

Major shifts in sediment provenance revealed by a Pleistocene drill core record from the Eastern Alps (Austria)

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1) INTRODUCTION

As part of the Intercontinental Scientific Drilling Project (ICDP), the project DOVE (Drilling Overdeepened Alpine Valleys) aims to study the sedimentary infill of glacially overdeepened valleys as an archive of the environmental and landscape history of the Alps. At one of the study sites in the Eastern Alps near Bad Aussee, an exploratory drilling for salt revealed a stunning 880-m-long sequence of lacustrine, fluvial and subglacial sediments (van Husen & Mayr, 2007). The drill core material is currently re-investigated. Here, we present sedimentological evidence for major reorganizations of the drainage network of the rivers Traun and Enns during the last glaciation cycle.

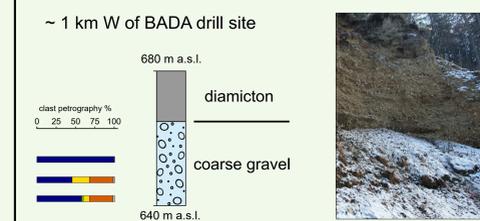


Fig. 1: Panoramic view of the glacially shaped Bad Aussee basin, showing the location of the drill site, where 880 m of Quaternary sediments were recovered (source: www.badaussee.com)

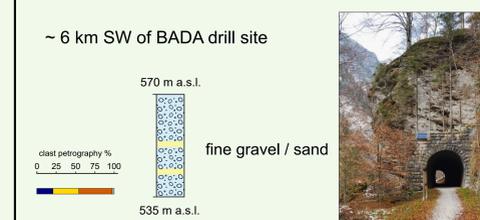
4) PRELIMINARY RESULTS

- Drill record: **coarsening-upward** trend (Fig. 3a)
- Gravels rich in **crystalline rocks** (mainly gneisses and mica schists)
- Outcrops along Traun show similar composition (Fig. 3b & c)
- Carbonates dominant towards top of succession

b) Outcrop Kirchlatzbach (KLB)



c) Outcrop Mühlwerkstein (MÜH)



a) Drilling

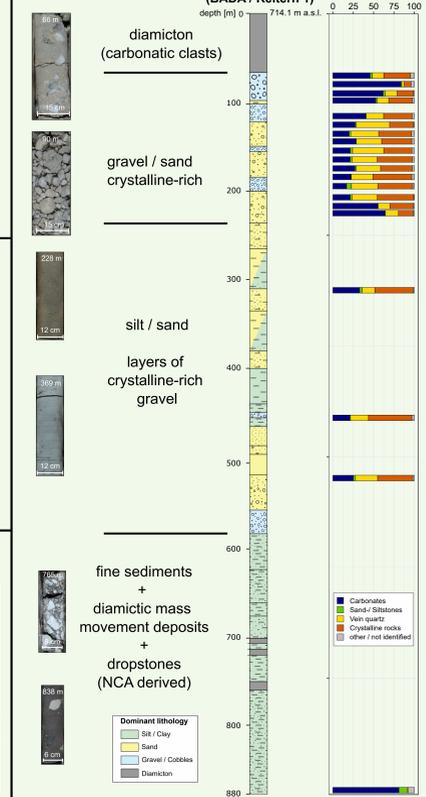


Fig. 3: Lithological description and clast petrography of a) the BADA drillcore and two nearby outcrops (location is shown in Fig. 5); for each sample >100 clasts were identified

2) GEOLOGICAL SETTING

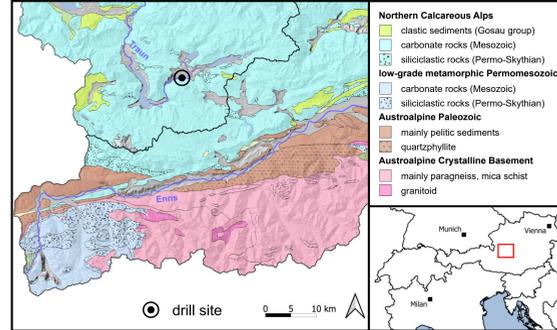


Fig. 2: Geological overview map of the upper Enns and Traun catchments, modified from Weber (1997).

- Traun catchment: Northern Calcareous Alps (NCA)
- South of Enns Valley:
Austroalpine Paleozoic & Crystalline Basement units
- Glacially overdeepened valleys

3) METHODS

- Sedimentological core description
- Clast petrography
- Luminescence dating (ongoing)
- Cosmogenic nuclide burial dating (ongoing)

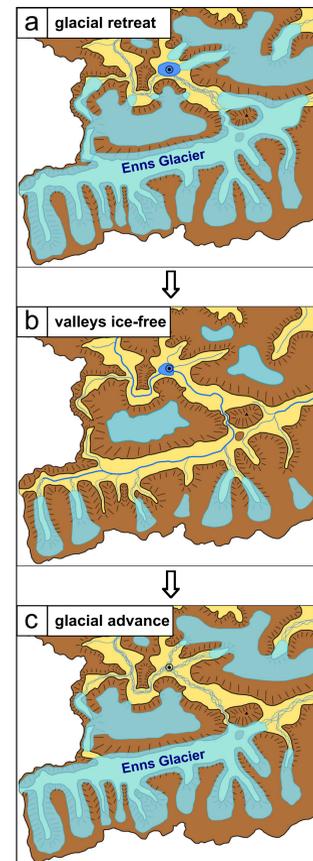


Fig. 4: Reconstruction of glacial and fluvial configurations, which could explain the observed facies and provenance of the drilled sediments

5) INTERPRETATION

From the sedimentary record & the present-day topography we interpret the following evolution of the Bad Aussee basin:

- 1) Proglacial lake (Fig. 4a)**
Deposition of fine sediments with dropstones & debris from local lithologies
- 2) Prograding delta (Fig. 4b)**
sand and gravel from largely crystalline material transported from S of Enns valley (possibly through today's Salza valley)
- 3) Glacial advance (Fig. 4c)**
deposition of gravel and basal till on top of the filled lake basin, input of crystalline material is cut off

Glacial erosion during LGM results in **drainage reorganization after deglaciation** (present situation; Fig. 5)

6) CONCLUSIONS & OUTLOOK

The Bad Aussee paleolake record reflects the glacial modification of the regional valley network

Depositional ages from luminescence & cosmogenic nuclide will provide chronological framework

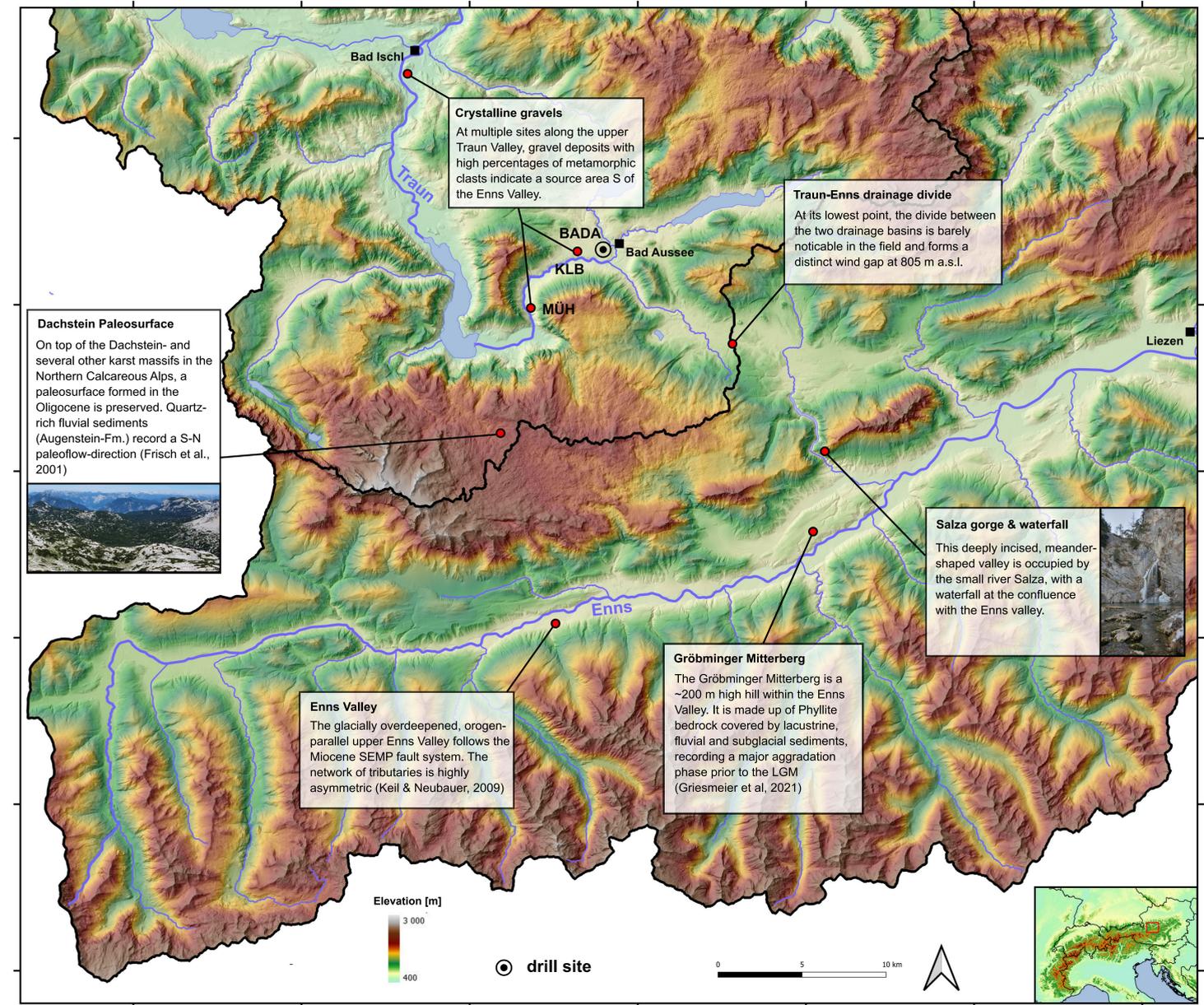


Fig. 5: Topographic map and drainage network of the upper Traun and Enns catchments with selected geological and morphological features highlighted. The black lines delineate the respective drainage basins, coordinates: UTM 33N.

REFERENCES

- Frisch, W., Kuhlmann, J., Dunkl, I. & Székely, B. (2001): The Dachstein paleosurface and the Augenstein formation in the Northern Calcareous Alps – a mosaic stone in the geomorphological evolution of the Eastern Alps. – Int. J. Earth Sc. (Geol. Rundschau), 90, 500–518. Stuttgart
- Griesmeier, G.E.U., Reiter, J.M., Le Heron, D.P. (2021): The Gröbminger Mitterberg (Austria): A time machine to the pre-LGM. Conference presentation, EGU 21, Vienna.
- Husen van, D. & Mayr, M. (2007): The hole of Bad Aussee. An unexpected overdeepened area in NW Steiermark, Austria. – Austrian Journal of Earth Sciences, 100, 128–136, Wien.
- Keil, M. & Neubauer, F. (2009): Initiation and development of a fault-controlled, orogen-parallel overdeepened valley: the Upper Enns Valley, Austria. – Austrian Journal of Earth Sciences, 102, 80–90, Wien.
- Weber, L. (1997): Metallogenetische Karte von Österreich 1:500.000: unter Einbeziehung der Industriemineraler und Energierohstoffe.

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Abstract:

