

Glacial evolution of the Pamir mountains: insights from geomorphology and cosmogenic radionuclide dating

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The Pamir mountains at the western end of the Himalaya–Karakorum–Tibet mountain belt are characterized by landscape extremes: The western Pamir has an extreme local relief of >2000 m. The eastern Pamir is a low-relief orogenic plateau at \sim 4100 m. In most of the Pamir, modern glaciers are small and often are rock glaciers restricted to the north sides of the crests but significant ice caps occur in the eastern Pamir (Muztagh Ata, Kongur Shan) and in the northwestern Pamir, where the Fedchenko glacier is the longest glacier outside the polar regions. Glaciation of the Pamir contrasts with the strong glaciation of the Karakorum ranges farther south reflecting differences in annual precipitation between the Monsoon-influenced Karakorum and the arid, Westerlies-controlled Pamir.

Glacial and glaciogenic sediments that have been mapped throughout the Pamir suggest much more widespread glaciation during the Pleistocene. Cosmogenic radionuclide (CRN) dates indicate that one or several glacial maxima occurred \geq 100 ka, but the extent of the mid-Pleistocene ice cover is currently not known. While CRN exposure ages of glacially polished bedrock in the west-Pamir valleys suggest that these may have been formed by mid-late Pleistocene Alpine glaciers there is little record of the glacial advances on the east-Pamir plateau. We present new CRN exposure ages that elucidate the glacial and post-glacial history of the Pamir. We also present a geomorphological analysis focusing on the strong east-west difference in topography and on morphological evidence of glaciation in the eastern Pamir. Our analysis sheds light on the landscape evolution and on the competing effects of fluvial and glacial erosion and mass-wasting processes in an arid mountain environment.