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TCN dating of Holocene rock avalanches in the Karakoram Himalaya, northern

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This paper re-examines seven field sites where blocky, cross-valley deposits have been important in interpretations of Quaternary events. The deposits are products of run out and emplacement of rock slide - rock avalanches. Each of the events dammed the river where it occurred and impounded large parts of the Upper Indus drainage for some centuries at least. The landslide barriers are still not fully dissected and continue to affect fluvial and related developments in the basin. The seven sites are 'key' in that they control sediment delivery in the Upper Indus drainage system. Of interest are new, well-constrained TCN ages of boulders on the surface of six of the deposits. The ages indicate that six of the seven landslides occurred between 6,500 and 3,100 years ago. A radiocarbon age from the seventh site is older, but still well within the Holocene. Landforms and sediments associated with the landslides have long been described and discussed as characteristic morphological elements of the trans-Himalayan, Upper Indus basin. Previously, however, the features were seen primarily as responses to tectonics or glaciation. Until recently each of the landslide deposits was misinterpreted as glacial in origin and thus was used to reconstruct Quaternary glacial sequences. The new ages challenge existing views of the timing and sequence of glaciation, notably that the last Pleistocene glaciation occurred earlier in the Karakoram than in other parts of the Northern Hemisphere. Here, the deposits are shown mainly to reflect developments in landslide-interrupted river valleys. Moreover, the TCN ages suggest a dramatically higher pace of these events. The tectonic interpretations of Augusto Gansser and others, for example, attribute the deposits to processes operating over millions of years. Glacial interpretations relate the deposits to three or four glaciations, spanning a total period of hundreds of thousands of years at least. However, they are post-glacial and span a time frame of only thousands of years. Although our results radically reduce the time frame of these morphological developments, they are much more in keeping with the exceptionally high measured rates of uplift and denudation in the late Quaternary, and of present-day earth surface processes. Our results highlight some hitherto unrecognized periods of zero net incision in one of the most rugged basins on Earth – thousands of years when the landslide dams have been wholly or partly intact.