Towards Defining the Transition in Style and Timing of Quaternary Glaciation between the Monsoon-Influenced Greater Himalaya and the Semi-Arid Transhimalaya of Northern India

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Himalayan glaciation is heavily influenced by variable input from competing climate systems: the South Asian summer monsoon and the mid-latitude westerlies (Benn and Owen, 1998). To delineate the transition in climatic glacial forcing between two regions with contrasting glacial history—Lahul to the south and Ladakh to the north—moraines in Puga and Karzok valleys, located in the intermediate Zanskar region of the Transhimalaya, were mapped and moraine boulders dated using ^{10}Be terrestrial cosmogenic nuclide exposure age dating. In Lahul, Late Quaternary glaciation was extensive; glaciers advanced >100 km from the modern ice margin, whereas glaciation in Ladakh has been comparatively restricted as advances reached only ~30 km from the contemporary glacial margins during the last 200 ka (Owen and others, 1997, 2001, 2006).

In the Puga valley, glaciers advanced >10 km at ~115 ka and <10 km at ~40 ka, ~3.3 ka, and ~0.5 ka, while in the Karzok valley glaciers advanced <2 km at ~3.6 ka. Boulder exposure ages from a large moraine complex in Karzok indicate a possible glacial advance at ~80 ka of <5 km. The oldest moraine in Karzok is ~310 ka, indicating that glaciers advanced >10 km during MIS-9 or older.

The glacial chronology of the Puga and Karzok valleys shows generally asynchronous glaciation despite the proximity of the valleys (~25 km). Moraine ages in the Puga and Karzok valleys broadly correlate with previous studies in the Zanskar Range (Taylor and Mitchell, 2000) but the paucity of data for many of the glacial stages across the Zanskar region makes these correlations tentative. The lack of early Holocene glaciation in the Puga and Karzok valleys is in stark contrast to many regions of the Himalaya, including the Lahul and Garhwal ranges to the south, the Karakoram to the north, and in Nanga Parbat and the Swat valley in the Greater Himalaya to the west (Benn and Owen, 1998). The restricted glacial extent in Puga and Karzok valleys is more similar in style to glaciations in Ladakh, however, moraines in both valleys have ^{10}Be ages similar to the northern ranges; well-established advances in the Karakoram and Ladakh range at ~20 and ~80 ka may match Karzok valley glacial records, whereas advances at ~100 and ~40 ka match the Puga valley records (Owen and others, 1997, 2001, 2006). The dissimilarity between the glacial records in the Puga and Karzok study areas suggests a possible relatively sharp transition from southern monsoon to westerly-controlled glacial advances.

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