (9 Km)

Geological Structures

The study area mainly consisted of secondary geological structures since it lies in the metamorphic terrain. The folds and joints are prominent structures in the higher himalayan gneiss as well as in the Tibetan Tethys rocks. The migmatites consists of non-cylindrical, chevron shaped folds at many places whereas, the marbles in Tibetan Tethys consists of cylindrical folds. The detachment zone (also called low angle fault) of the South Tibetan Detachment System (STDS) lies around Chame. Foliations and mineral lineations are common secondary structures in the area.

Mineral Content

The common minerals in the rocks of the Higher Himalaya are quartz, feldspar (microcline, plagioclase), muscovite, biotite, calcite, etc. There is an occurrence of garnet minerals near Tal in the gneiss. Tourmaline, amphibole, hornblende, etc. are also present. Similarly, quartz, feldspar and calcite are common in the Tibetan Tethys rocks. The petrographical study was performed to recognize the presence of minerals and identification of rock samples (Fig. 5).

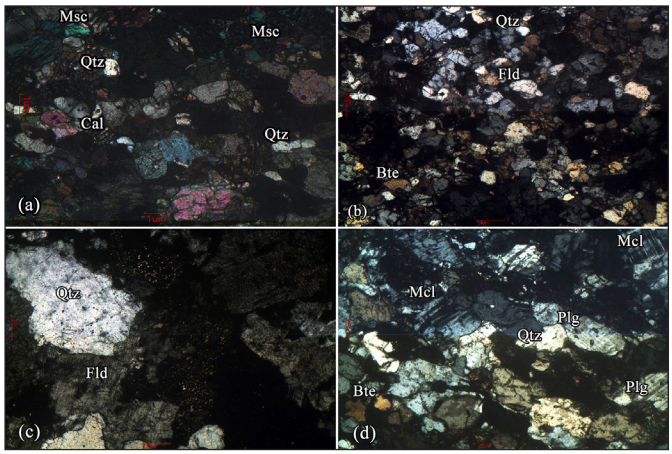

Fig. 5: Mineral contents in (a) Calc. Gneiss (b) (c) Augen gneiss (d) Granitic Gneiss [Qtz: Quartz, Cal: Calcite, Msc: Muscovite, Fld: Feldspar, Bte: Biotite, Mcl: Microclin, Plg, Plagioclase]

DISCUSSION

The geology of the Higher Himalaya in Marshyangdi Valley was explored by many geoscientists previously. The classification of Bordet al. (1971) showed that there are 4 distinct lithological units; Kyanite Gneisses, Marbles and Pyroxenite Gneisses, Fine Banded Gneisses and Augen Gneisses. That was correlated to the similar section in Kali Gandaki valley (Fig.6). The present study, however, is correlable to the study in Ghasa area by Upreti et al. (2005). The Calc. Silicate Gneiss and Paragneiss of the lowermost unit of study area can be correlated to the Formation II whereas the upper unit of the Higher Himalaya can be correlated to the Formation I, based on the lithological similarity.

The exact correlation is with Dhital (2014), where he has pointed the units as the Calc. Silicate Gneiss and Paragneiss as the lower unit and the Orthogneiss and Miocene Granite as the upper unit. Due to the lack of research in chronological level, the age of granite couldn't be well discussed in the present study. Similar pointings have been made by Parsons et al. (2016) in their work where they had combined the old and new works in a single map.

The study of the Tibetan Tethys Himalaya shows that the basal part has marbles and calcareous silicate gneisses overlying the Higher Himalaya. Similar findings have been made by Bordet et al. (1975). According to them, the thick succession of marbles and carbonate gneisses lies west of Chame. Fuchs et al. (1988) also had agreed the presence of this lithology near STDS in the Nilgiri Limestone Formation.

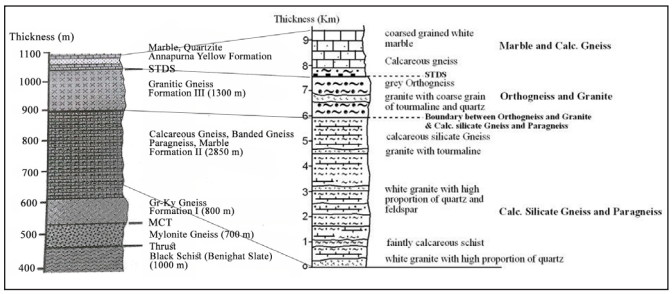

Fig. 6: Correlation of Stratigraphic Columns from the present Study (right) to that of Upreti et al. (2005) in the left

CONCLUSIONS

The study found that there are three main lithological Formations in the study area. The Marble and Calc. Gneiss of the Tibetan Tethys Sequence are underalined by the Orthogneiss and Granite of the Higher Himalayan Crystalline. The two groups; the Tibetan Tethys and the Higher Himalaya are separated by a detachment fault, namely the South Tibetan Detachment System (STDS). The rocks of the Tibetan Tethys though normally described as sedimentary sequence are well metamorphosed. The Higher Himalayan rocks are mostly composed of metamorphosed granites and feldspar rich gneisses. The lowermost unit in the studied area is the Calc. Silicate Gneiss and Paragneiss. There are sequences of calcareous and non-calcareous gneisses with dominance of quartz and mica minerals. Migmatites, quartzite and schist are also present. The lowest part of the area contains garnet in and near schist. Mostly, the rocks are dipping towards north-west direction, however, the rocks near Dharapani and lower areas are dipping towards north east.

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