Geophysical Research Abstracts
Vol. 21, EGU2019-10108, 2019
EGU General Assembly 2019

New age constraints of Swiss Deckenschotter constrained by cosmogenic isochron burial dating

Reto Grischott (1), Florian Kober (2), Susan Ivy-Ochs (1), Kristina Hippe (1), Maarten Lupker (3), Marcus Christl (1), Christof Vockenhuber (3), Colin Maden (3), Mads Faurschou Knudsen (4), and John Jansen (4)

(1) Laboratory for Ion Beam Physics, ETH Zurich, Otto-Stern Weg 5, 8093 Zürich, Switzerland, (2) NAGRA, Hardstrasse 73, 5430 Wettingen, Switzerland, (3) Department of Earth Sciences, Sonneggstrasse 5, 8092 Zürich, Switzerland, (4) Department of Geosciences, Høegh-Guldbergs Gade 2, 8000 Aarhus C, Denmark

The landscape in the northern Alpine Foreland is the combined result of tectonic and climatic processes and particularly of numerous glaciations. Aggradation of glaciofluvial sediments and the subsequent fluvial incision led to the development of terraces comprised of thick gravel units. The oldest terraces/gravel units preserved in the Foreland – the so-called Deckenschotter – are morphostratigraphically divided into the Höhere (HDS) and Tiefere Deckenschotter (TDS) units which are separated mostly by a significant altitude difference of ∼100-150 m. Both gravel terraces/gravel units represent spatially extensive paleosurfaces and can form plateaus up to 200-300 m above the modern valley bottom. Knowing the timing of deposition and incision of these terraces/gravel units is of special interest for modelling the long-term safety of the deep geological repositories for nuclear waste disposal in the northern Alpine Foreland [1]. Furthermore, absolute ages of former fluvial systems are crucial to establish landscape evolution scenarios and to reconstruct past river drainage patterns and related (local/regional) base-levels.

Deriving absolute ages for old Pleistocene glaciofluvial gravels has been a challenge. The recently introduced cosmogenic burial dating method makes use of the differential decay of an in-situ produced nuclide pair in a mineral target (here: 26Al and 10Be in quartz) and the fact that pebbles in the initial fluvial sediment have different nuclide signatures due to varying erosion [2].

In this study, we aim to reconstruct the chronology of the Deckenschotter units along a transect in space and time at three locations in the Northern Foreland: In particular we focus on sites northwest of Zurich: the gravel pit Tromsberg / Kirchdorf and Feusi / Oberweningen (HDS) and a nearby gravel pit at Bärengraben in Würenlingen (TDS). Previous age estimates for HDS suggested an age range of 1.5 ±0.2 Myr based on isochron burial dating at the nearby Siglistorf site [3] and 1.8 to 2.5 Myr based on mammalian faunal assemblages (MN17) at site Irchel [4]. Pebbles from various lithologies and sands were sampled in order to maximize the spread in the data.

The first presented age estimates [3] indicate that deposition of glaciofluvial gravels and subsequent incision into them can locally be more complex and controversial than assumed by the classical distinction of deposits based solely on topography and morphostratigraphy. Here we confirm these revised ages and provide new ages constraints for the TDS. Furthermore, the impact of the improved gravel chronology is discussed in terms of landscape evolution and incision scenarios in the Foreland.
Additionally, our data are compared with a source-to-sink nuclide/clast model specifically which takes into account alpine erosion scenarios at the source, transport by ice to the Foreland and deposition in a glaciofluvial environment in the Foreland. The model illustrates the high complexity induced by samples sourced from the Alps over longer time periods and which are attempted to date in the Foreland and the generally observed and challenging low nuclide concentrations.

[1]: Nagra, NTB 14-01, 2014
[2]: Balco & Rovey, AJS, 2008
[3]: Akcar et al., ESPL, 2017
[4]: Bolliger et al. 1996, Eclogae Geol. Helv.