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Dynamics and timing of paleoglaciation on opposite flanks of the Ikh-Turgen Mountains, Central Asia

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Spanning a northern sector of continental Central Asia, the Altai Mountains contains a rich record of glaciation. Still, there are few studies reconstructing the dynamics and timing of former glaciers in the region. We investigated the glacial history of two paleoglaciers, residing on opposite flanks of the Ikh-Turgen Mountains, straddling the border between Russia and Mongolia, using a combination of remote sensing, terrain analysis, field investigations and 10Be surface exposure dating.

On the eastern side (Mongolia) of Ikh-Turgen, mean arithmetic exposure ages from a latero-frontal moraine indicate deglaciation during Marine Isotope Stage (MIS) 3 (45.3±2.7 ka, n=5) and MIS 2 (22.8±3.5 ka, n=4). These age constraints are consistent with other paleoclimate records from the region. Cold and wet conditions during early MIS 2 and MIS 3 likely triggered glacier expansions but the transition to a drier climate resulted in more restricted paleoglacier extents during MIS 2 than during MIS 3. Well-constrained MIS 3 glacier expansions in Central Asia are rare. We therefore speculate whether the climatic and topographic setting of the eastern flank of the Ikh-Turgen Mountains has allowed for a better preservation potential of these moraines, making them more suitable for surface exposure dating than other regions of Central Asia, or whether MIS 3 moraines occur more widespread but await to be robustly dated.

Corresponding surface exposure ages, from the western side (Russia) of Ikh-Turgen, indicate a more complex story with large scatter (∼14–53 ka, n=8) making paleoclimate inference and comparison to other proxies difficult. Owing to their proximity, the paleoglaciers of Ikh-Turgen, should have responded similarly to climate forcing, yet they exhibited distinctly different behaviours. We discuss the connection between paleoglacier dynamics and style of moraine deposition and propose that differences in glacier dynamics caused differences in ice-marginal depositional environments, explaining the scatter in exposure ages on the western side. This study shows the importance of style of deposition in chronological studies of glacial landforms and demonstrates that certain moraine types can be difficult to use as paleoclimate proxies.