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Reconstruction of an extensive Younger Dryas glacial stadial in Canton Valais, Switzerland

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Remnant moraine deposits preserved on the walls of inner Alpine valleys provide valuable constraint on the timing and extent of Alpine glaciers during Lateglacial stadials. The Matter and Saas Valleys (Canton Valais, Switzerland) were major tributaries to the Rhone Glacier during the Last Glacial Maximum. They are oriented approximately north-south, and sub-parallel, approximately 10 km apart. The total catchment area of the Matter Valley is 450 km2, while the Saas Valley has a catchment area of 250 km2, valley floor elevations vary between 700 m and 2200 m. Detailed mapping of a prominent moraine sequence within the region has allowed us to delineate an extensive Younger Dryas re-advance in each valley that coincides with a clear, and consistent change in the geomorphology of both. Moraine deposits interpreted to reflect the terminus of the principal valley glaciers are located at 1300 m elevation in the Matter Valley, and 1650 m in the Saas Valley, with lateral moraine deposits located between 300 m and 500 m above the present-day valley floor.

Although the geography of the two valleys is similar, the mapped extents reflect complicated dendritic glacier systems, and calculations of equilibrium line altitude, or correlation of the stadials are difficult. We use the numerical landscape evolution model ICE-CASCADE (Braun et al., 2008) to model glacial ice extents, and find a close correlation between modelled and mapped glaciers for a given equivalent ocean surface temperature. While the principal valley glaciers are particularly sensitive to this variation, it is likely that the mapped re-advance is contemporaneous. Cosmogenic 10Be exposure age dating is used to constrain the timing of moraine emplacement, and allows us to both correlate this prominent stadial with Lateglacial advances recorded elsewhere in the Alps, and calibrate the ICE-CASCADE model for inferred climatic conditions during this stadial. Alongside results from our field mapping, we present a correlation of mapped extents with model results, as well as first results from surface exposure dating.

REFERENCES

J. Braun, D. Zwartz, and J. Tomkin. A new surface-processes model combining glacial and fluvial erosion. Annals of Glaciology, 28:282-290, 1998.