



Reconstructing spatial and temporal patterns of paleoglaciation across Central Asia

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Understanding the behaviour of mountain glaciers and ice caps, the evolution of mountain landscapes, and testing global climate models all require well-constrained information on past spatial and temporal patterns of glacier change. Particularly important are transitional regions that have high spatial and temporal variation in glacier activity and that can provide a sensitive record of past climate change. Central Asia is an extreme continental location with glaciers that have responded sensitively to variations in major regional climate systems. As an international team, we are reconstructing glacial histories of several areas of the Tibetan Plateau as well as along the Tian Shan, Altai and Kunlun Mountains. Building on previous work, we are using remote sensing-based geomorphological mapping augmented with field observations to map out glacial landforms and the maximum distributions of erratics. We then use cosmogenic nuclide Be-10 and Al-26, optically stimulated luminescence, and electron spin resonance dating of moraines and other landforms to compare dating techniques and to constrain the ages of defined extents of paleo-glaciers and ice caps. Comparing consistently dated glacial histories across central Asia provides an opportunity to examine shifts in the dominance patterns of climate systems over time in the region. Results to date show significant variations in the timing and extent of glaciation, including areas in the southeast Tibetan Plateau and Tian Shan with extensive valley and small polythermal ice cap glaciation during the global last glacial maximum in contrast to areas in central and northeast Tibetan Plateau that had very limited valley glacier expansion then. Initial numerical modelling attempting to simulate mapped and dated paleoglacial extents indicates that relatively limited cooling is sufficient to produce observed past expansions of glaciers across the Tibetan Plateau, and predicts complex basal thermal regimes in some locations that match patterns of past glacial erosion inferred from landform patterns and ages. Future modelling will examine glacier behaviour along major mountain ranges across central Asia.