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Giant striations at the base of submarine landslides (Late Proterozoic, NW Himalaya): implications for their formation

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In the NW India (Chenap Valley) well-exposed, giant striations have been found on the lower bed surfaces of greywacke beds in lower levels of the Phe Formation (Higher Himalaya tectonic unit). The striations are up to 4 m broad and form linear grooves that can be traced for more than 15 m up to the limits of the outcrop. The striations show intersecting geometries at angles of about 20˚. Because of the linear geometry of the grooves and the observation that even small details of the striations do not change along the complete exposed length, the grooves probably formed by a single large block sliding on the striated surface, possibly in the proximal part of a submarine landslide, before the block breaks apart or is being disaggregated. The spectacular Indian striations range among the largest erosion structures related to submarine land slides ever observed in the outcrop and they give insight in erosion processes usually just visible from distance by sea floor mapping techniques.

The grooves are associated with chevron casts and flute casts and after correction for tilting related to Tertiary folding these structures show palaeo-current directions towards the SW-SE. In contrast the Simla Slates of the Lesser Himalaya have a dominant sediment transport direction to the NW-NE. As a consequence the model of a Proterozoic sedimentation of the Higher and Lesser Himalaya both on the northern shelf of India in a single basin, where Proterozoic sediments of the Higher Himalaya are the distal equivalents of the Lesser Himalayan succession is oversimplified. The palaeo-current direction data indicate the existence of a sediment source to the North of the Haimanta depositional area, sheding sediments from north to south. Different

source areas of the Lesser and Higher Himalayan Proterozoic clastic sediments are also indicated by isotopic whole-rock analyses, as well as isotopic age data on detrital mineral. The source area for the clastic sediments in the Simla Slate can probably be identified in the Aravalli-Delhi Mountains, while the source area for the Haimanta Group probable is a yet unidentified Gondwana fragment in the North of the basin.