# Late Pliocene to late Quaternary apparent exposure ages from glacial deposits in Ak-Shyrak, central Kyrgyz Tian Shan

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The Tian Shan in central Asia is one of the world's highest mountain ranges. The 2500 km-long WSW-ENE-trending arc of mountains extends from the western Kyrgyz Republic across northwestern China and almost to the border with Mongolia. Understanding the glacial history of this vast region is important because there is a general lack of paleoclimatic data from this highly continental location, at the confluence of major climate systems, and because glaciers are sensitive monitors of climate change. We examine the glacial history of the Ak-Shyrak massif and surrounding plateaus with average altitudes of ~3500 m a.s.l. To reconstruct the glacial history of this area we use a combined approach including geomorphological mapping, and cosmogenic nuclide surface exposure dating of erratic boulders on glacial landforms. We observe large site-specific scatter in our $^{10}$Be and $^{26}$Al exposure ages. Apparent minimum surface exposure ages range from ~2 ka to ~2.5 Ma, with early Quaternary- late Pliocene apparent exposure ages relating to some of the highest $^{10}$Be concentrations ever recorded for glacial deposits. Most dated boulders, however, fall in the apparent exposure age range of 100 ka to 300 ka. Consistent with previous results from the western and central Tian Shan, none of our boulders record a global last glacial maxima expansion of glaciers, and this contrasts to data from the eastern Kyrgyz Tian Shan. This spatial variation in glacier extent might be due to differences in paleoclimate. However, local physiographic conditions (e.g. altitude, slope, aspect) or external forcing factors other than climate (e.g., landslides) may cause local or regional differences in glacier response. We refrain from assigning mapped glacial advances to marine oxygen isotope stages because of the considerable age scatter. Finally we assess and discuss possible reasons for the observed age scatter and early Quaternary-late Pliocene apparent exposure ages in terms of prior and/or incomplete exposure histories of individual samples and compare our data to other regional datasets.