*Geogr. Fis. Dinam. Quat.*
*36 (2013), 81-94, 14 figg., 1 tab.*

DOI 10.4461/GFDQ.2013.36.6

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# «THE GREAT LATERAL MORAINE», KARAKORAM HIMALAYA, INNER ASIA

**ABSTRACT**: HEWITT K., *«The Great Lateral Moraine», Karakoram Himalaya, Inner Asia*. (IT ISSN 0391-9838, 2013).

Large moraines and related ice margin deposits, observed along the ablation zones of Karakoram glaciers, have been grouped together as the Great Lateral Moraine (GLM). It was formerly attributed to the Little Ice Age. Other studies propose a longer sequence beginning with late Pleistocene glaciations. All investigations have assumed the GLM records climate-driven glacier expansions. Evidence presented here challenges this, and the idea of a single origin in time or process. Bualtar Glacier in the Hunza Basin, with a much-discussed GLM, introduces the complexities involved. The glacier is surge-type, its fluctuations affected by large landslides onto the ice. Both have triggered depositional episodes out-of-phase with surrounding glaciers and climate variability. More decisive has been local base-level control by landslides downstream of Bualtar, especially the late Holocene, Baltit-Sumayar landslide. Similar conditions are shown to affect many, if not all, GLMs. No consistent relations were found with glacier size, morphology or known patterns of advance, but many surge-type glaciers and landslides in glacier basins are involved. A pervasive influence has been blocking of the upper Indus streams by large mass movements. To address these complex developments, valley glacier landsystems concepts are employed, especially as applied to debris-covered glaciers. Some distinctive Karakoram variants are identified. The regional environment seems not to produce a unique type, but a complete spectrum of valley glacier landsystems. Recent evidence of glaciers transitioning between landsystem types suggest how GLMs have developed and why interactions of glacial, fluvial, lacustrine and eolian systems, are important. GLMs are distinguished as «transglacial landsystems», developments in which glacial activity is disturbed and reconfigured by non-glacial processes. A paraglacial influence is also present, mainly through glacially induced rock slope instabilities. These lead to large postglacial landslides blocking rivers or descending onto smaller surviving glaciers. The interpretation offered is a challenge for existing views of late Quaternary developments.

KEY WORDS: Lateral moraines and troughs, Ice-marginal ramps, Moraine-dammed glaciers, Breach-lobes, Surge-type glaciers, Rockslide-rock avalanches, Fragmented drainage systems, Intermontane sedimentation, Transglacial processes, Valley glacier landsystems, Karakoram Himalaya.

## INTRODUCTION

Along the ablation zones of many Karakoram glaciers bare cliffs in old lateral deposits rise from the ice edge and culminate above in prominent lateral moraines. The largest of these were formerly regarded as a single regional phenomenon and called the Great Lateral Moraine (GLM). Meiners (1998, p. 55) describes it as «*… a very well-marked and well-formed lateral, partly high moraine, which surrounds the glacier tongues*». A more explicit German term is *Ufermoranen-Dammen* [«embankment moraine dam (or barrier)»] (Wiche, 1961; Haserodt, 1989, p. 212). There are usually substantial troughs between the lateral moraines and valley sides - the «ablation valleys» of older literature (Visser & Visser-Hooft, 1935-1938; Hewitt, 1993). In them, heterogeneous and discontinuous deposits build up where avalanches, rock falls and debris flows come from the valley slopes, and where drainage is channeled or impounded (fig. 1).

In the 19th and early 20th centuries, glacier ice was commonly observed standing at or above the lateral moraines, adding to them and shedding water and debris into valley side troughs. It is something rarely observed since the 1920s except during glacier surges, making it seem logical to identify the GLM with the Little Ice Age (LIA). Some equated it specifically with the «1850 moraines» in the European Alps. According to von Wissmann (1959), «*… in High Asia [generally] the moraines…*

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*The paper is dedicated to Prof. Monique Fort, to acknowledge her special and outstanding contributions to the geomorphology of the High Asian mountains. She has been an inspiration in tackling problems of scale and complexity that distinguish the region; that require attention to its peculiarities, and thinking «outside the box» of predominantly Eurocentric ideas (Fort, 1987, 1995; Fort & Peulvast, 1995; Fort, 2000). Investigations at Bualtar Glacier were funded by the International Development Research Centre, Ottawa, Canada; Pakistan's Water and Power Development Authority; and Wilfrid Laurier University's Office of Research. Local residents and mountain guides, especially Mr. Shaffi Ahmed of Nagar, gave invaluable information and field assistance. I am indebted to two reviewers for helpful comments, and Ms. P. Schaus for preparing the figures.*