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GEOLOGY OF DHANGARHI - DANDELDHURA ROAD SECTION AND ITS REGIONAL SIGNIFICANCE

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ABSTRACT

The present paper deals with the geological section of the Dhangarhi–Dandeldhura Road in the far Western Nepal. The section, south to north, crosses the Gangetic plain, Siwaliks, and the Lesser Himalayan metasedimentary and crystalline rocks. Two tectonic units to the north of MBT, Budar Metasedimentary Complex and Dandeldhura Crystalline Complex, are recognised. The latter which is equivalent to the Almora Crystalline Nappe, is thrust over the Lesser Himalayan metasedimentary complex along the Goganpani Thrust and has been preserved in the synclinal structure. The Budar Complex comprising Budar quartzites and Rupaskanra Phyllites, is correlable to Nagthat quartzites (Krol Nappe ?) and Ramgarh unit (Valdiya, 1980) or the Chail Nappe (Fuchs & Sinha, 1978) of the Kumaun Himalays.

INTRODUCTION

Dhangarhi–Dandeldhura road stretches for 135 km from the northern edge of the Gangetic plain across the Mahabharat range to the Midland of the far western Nepal. The alignment traversses the Gangetic plain, Siwaliks, the metasedimentaries and the crystalline rocks with granite body (Figure 1).

General information on the geology of the far western part of Nepal can be obtained from the various previous works (Khan, 1976; Talalov, 1972; Remy, 1975). The siwaliks and the Mahabharat range are mapped on a regional scale of 1: 63,360 by Thapa (1977) and Thapa & Adhikary (1977). The present paper deals with the various lithotectonic units of the area and their regional significance.

Two main tectonic units can be distinguished in the Lesser Himalayas of the present area, separated by the MBT (Main Boundary Thrust) from the Sub–

Himalayas of south (Table 1). They are the Budar Metasedimentary Complex of parautochthonous character, thrust over by the allochthonous Dandeldhura Crystalline Complex.

Besides the Gangetic alluvium from Dhangarhi to Godavari (23 km), Recent-Quaternary sediments are deposited on the erosional surfaces of the Middle Siwaliks or the metasedimentaries. The sediments are comprised of loose, unsorted, boulder to fine grains of quartzite, schists, phyllites and granite-gneiss. At Budar, the Recent-Quaternary deposits are thrust over by the quartzites along the longitudinal high angle reverse fault (Figure 2) indicating the recent movements. Such neotectonic movement is characteristic of the Himalaya.

Table 1: Lithotectonic Units in the Lesser Himalayas of Far Western Nepal

Tectonic Units	*Formations*	*Lithology*
	Dandeldhura Phyllites	Phyllites, lead–gray and carbonaceous phyllites, sandstone and quartzites.
Dandeldhura Crystalline Complex:	Saukhark Granite –Gneiss	Granite – gneiss, augen gneiss, schists and quartzites with granite body.
	Gaira Schists	Mica schists, quartzites, gneiss.
– – – – – – – – – –	Goganpani Thrust	– – – – – – – – – –
Budar Metasedimentary Complex:	Rupaskanra Phyllites	Phyllites, quartzites with amphibolites.
	– – – –?– – –Thrust	?– – – – ? – –
	Budar Quartzites	Quartzites & slates.
– – – – – – – – – –	Main Boundary Thrust.– Siwaliks	– – – – – – – – –

SUB–HIMALAYAS

Lower, Middle and Upper members of Siwaliks, distinguished on lithological basis, are exposed in the Sub–Himalayas from Godavari to Budar. Lower Siwaliks are represented by fine to medium grained micaceous sandstone interbedded with greenish and purple reddish shale. Middle Siwaliks are characterised by the

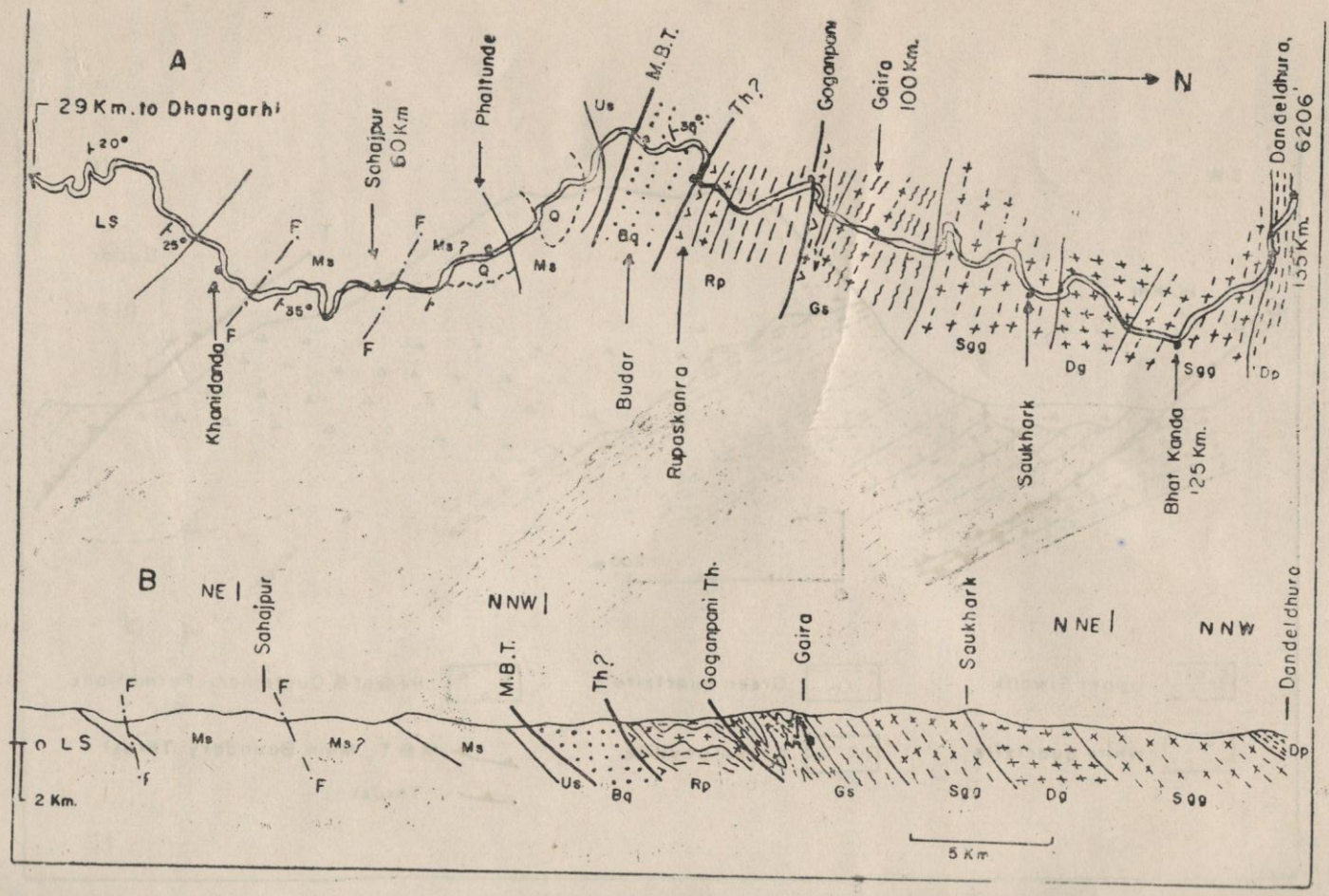

Figure 1 : Geological map (A) and section (B) Dhangarhi–Dandeldhura Road. (LS : Lower Siwaliks; MS : Middle Siwaliks; US : Upper Siwaliks; Q : Quaternary and Recent deposits; Bq : Budar quartzites; Rp : Rupaskanra phyllites; GS : Gaira schists; Sgg : Saukhark Granite-gneiss; Dg : Dandeldhura granite; Dp : Dandeldhura Phyllites).

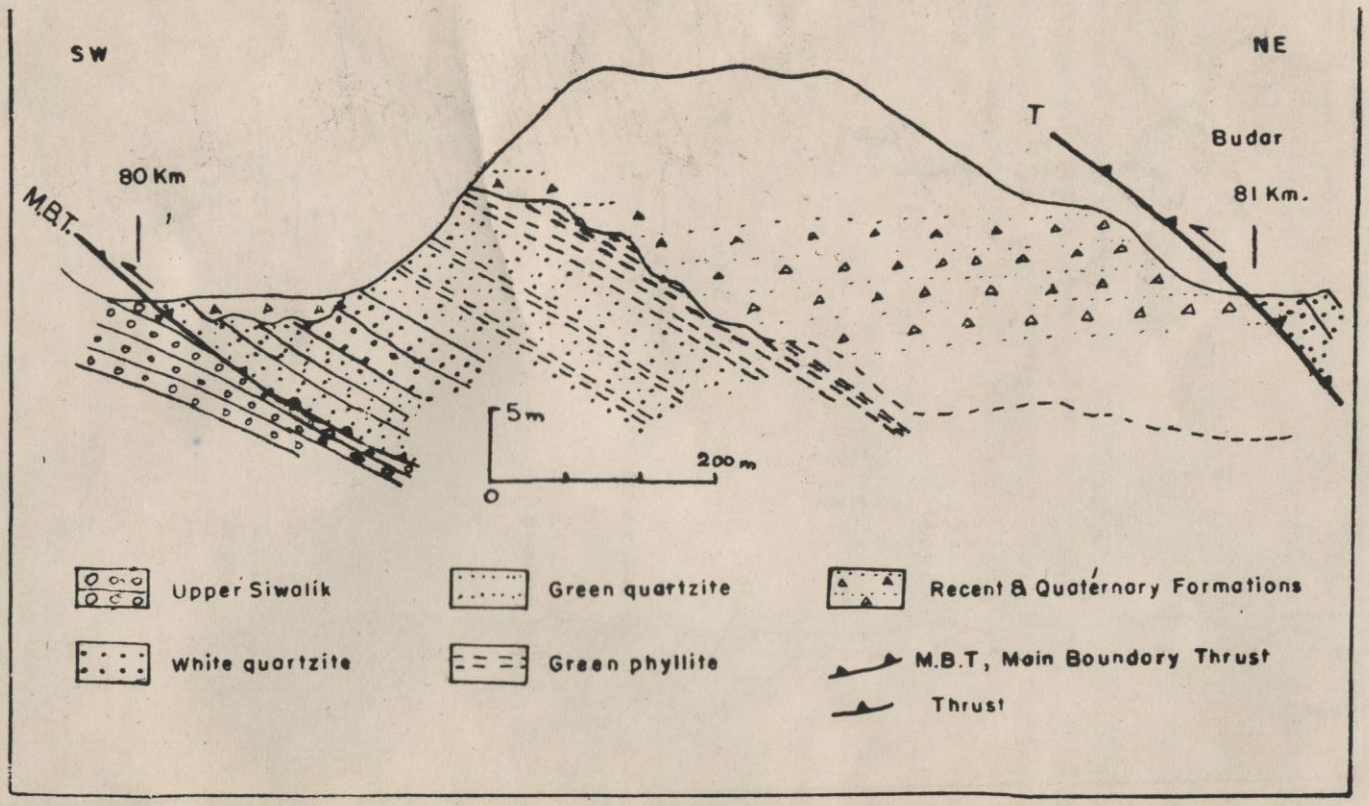

Figure 2 : Section along MBT at Budar showing the recent movements along high angle reverse fault

presence of pebbly beds as found in Khanidanda (46 km) and Bhasu Bhir (51 km). The thick bedded (25m thick), white micaceous sandstones are interstratified with greenish gray shales and siltstones. Crossbedding and load casts are common. The well rounded quartzite pebbles of up to 20 cm diameter cemented by sandy materials constitute the conglomerate beds. Upper Siwaliks conglomerates are composed of pebbles of various metamorphic rocks with sandstone lenses and channel structures. They have a conformable contact with underlying Middle Siwaliks and are delimited to the north by Main Boundary Thrust (Figure 1).

Main Boundary Thrust, a major structural element of the area, separates the Siwalik foredeep of the Himalayas from the Lesser Himalayan metasediments. MBT observed in Budar and Devta khola, dips with angle of 40° to 50° towards north. Along this plane the metasedimentary rocks of the north are thrust over the siwalik sediments. The quartzites and phyllites of Budar and green amphibolite of Devta khola are highly crushed near the fault zone. A few longitudinal high angle reverse faults occur parallel to MBT. Along such faults the recent movement is noticeable as Budar Quartzites are thrust over the Quaternary deposits (Figure 2).

LESSER HIMALAYAS

The Lesser Himalayas north of MBT is divisible into two distinct tectonic units: the Budar Metasedimentary Complex and the Dandeldhura Crystalline Complex. The various formations comprising these tectonic units with their lithological characters and field relations are briefly described below.

Budar Metasedimentary Complex

This complex lies between MBT in the south and Goganpani Thrust in the north. It consists of two formations namely i) Budar Quartzites and ii) Rupaskanra Phyllites separated by a sharp, probably, a thrust contact (Figure 1).

Budar Quartzites are composed of gray, greenish and violet coloured slates and white to greenish quartzites. Near Budar village, the quartzites are reddish. Upwards in the section greenish slates and khaki coloured slatty phyllites weathering to red soils were observed. These phyllites contain 8–10 m. thick bands of amphibolites which contain phenocrysts and laths of labradorite with pyroxene altered to chlorite and the opaque minerals.

Rupaskanra Phyllites exposed for six kilometers from Rupaskanra to Goganpani village is highly folded. The southern lower contact of this unit is a sharp, probably thrust, and is located at the base of a 500 m thick amphibolite. The field relation clearly indicates the intrusive nature of its upper contact (Figure 3). The amphibo-

–lites consist of altered pyroxene, green amphibole, feldspar and quartz with abundant opaque minerals.

The main rock types are various phyllites and quartzites but the chlorite –sericite phyllite interbedded with micaceous white–greenish quartzite are dominant. Several quartz veins and grains of garnet are observed in the upper succession of this phyllite.

Nearly 1 km wide band of gneiss having a concordant contact with underlying phyllites (Fig. 3) is observed near 90 km which is composed of light coloured gneiss at its lower part changing upwards to dark schistose biotite gneiss. The gneiss is composed of augens of feldspar (orthoclase and plagioclase) or quartz enveloped by the fine grained mass of quartz and micas.

Dandeldhura Crystalline Complex

The crystalline complex, thrust over the Budar Metasedimentary Complex, is exposed along the road from Goganpani village to Dandeldhura Bazar. Goganpani Thrust, forming the southern contact of crystalline complex, is observed near 95 km. It is marked by an intensively sheared zone of underlying phyllites and overlying gneiss and amphibolites. This thrust dips moderately towards north. The northern thrust contact which dips southerly is located at 11 km to the north of Dandeldhura. (Figure 5).

The crystalline sheet consists of three formations: Gaira Schists, Saukhark Granite–gneiss, and Dandeldhura Phyllites.

Gaira Schists are represented by the mica schist, quartzite and gneiss. The basal part of the formation contains 10–12 m thick amphibolite band and pegmatite veins up to 15 m thick. The amphibolite is composed of labradorite–bytownite, green prismatic hornblende with a minor quantity of quartz, biotite and pyroxene.

The dark two mica gneiss is highly folded in this section and they have sharp concordant contacts with the schists. The gneiss is characterised by the augen structures. The augens of feldspar or feldspar and quartz are enveloped by the newly formed fine grained quartz–mica minerals. Among the accessory minerals, garnet, black tourmaline and opaque minerals are found.

The major part of the formation consists of fine to medium grained quartz–muscovite–biotite schists with a few grains of garnet interstratified with micaceous quartzites. In the upper part of the formation, several pegmatite viens are associated with white quartzites.

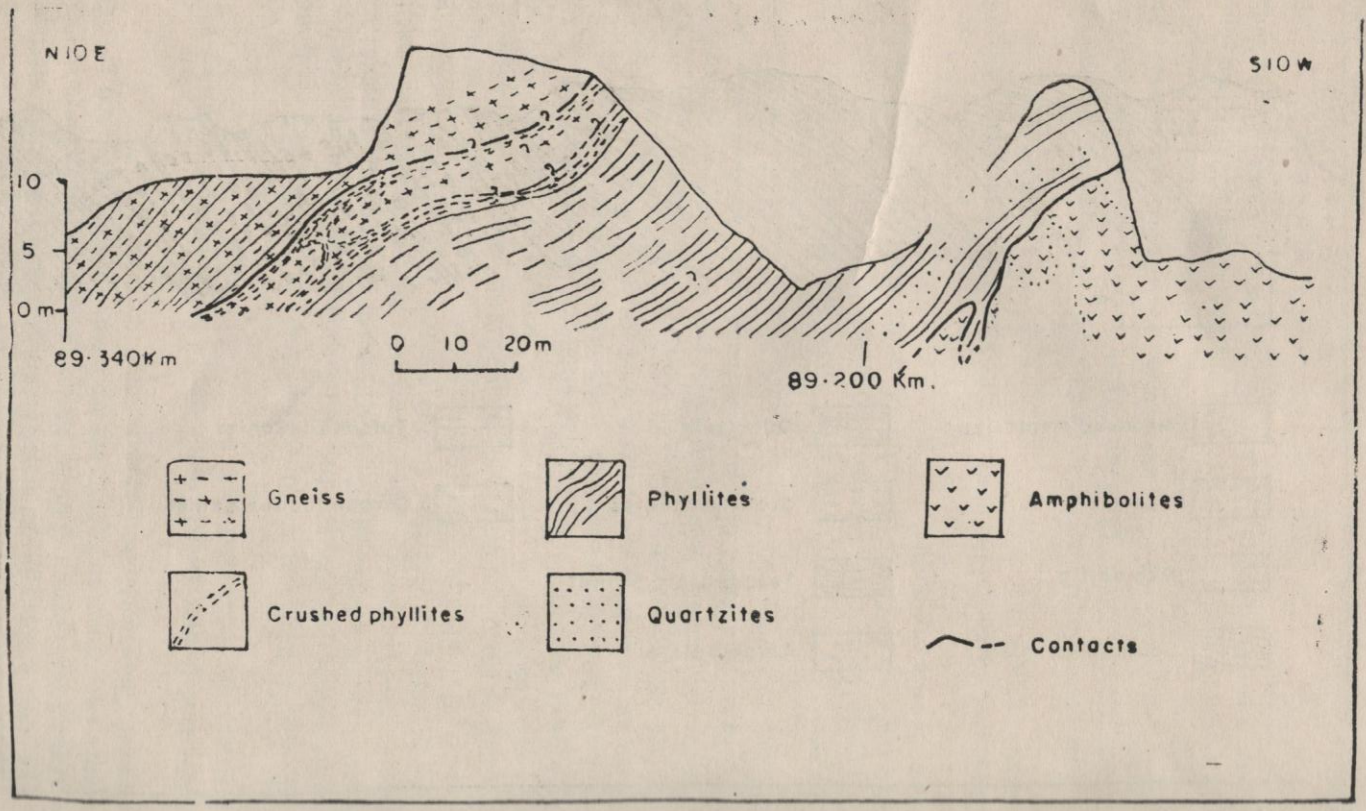

Figure 3 : Contact of Phyllites and Quartzites with basic rocks and gneiss

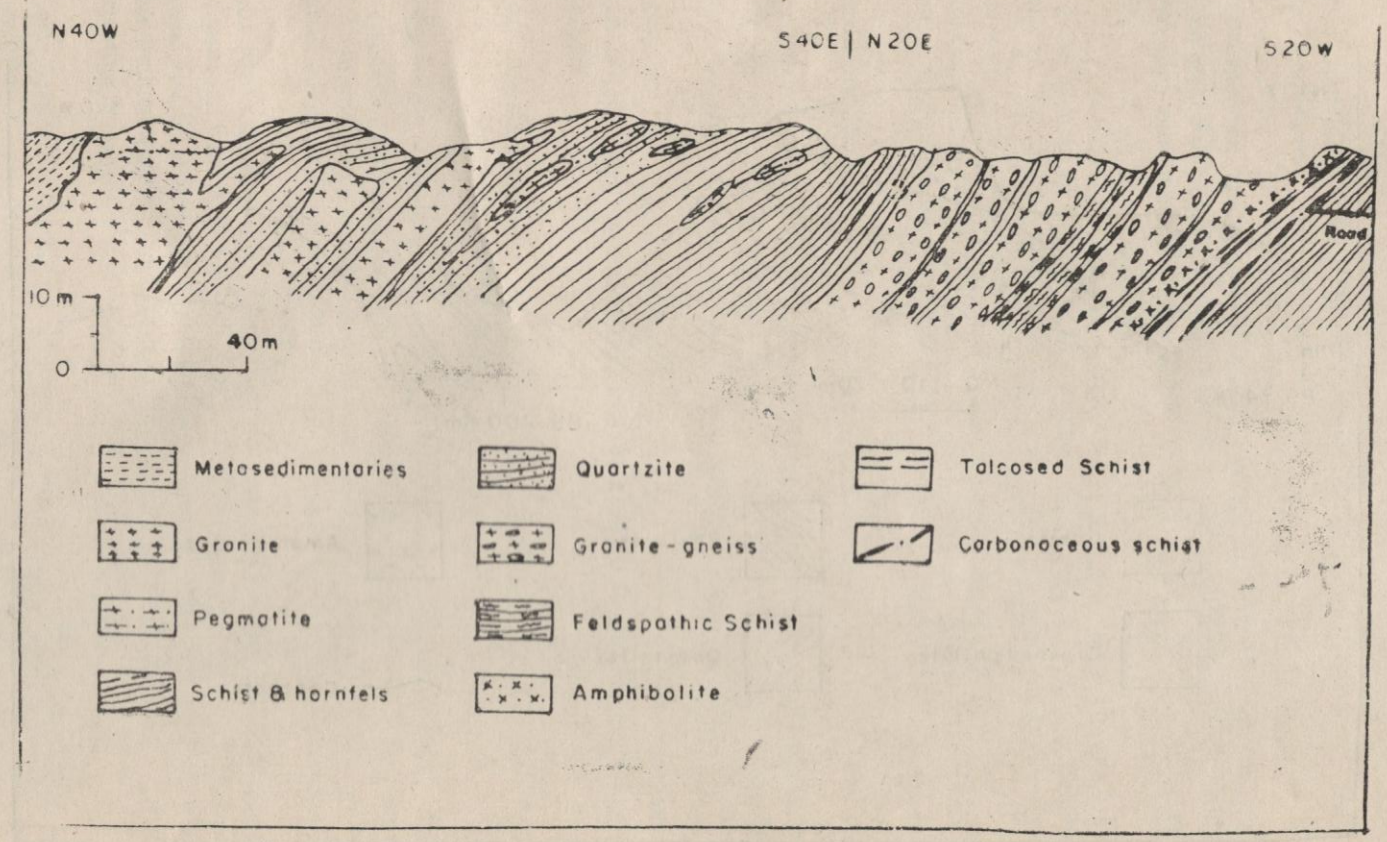

Figure 4 : Detail section of contact zone of granite-gneiss with Dandeldhura metasedimentaries.

The rocks of this unit are highly folded particuraly the basal part. Several tight and asymmetrical horizontal folds having south or south-east axial trend are observed. The schists and quartzites are intensively fractured and gravitationl folds are observed in many landslide areas.

Saukhark Granite-gneiss is represented by the various gneisses with massive granite body in the central part.

The granite-gneiss in south is composed of orthoclase with inclusion of muscovite, quartz and biotite. The porphyroblasts of feldspar and quartz are surrounded by the preferentially oriented fine grained quartz-mica mass. The cataclastic structures indicate the deformation suffered by the gneisses.

The granite body occurring in the central part of Saukhark granite-gneiss stretches in NW-SE direction for about 65 km. The contact of granite with the country rock is sharp and dips moderately towards north. Two apophyses of granite occur just to the north of Saukhark. The granite do not develop the gneissic character as in surrounding gneiss. The granite is light coloured, massive and coarse to medium grained. It is composed of sericitised feldspar with graphic growth of quartz and the subhedral saussiritized plagioclase and biotite altered to green chlorite. The idiomorphism of coloured minerals and feldspars in comparison to quartz grains markes the hypidiomrphic or granitic texture. The granites in the upper reaches of Rao khola indicate a Permian age (265 million years by K/Ar method after Talalov, 1972).

The gneiss, to the north of granite body has augens of feldspar along the foliation plane. This gneiss, around Bhatkanda, is characterised by the presence of orthoclase and microcline in the form of porphyroblasts together with andesine, quartz, muscovite and biotite.

The quartz lenses and the black tourmaline-bearing pegmatite and aplite viens are common in these gneisses.

A detail section of the northern contact zone of Saukhark Granite-gneiss was examined near Sidha Bazar, 131.4 km (Figure 4). The coarse grained leucocratic granites, composed of sericitized microcline, muscovite, and altered biotite, are intruded among the micaceous quartzites and schists. The granites contain the large xenoliths of the rocks similar to overlying phyllites. Some 300m to the south fo this contact, the green amphibolite, the talcosed schists and carbonaceous bands occur among the gneisses.

Dandeldhura Phyllites exposed in the nothern most part of the road have a sharp contact with underlying Saukhark granite gneiss and the latter contains large enclaves of phyllites. The chlorite-sericite phyllites are interstratified with feebly

metamorphosed sandstones and quartzites. This formation occurring in a synclinal structure is underlain towards north by micaschists and gneiss having a thrust contact dipping southerly.

REGIONAL SIGNIFICANCE

The Lesser Himalaya of far western Nepal has not been investigated in detail. However, many workers envisage the continuation of tectonic units of Kumaun Himalayas of India into far western Nepal (Fuchs & Sinha, 1978; Fuchs, 1967; Fuchs & Frank, 1970; Remy, 1975; Hagen, 1969; Gansser, 1964). The present worker has attempted to correlate the different lithotectonic units of Kumaun and that of farWestern Nepal.

The two tectonic units (Budar Metasedimentary Complex and Dandeldhura Crystalline Complex) and the major thrusts (MBT, Goganpani Th., the northern thrust) are continuous and traceable from the west in Mahakali River towards Central Nepal in east within the Lesser Nepal Himalayas (Gansser, 1964; Remy, 1975; unpublished geological maps, DMG, Kathmandu).

The different lithotectonic units continue from the Kumaun Himalayas across the Mahakali River in Nepal. So they can be correlated easily with the different tectonic units of the Kumaun. (Table 2).

Budar Quartzites, exposed to the north of MBT, are the eastern extension of Nagthat quartzites (Valdiya, 1979). The overlying Rupaskanra Phyllites with intrusion of basic rocks and gneiss are correlable to Ramgarh unit of Valdiya (1979). The two formations are considered as undifferentiated Chail (C_2 and C_3) by Fuchs & Sinha (1978). The presence of thrust between Budar Quartzites and Rupaskanra Phyllites, equivalent of Ramgarh Thrust, could not be acertained in the present road section, however, the two formations are separated by an intrusive basic rock (Figure 1).

Dandeldhura crystalline sheet is separated from the parautochthonous Budar Metasedimentary Complex by the Goganpani Thrust which is equivalent to South Almora Thrust of Kumaun Lesser Himalayas recognised by many workers. The crystallines occur in a synclinal structure and the northern thrust is located some 11 km from Dandeldhura to the north of presented area. Dandeldhura Phyllites are exposed in the synclinal core of the crystatlline sheet, whose axial part is faulted (Figure 5).

The two tectonic units of the present area are grouped as the "Serie de la Nappe du Nepal" by Remy (1975) who recognises the separate lithounit of

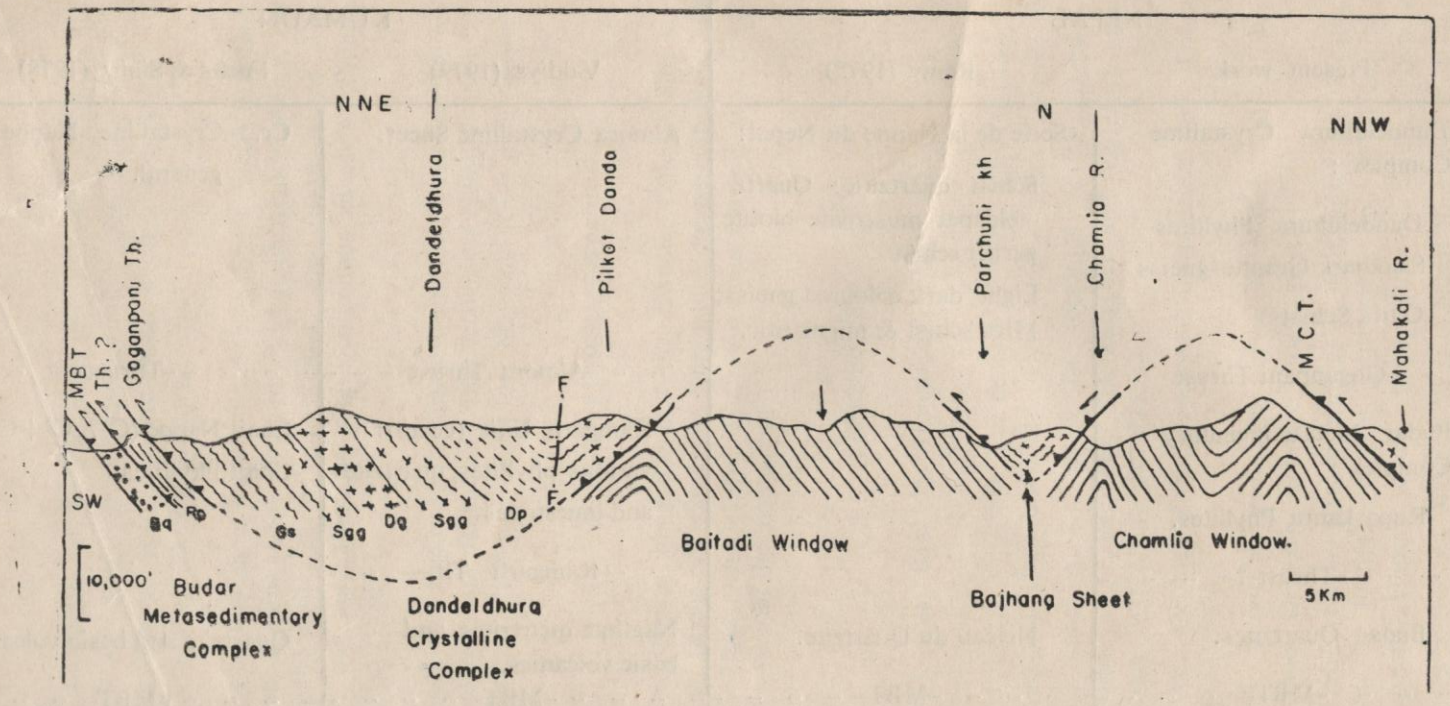

Figure 5 : Schematic cross-section across the Lesser Himalaya of Far Western Nepal, (SW–Siwaliks; Bq–Budar quartzites; Rp–Rupaskanra Phyllites; Gs–Gaira schists; Sgg–Saukhark Granite-gneiss; Dg–Dandeldhura granite; Dp–Dandeldhura Phyllites.)

Table 2 – Lithotectonic correlation of Lesser Himalayas of Far Western Nepal with Kumaun.

NEPAL		KUMAUN	
Present work	Remy (1975)	Valdiya (1979)	Fuchs & Sinha (1978)
Dandeldhura Crystalline Complex : Dandeldhura Phyllites Saukhark Granite–gneiss Gaira Schists	Serie de la Nappe du Nepal: Schist quartzitic; Quartz –feldspar–muscovite–biotite garnet schist Light, dark coloured gneiss; Mica schist & migmatitic.	Almora Crystalline Sheet.	Cr. – Crystalline Nappe in general.
– – –Goganpani Thrust– – –		– – – –Almora Thrust – – –	– – – – –Thrust– – – – –
Budar Metasedimentary Complex : Rupaskanra Phyllites.		Ramgarh Unit (Chail): various phyllites, quartzites and limestones	Chail Nappe (C^3?, C^2+C_3): Chail Phyllites
– – – –Thrust ?– – – –		– – —Ramgarh Th.— – –	
Budar Quartzites.	Niveau du Quartzite.	Nagthat quartzites and basic volcanics.	Quartzite and basic volcanics
– – – – –MBT– – – – –	– – – – –MBT– – – – –	– – – – –MBT– – – – –	– – – – –MBT– – – – –
Siwaliks	Siwaliks	Siwaliks	Siwaliks

quartzite in the south and the occurrence of gneiss and mica schists in the central part of Nappe of Nepal(Table 2). These crystalline extend up to the Karnali region in west. The southerly dipping northern thrust is traceable from the western border eastward for more than 200 km in central Nepal.

Another crystalline sheet namely the Bajang Sheet (Figure 5) is located to the north of Baitadi window and to the south of Chamlia window (Remy, 1975). Bajang sheet occupies the similar tectonic position as the Askot nappe. The windows correspond to the autochthonous–parautochthonous zones of Pithoragarh and Tejam of Valdiya (1980).

Present geological study of Dhangarhi–Dandeldhura road section reveals many similarities with Kumaun Himalayas. The recognised tectonic units of Kumaun could be established with surity across the Mahakali River in far western Nepal.

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