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Extent and timing of paleoglaciation in the Kanas Valley, Altai Mountains, China, based on remote sensing, field investigations and multiple dating methods

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Reconstructions of the timing and extent of past glaciation provide key constraints for paleoclimate and numerical modeling of past glacier behavior. As part of the multinational Central Asian Paleoglaciology Project we are reconstructing the timing and extent of past glaciation along and across a series of mountain ranges in central Asia using consistent methods for mapping, field investigations and numerical dating. Here we report on new findings for the Kanas Valley in northwest China, a large glaciated valley system on the south side of the Altai Mountains.

Previous studies have concluded that the Kanas Valley has been shaped by a series of major glacial advances that produced overdeepened basins, a U-shaped valley cross profile, and extensive glacial and glaciofluvial deposits. Existing Optically Stimulated Luminescence (OSL) and Electron Spin Resonance (ESR) dating results suggest major glaciation in the Kanas Valley during Marine Oxygen Isotope Stages (MIS) 3, 5, and 6, but very limited MIS 2 glaciation. Limited MIS 2 glaciation has also been suggested for other parts of central Asia, and this contrasts with extensive MIS 2 glaciation in Europe and North America.

Field studies in 2013 provided new evidence for the highest elevation extent of glaciation in the Kanas Valley in the vicinity of the 20-km long Lake Kanas, with the upper limit of distinct erratics on the valley sidewalls indicating past ice thicknesses here up to 1000 m. Upper limits of erratics extending from Lake Kanas to the mapped maximum down-valley extent of glaciation suggest an ice surface slope of 1.8 degrees for the lower half of the paleoglacier in the Kanas Valley, assuming that all the erratics were deposited at the same time. Systematic sampling of glacial erratics, basal till, terminal moraines, glacially eroded bedrock, and glaciofluvial deposits provided material that is being used for cosmogenic radionuclide, OSL and ESR dating of the glacial chronology, and for dating intercomparisons.