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Predesign, failure and displacement mechanisms of large rockslides in the Langthang-, Annapurna- and Kanjiroba Himalayas of Nepal

J.T. Weidinger (1,2)

(1) Department of Geography, Geology and Mineralogy, Salzburg University, Austria, (2) Erkudok Institute, Museum of Gmunden, Austria

The study analyses and compares six large (10^9 to 10^{10}m^3) rockslides in the Nepal Himalayas from engineering, geological, quaternary geological, and geomorphological viewpoints.

The gigantic Tsergo Ri slope failure (dated with 71,2 ka) is situated 60 km north of Kathmandu (capital of Nepal) in the Langthang valley, at altitudes of 3,920 to 6,950 m. It is one of the earth's largest mass movements in a crystalline environment and confirms the assumption that the mountain before the collapse could have been the earth's 15^{th} 8,000 m peak. 45 km west of this former peak the recent Annapurna Ranges are bounded by two main valley systems. The Kali Gandhaki River valley in the west follows the Thakkhola graben between the peaks Dhaulagiri (8,172 m) and Annapurna I (8,091 m). The course of the Marsyandi River crosses the EW-oriented Manang valley north of the Annapurna Himal and the NS-striking gorge east of the adjacent Lamjung Himal (6,988 m). During the last interglacial (or interstadial), the late glacial and postglacial four large rockslides have occurred along these valleys near the villages of Kalopani, Braga, Dukur Pokhari and Latamrang. 35 km due west from there, east of the Kanjiroba Himal (7,043 m), one of the largest rockslide deposits (dated with 30-40ka) in the Himalayas formed a massive barrier, which has dammed Phoksundo Lake (alt. 3,700 m) near Ringmo village.

Comparing all these rockslide localities, the study shows that their location and orientation is mainly predesigned by tectonics. Focusing on the major preparatory factor causing the former mountain in the Langthang valley to collapse a sulfidic mineralized ore structure within a discordant leucogranitic dike along a tectonic fault has

been detected. Also the litho-tectonic positions of the rockslides around the Annapurnas confirm a strong influence of tectonic predesign on their failure and displacement mechanisms. And last but not least the rockslide at Ringmo affected Dhaulagiri limestones of the Tibetan sediments near a huge fould, which has tectonically formed during overthrusting.

Concluding generally we can say that the regional tectonic structures such as the sheeted units and the main thrusts of the Himalayas define the primary and basic design and neotectonics play a major part in the secondary pre-existing structures. In addition tectonics not only predesigned the failure mechanisms of the rockslides; in combination with the lithologies involved and their fabric it also had a strong influence on the mechanisms of displacement – giant translational rockslides in which the primary rock structure or fabric is preserved, but shattered by mechanical stress during the sliding event.