Climate changes and movement of people in central Asia during the Late Holocene by comparing archeological evidence and ice core records

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The Eurasian continent has a long history of movements of people and cultural transformations during the Holocene. Archeological evidence showed that Steppe pastoralists had moved to Central Asia from the west. The timing of their migration is possibly associated with climate change in central Asia.
Ice cores have been drilled from mountain glaciers in central Asia to reveal the past climate changes. An ice core was drilled in 2007 on Grigoriev Ice Cap (41˚58'33"N, 75˚54'48"E, 4,563 m a.s.l) in the Tian Shan Mountains, which is located in the region where the archaeological evidence of human movement was discovered. The ice core was 87 m long from the surface to the bottom bedrock and covered the last 13000 yr BP according to the radiocarbon dating.
In this study, we focus on the factors that led to the migration of people. We compared the ice core records of the Grigoriev ice cap with the age of the appearance of archaeological sites around the glacier. The ice core was cut at 10-mm intervals to reveal the climate and environmental changes during the period in the smaller interval. The analyses of water stable isotopes and chemical solubles were performed for a total of 319 samples. The radiocarbon dating at the two depths of the ice core showed the time of 6026 and 2835 cal yr BP, at 76.54 m and 79.53 m, respectively. We applied the relationship between time and depth linearly in this section based on the assumption of continuous accumulation and ice deformation.
The analysis revealed that the stable oxygen isotope ratios has fluctuated in hundred-year cycles. The comparison of the reconstructed temperatures indicates that the age of the archaeological site coincides with the warming period. The soluble chemical ions of the ice cores showed that there were several dust events during the period of the archaeological ruins in this area. Pollen records in the ice core show a significant change in the vegetation from trees to herbs at 4700 cal yr BP.
These results suggest the environmental changes in the late Holocene, such as temperature rises, dust events, and mountain grassland expansion, may have affected the migration of people in central Asia.

