Lateglacial to interglacial sediment infills in Alpine valleys: timing, sediment provenance and paleo-environmental conditions

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Glacial/interglacial transitions in mountainous areas are marked by significant glacier retreat from forelands to inner massifs, resulting in large-scale and ephemeral lake formation that are subsequently filled (or not) by sediment transfer during lateglacial to postglacial times. When valley paleo-infills are preserved, they form precious archives to investigate (1) Alpine erosion dynamics and paleo-environmental conditions during key transition periods from full glacial stages to interglacials, and (2) glacial erosion patterns during susbequent glaciation.

In this contribution, we investigate such sedimentary deposits (locally called as "banquettes") in the French western Alps, and more precisely along the Isère valley and Val du Bourget. Previous research have attributed these deposits to the Riss – Würm transition due to their position under a basal compact till and to the MIS 6/5 transition up to early MIS 4 from palynological constraints, although no absolute ages has been available so far. Based on existing mapping of their spatial distribution and stratigraphic reconstructions, we sampled coarse-sand and sandy-gravel layers within these deposits for constraining both sediment deposition time (OSL dating) and provenance (glacial/postglacial origin, using terrestrial cosmogenic nuclide TCN 10Be in quartz). In addition, their spatial distribution provides estimates of maximum glacial erosion during the last glacial cycle, which can be subsequently used as spatial constraints for ice model predictions.

Our results confirm deposition times of these sedimentary units at the MIS 6/5 transition, with dating constraints from the late MIS 6 (ca. 145 ka) to the early MIS 5 (Eemien, 115-130 ka) for sandy layers. Upper sandy-gravel layers have younger deposition ages of ca. 80 ka, illustrating sediment fluxes at the transition from late MIS 5 to early MIS 4. We compare this temporal sequence to more recent sediment infills of the Isère valley (14C and OSL dating) during the Lateglacial to Holocene (MIS 2/1) transition. TCN data from sand samples also illustrate the sharp transition from full glacial to interglacial conditions, with a significant increase in 10Be concentrations from Lateglacial to post-glacial sediments. We propose that the observed signal can reflect changes in erosion rates, but also in glacier expansion or in paleo-environmental conditions, with export of stored subglacial sediments as well as the re-establishment of sediment/soil production and transfer along the catchment routing system following glacier retreat.