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SHORT COMMUNICATIONS

SHONTARGALI THRUST; AN ANALOGUE OF THE MAIN CENTRAL THRUST (MCT) IN THE NW HIMALAYA IN PAKISTAN

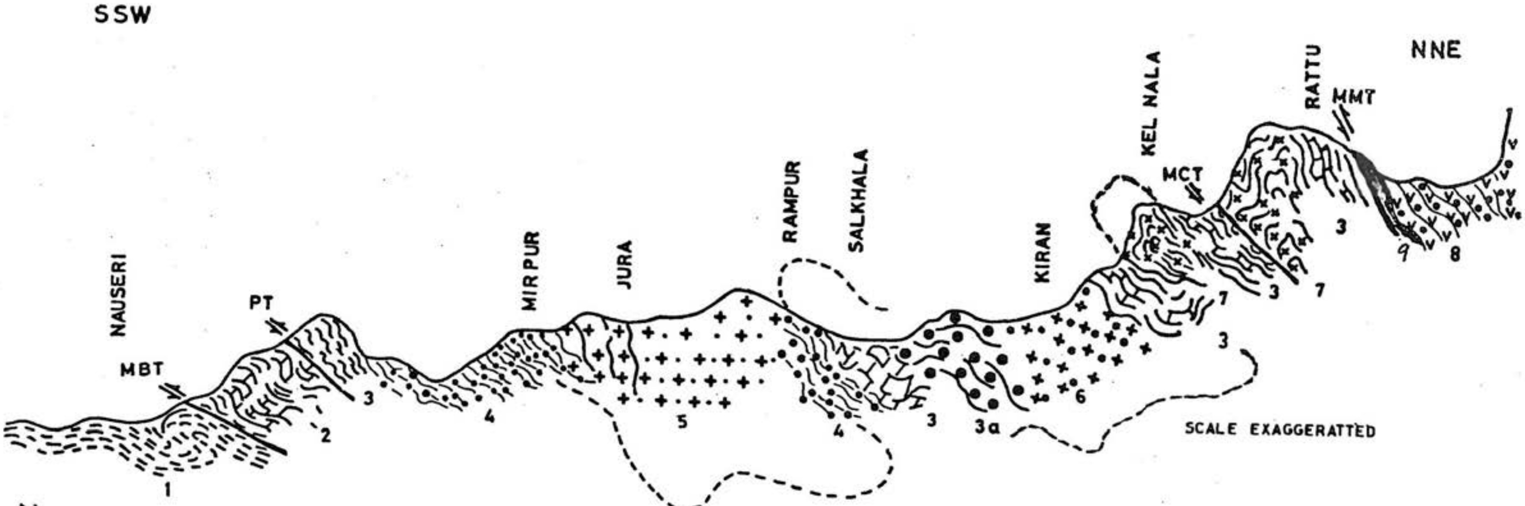
The Main Central Thrust (MCT) is one of the three principal megashears of the Himalayan orogenic belt which is formed as a result of collision between the Indian and Eurasian plates (Fig. 1). This shearzone has been well defined in the eastern, central and western Himalaya (Heim and Gansser, 1939). West of the Punjab (Simla) Himalaya, MCT loses its identity, as a result, the earlier workers (Gansser, 1979) considered the Main Boundary Thrust (MBT) and the Panjal Thrust (PT) in Kashmir to be its surficial equivalents in the northwest. The Panjal Thrust has been extended to the northern tip of the Hazara-Kashmir syntaxis and beyond across the Indus river towards west (Calkins *et al.*, 1975).

Himalayan Crystallines, and stratigraphically the tectonic contact is located at the base MCT at its type section divides the Lesser Himalayan sequence from the Great of the latter (Bordet, 1973; Pecher, 1979).

Present studies in the substreams of the Kel nala, one of the tributaries of the Nilam river (old name Kishenganga) in Kashmir and in another section located in Baloshbar area about 12 km south of Astor in close vicinity of the Nanga Parbat massif, have revealed a new megashear which in stratigraphic,, tectonic and metamorphic settings appears to be an analogue of the MCT in the NW Himalaya (Fig. 2). This megashear is named Shontargali Thrust and like MCT, separates the Salkhala series of the Lesser Himalaya from the Nanga Parbat Gneisses of the Great Himalaya in Kashmir and Hazara in Pakistan (Tahirkheli, *et al.*, 1976; Tahirkheli and Jan, 1979; Tahirkheli, 1979a, b).

The Nanga Parbat Haramosh massif exposes high grade katazonal metamorphic rocks consisting of migmatites, mylonitized porphyritic para- and ortho-gneisses alongwith recrystallized quartzites, marble and calc-silicate rocks. Biotite gneisses remain dominant in bulk of the sequence. In general the metamorphism is that of biotite-amphibolite grade but in more tectonized sections metamorphism culminates to kyanite-sillimanite grade. Besides having emplacement of amphibolite sills and dykes, syn- to post-tectonic granite intrusions are common in the Nanga Parbat-Haromosh mass (Tahirkheli, 1982; Jan and Tahirkheli, 1969).

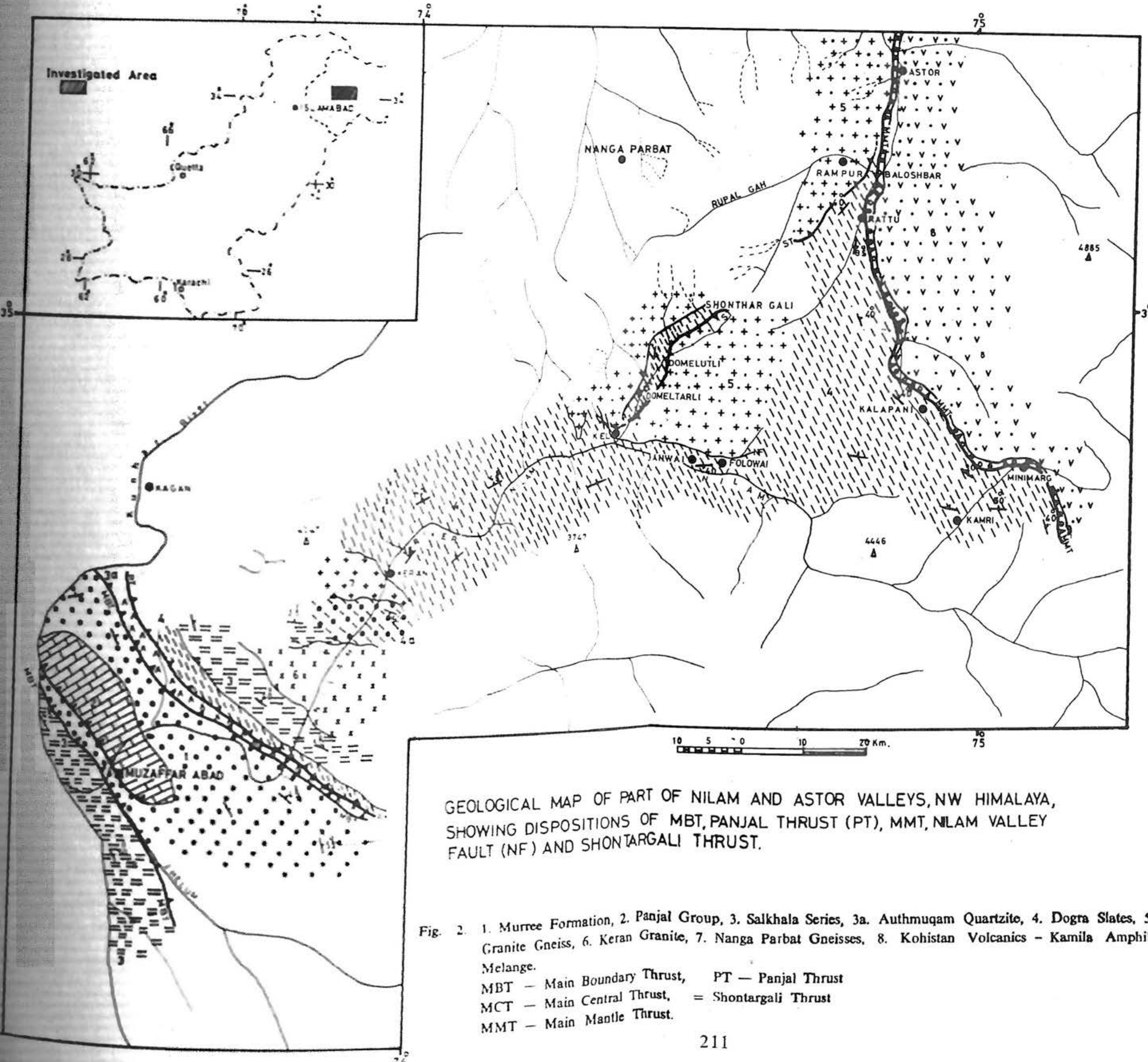
Regarding the age of these rocks, recent studies on zicron and amphibole using U/Pb, $^{39}Ar/^{40}Ar$ and K-Ar methods, have yielded three distinct age groups: *c* 1800–2700 Ma *c* 500–600 Ma and *c* 10–58 Ma (Zeitler *et al.*, 1986). The oldest age pertains to NP gneisses, the middle one corresponds to the Mansehra granite magmatic episode which has yielded a 516 ± 16 Ma whole rock Rb/Sr isochron (Le Fort *et al.*, 1980). The last age group is related to the magmatic episodes associated with the alpine orogeny.



SECTION ALONG NILAM VALLEY, AZAD KASHMIR, PAKISTAN, INDICATING LOCATIONS OF MBT, PT AND MMT WITH RESPECT TO, MCT = SHONTARGALI THRUST.

Fig. 1. 1. Murree Formation, 2. Abbottabad Group, 3. Hazara/Dogra Slates, 3**a**. Panjal Thrust, 4. Salkhala Series, 4a. Authmuqam Quartzite, 5. Nanga Parbat Gneisses, 6. Jura Granite and Granite Gneiss, 7. Keran Granite, 8. Kohistan Volcanics-Kamila Amphibolites, 9. Tectonic Melange.

MBT—Main Boundary Thrust, PT—Panjal Thrust, MCT—Main Central Thrust = Shontargali Thrust, MMT—Main Mantle Thrust.



GEOLOGICAL MAP OF PART OF NILAM AND ASTOR VALLEYS, NW HIMALAYA, SHOWING DISPOSITIONS OF MBT, PANJAL THRUST (PT), MMT, NILAM VALLEY FAULT (NF) AND SHONTARGALI THRUST.

Fig. 2. 1. Murree Formation, 2. Panjal Group, 3. Salkhala Series, 3a. Authmuqam Quartzite, 4. Dogra Slates, 5. Jura Granite and Granite Gneiss, 6. Keran Granite, 7. Nanga Parbat Gneisses, 8. Kohistan Volcanics – Kamila Amphibolites, 9. Tectonic Melange.

MBT — Main Boundary Thrust, PT — Panjal Thrust
MCT — Main Central Thrust, = Shontargali Thrust
MMT — Main Mantle Thrust.

On the basis of age and composition of the rocks, forming the Nanga Parbat-Haramosh massif, the Nanga Parbat gneisses may be correlated with the Vaikritta Group of Kumaon (Valdiya, 1980), Central Himalayan crystallines and Tibetan Slab in the Central Nepal (Bordet, 1979), Khumbu gneisses and Darjeeling gneisses in Sikkim (Thakur, 1981).

The Salkhala Series in Kashmir (type section) and Hazara form base of the inner zone of the Lesser Himalayan sequence. The rock type incorporates biotite schist, garnet - mica - schist, graphitic schist, gneisses, medium to coarse, thin to thick bedded medium crystalline limestone and marble and medium textured ferruginous quartzite. Sills and dykes of amphibolite are common. Dolerites, diorite, gabbro, and pre- to post-tectonic granitic bodies occur as intrusives. The schistose component in the Salkhala sequence is usually dominant and metamorphism in general does not exceed high greenschist facies.

The Salkhalas in rest of the Himalaya are correlated with Chail and Jatogh series in Panjab (Sinha, 1987), Munsiari in Kumaon, Paro in Sikkim, Bomdila and Upper Midland Formations in Nepal (LeForte, 1975; Valdiya, 1980).

In the Shontargali Thrust, the Nanga Parbat gneisses thrust over the younger Salkhalas, the former constitute the hangingwall while the latter a footwall zone of the thrust. Both the zones display intense shearing, deformation and subsequent metamorphic crystallization giving rise to frequent development of cataclasites, mylonites and magmatites. Folding is quite conspicuous, both above and below the thrust plane. The folds are isoclinal and attain tightly squeezed reclined or recumbent styles in the more tectonized sections.

An important feature of the Shontargali Thrust is the development of two juxtaposed megafolds, a syncline and an anticline, over three km wide, in the Burjiwala section, a substream of Kel nala. These megafolds are developed in the footwall zone of the Shontargali Thrust. This structure gives an appearance of a duplex which has been generated from imbricate horses formed due to the failure of the footwall ramp of the thrust. The rocks involved in these megafolds belong to the Salkhalas and are comprised of biotite schist and gneiss, quartzfeldspathic gneiss, garnet mica schist, quartzite and marble with conspicuous amphibolite bands.

Geological mapping of Shontargali Thrust is still continuing to delineate its position in adjacent areas of Kashmir, Hazara and Northern Areas of Pakistan. However, based on the informations so far gathered, it appears that the newly discovered Shontargali Thrust is a new addition in the orogenic domain of the NW Himalaya which by virtue of its stratigraphic location, metamorphic and tectonic settings is treated as a major shear and is correlated with the Main Central Thrust of the Central Himalaya.

In the northwestern Himalaya, unlike the rest, two suture zones have been differentiated (Tahirkheli, *et al.*, 1976; Tahirkheli, 1979a, b; Tahirkheli, 1982). The northern one is called the Main Karakoram Thrust (MKT) and the southern is named the Main Mantle Thrust (MMT) (Tahirkheli *et al.*, 1976). These two sutures juxtapose the Kohistan island arc with the Eurasian and the Indian plates respectively. Keeping in view the timing of collision of the Indian and Eurasian plates and the period of development of MCT (Oligocene-Miocene); it appears that the Shontargali Thrust started developing during Oligocene after the creation of MMT, the southern suture. Its tectonics activities reached their zenith by Middle Miocene.

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NI, CR, CU, ZN, CO, AG AND AU CONTENT OF SOME TALC-CARBONATE ROCKS FROM NWFP, PAKISTAN.

The principal ophiolite complexes of northern Pakistan (i.e., Waziristan, Skhakot-Qila, Jijal, Shangla-Mingora) are characterized by the occurances of talc-carbonate rocks (± quartz, chlorite, serpentine, fuchsite, epidote, oxide and sparingly, emerald and Cr-tourmaline). These rocks occur along the margins of, and in shear zones, within ultramafic rocks and have been considered as the product of alteration (Jan *et al.*, 1981; Rafiq and Jan, 1985). In the southern part of the Malakand pass, there are several small lenses of talc-carbonate-quartz rocks in greenschist facies metapelites.

Carbonate-bearing ultramafic rocks bordering alpine-type peridotites may contain various mineralizations such as Hg, As, Co-Ni arsenides; several occurances of gold have also been reported (for references, see Buisson and Leblanc, 1985). The carbonate-bearing rocks, termed listwaenite, are light grey-green rocks consisting mainly of carbonates with accessory quartz, talc, serpentine, chlorite, fuchsite, hematite, magnetite, pyrite, and Cr-spinel. These grade into serpentinized peridotite through a talc-carbonate zone.

Several Au-bearing listwaenites from upper proterozoic (Moroco, Saudi Arabia) and alpine (Liguria) ophiolite complexes were studied by Buisson and Leblanc (1985). They noted that gold is randomly distributed within the listwaenites by 10 to 100 orders magnitude (0.2 to 1.0 ppm) as compared to associated ultramafic rocks. The highest gold values (1 to 10 ppm) are of economic grade and related to pyrite-rich zones and especially to cobalt arsenide mineralization, and also to late quartz veins with accessory pyrite or arsenopyrite. Buisson and Leblanc (1985) suggested that the tectonic controls of ultramafic rocks acted as channelways for Co-Ca-S (As)-rich brines causing various alterations and mineralization. Elsewhere, as in Western Australia, alteration of serpentinites to talc-carbonate rocks and gold mineralization was caused by quartz-albite porphyries (Sund *et al.*, 1985).

TABLE 1. TRACE ELEMENT (PPM) IN SOME TALC-CARBONATE ROCK OF NWFP

	Ni	Cr	Cu	Zn	Co	Ag	Au
Duber Qala, Jijal complex	1635	1905	15	99	60	1.0	0.0
Road cut in southern part of Malakand pass	1540	2115	15	84	40	1.3	0.0
Butcha, Mohmand	1325	1673	15	113	67	1.0	0.0
Waziristan ophiolite	1625	1889	15	98	43	1.2	0.0

In a preliminary study, we determined seven trace elements in four talc-carbonate samples from Jijal, Malakand, Skhakot (Bucha) and Waziristan (Table 1). The high Cr and Ni values of the samples provide a clear proof that they are derived from ultramafic precursors. Gold was not detected in any of the samples and silver values are too low to be of economic interest. None of our samples, however, contained a sulphide or arsenide phase. We plan to analyze a good number of samples to evaluate the economic potential of Shangla and other ophiolites of NWFP.

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