NOTES

CATASTROPHIC LANDSLIDES IN UTTARANCHAL, CENTRAL HIMALAYA

Mass-movements, not an uncommon phenomenon

The August 1998 landslides and rockfalls that took a toll of more than 600 people in Guptakashi and Malpa areas in the inner belt of the Central Himalaya, are not at all an uncommon phenomenon. These occurred in the identified hazard zones and were of predicted severity and proportions (Valdiya, 1985, 1987). The mass-movements wiped tens of villages of the Guptakashi area in the very well-known shear zone of the active faults that divide the populated Lesser Himalayan terrane from ruggedly lofty Himadri (Great Himalaya) domain (Fig.1). In the Kali Valley crumbling of the mountain slope accompanied by burst of swollen stream in the proximity of a fault buried the village of Malpa along with its people and pilgrims in transit.

The Kapkot-Dharchula-Bajang belt in northwestern Kumaun is a highly seismic area. This is evident from the concentration of epicentres of earthquakes of magnitude 5 to 6.5. The strongest earthquake to rock the region in 1916 was of the magnitude 7.6, ravaging 2500 km^2 area between Bajang (East of Malpa in Nepal) and Kapkot in Kumaun. The 1958 event of M 7.5 and the 1968 earthquake of magnitude 7.0 shook the Bajang-Dharchula belt and rendered its mountain slopes extremely vulnerable.

The earthquake epicentres lie within 30 km wide strip parallel to the Main Central Thrust (MCT) and the hypocentres are located 15 to 25 km deep (Gaur et al. 1985).

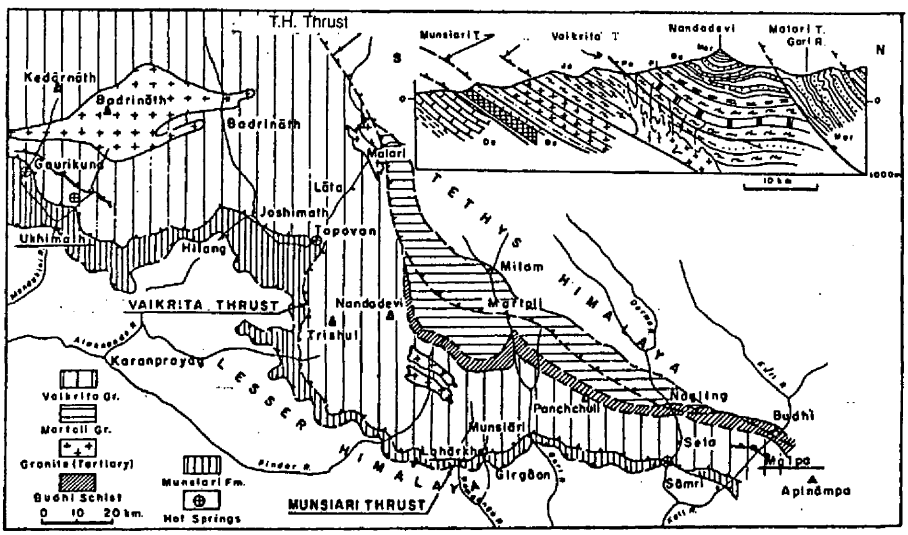

Fig.1. Tectonic sketch map and diagramatic section of the Himadri – Great Himalaya – between the rivers Kali and Mandakini in Uttaranchal. The vulnerable shear zone of the Main Central Thrust is a schuppen zone delimited by the Vaikrita and Munsiari thrusts. The Guptakashi-Okhimath-Ransi area in the Madhyamaheswar valley, the Pakhi-Tangani-Hilang sector in the Alaknanda valley, the Bharari-Loharkhet belt in the Saryu valley and the Tejam-Girgaon-Kalamuni sector in the Ramganga valley have experienced recurrent landslides of destructive nature. Malpa in the Kali valley is situated in the proximity of a fault.

Vulnerable MCT Zone

Inclined 20° to 45° northwards, the Main Central Thrust is a 5 to 20 km wide shear zone defined by the Munsiari Thrust at the base and the Vaikrita Thrust at the top (Fig.1). The Precambrian

(1900±100 m.y. old) rocks of the shear zone are pervasively mylonitized and intensely sheared or shattered practically throughout the belt. Tightened folds have been split up by a multiplicity of thrusts into imbricating stack tectonic sheets which evolved in a piggy-back style due to repeated movements (in early Miocene, late Miocene, early Pleistocene and late Pleistocene). Below the MCT even the Proterozoic sedimentary succession is split up repeatedly into a conspicuous schuppen zone comprising extremely weakened rocks, such as seen on the way to Badrinath between Belakuchi and Hilang (near Joshimath, on the road to Pindari Glacier between Bharari (near Kapkot) and Loharkhet, and on the trail to Milam Glacier between Tejam and Kalamuni (near Munsiari).

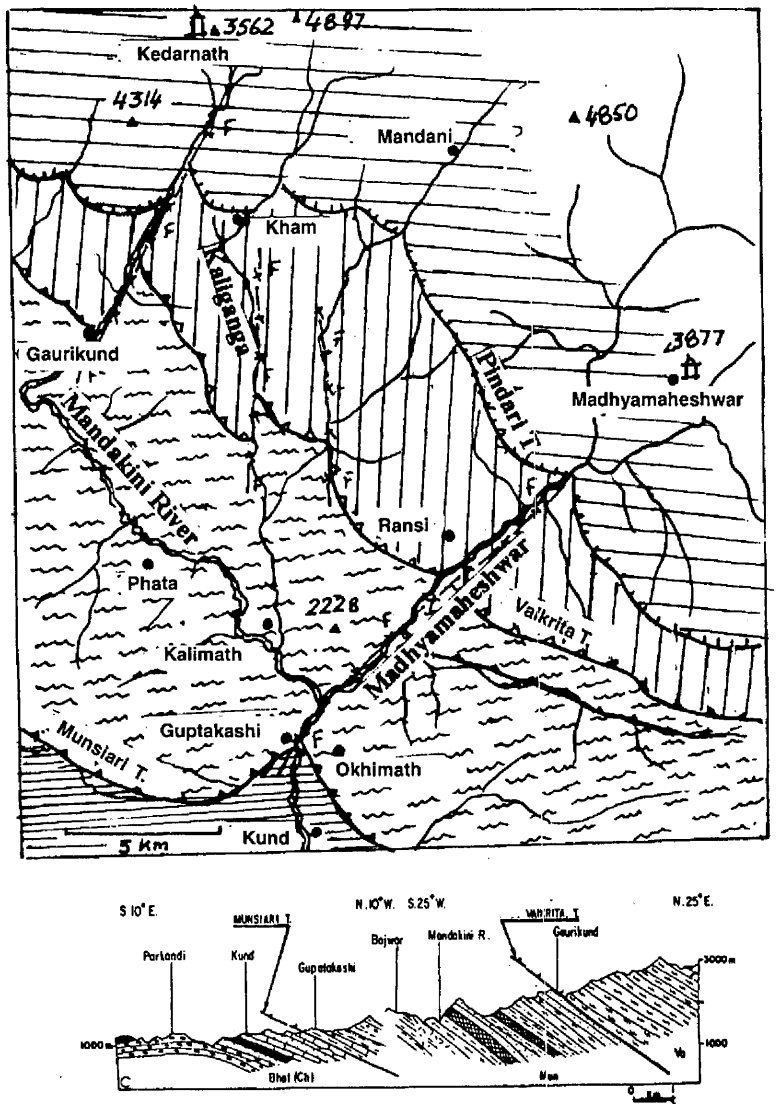

Fig.2. Sketch map and section of the Madhyamaheswar-Mandakini Valleys in the MCT zone in the Rudraprayag District. The map (after S.S. Bhakuni, 1987) shows the structural layout and the section illustrates the lithological succession. Thrusts shown by barbed lines and faults by broken lines with crosses. Slides occurred in the zones of these thrusts and faults. Legend: Ripple = Sericite-chlorite schist of the Munsiari Fm.; Vertical lines = Kyanite garnet-psammatic gneiss and schist; Horizontal lines = Calc-silicate rocks with sillimanite-kyanite-garnet gneiss and schist, Bhat-Bhawari gneisses (1900±100 m.y.), Mun-Munsiari Fm.; Va = Vaikrita Group.

The strongly tectonized rocks and the weakened mountain slopes of the MCT zone – in which the areas of Guptakashi (Fig.2) and Karmi-Kapkot lie – are very vulnerable to onslaughts of rains, shocks of earthquakes, vibration of heavy vehicles, excavation for agricultural terracing, construction of roads and canals and mining for soapstone and magnesite. Indeed so vulnerable has this belt become that even minor or apparently innocuous engineering or agricultural activity has precipitated changes that rapidly assumed alarming proportions.

The instability of mountain slopes is manifest in the form of myriads of landslides and rockfalls that have given rise to fans and cones of debris on the mountain slopes. Perched on steep slopes, these gently sloping but not-so-stable geomorphic features made up of loose fragmentary material provide locale for habitations and agricultural farms. Pressure of population has driven the mountain people upslope, thus encroaching upon the forests that provide protective cover to the mountain slopes. Bereft of protective cover of forests, these debris fans have been extensively furrowed and therefore subject to gully erosion and waterlogging due to disturbed/damaged drainage. Consequently these are easily and frequently susceptible to slumping and sliding downslope and blocking stream channels and giving rise to lakelets and natural reservoirs. The

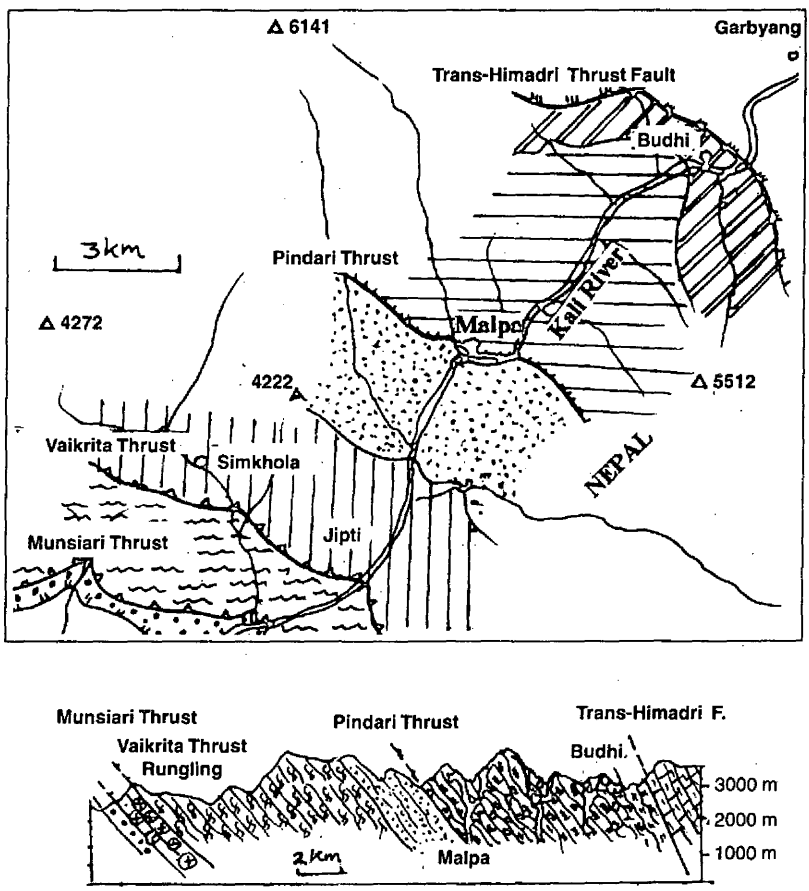

Fig.3. Sketchmap and section of the Kali valley in the Himadri domain in Pithoragarh district. Malpa is close to fault responsible for crumbling of the mountainside. The stream flowing SE brought enormous volume of fallen debris that buried houses and huts with more than 200 people. Close lines - Mandhali black phyllite and marble; Thick dots - Berinag quartzite; Ripple - Munsiari schists; Vertical lines - Joshimath gneiss and schist; Fine dots - Pandukeshwar quartzite with garnet-kyanite-schists; Horizontal lines - Pindari calc-silicate gneiss; Slanting lines - Budhi schists; Blank - Garbyang limestone and marl.

lakes disappeared as fast as they were formed many times in the past. This is what exactly happened in the Mandakini-Madhyamaheshwar valleys (Guptakashi area) (Fig.2) where incessant and exceptionally heavy rains lashed the region and brought down the mountain slope along with the patches of forests and farms.

Engineering activities compounded the problem. Unimaginatively planned roads that follow active thrusts and faults of the weakened shear zones and their cruelly executed construction have considerably aggravated the instability of the mountain slopes in this and other areas of the MCT zone.

Malpa Tragedy

Faults splitting the colossal pile of metamorphic rocks of the Himadri (Great Himalaya) have been frequently reactivated following the intense compression to which the massif is subjected. One such fault passes through Malpa located in the Kali gorge. Incessant rain brought down quartzite and gneiss of the Pandukeshwar Formation along the fault zone (Fig.3) damming the southeast flowing stream. Bursting of the piled up debris in the ravine suddenly dumped enormous debris mass on the houses and huts where unwary and ill-prepared people were taking shelter.

Tragedy waiting to happen

It is not that the nature and severity of the natural hazards in the geodynamically sensitive belts were not brought to the knowledge of the intelligentia and the governments (Valdiya, 1985, 1987). As a matter of fact, a comprehensive report (Valdiya, et al. 1984) submitted on July 14, 1984 to the Hill Development Department of the U.P. Government on the aspect of landslides, remedial measures and legislative action is gathering dust in the government archives.

If the government does not mind abdicating its responsibility for preparing hazard-coping programmes, the public at large is equally unconcerned about the restoration of ecological health and physical integrity of its land. We are quite adept at singing hymns on the majesty of mountains but quite loath to nursing ecological wounds that we have ourselves inflicted on the nature. It is but natural for the disaster to happen.

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