

A new tectonic subdivision in the Northern Calcareous Alps of western Austria that resolves a 100 year old controversy

Hugo Ortner¹, Sinah Kilian¹

¹Universität Innsbruck (Austria)

The Northern Calcareous Alps (NCA) are an Upper Cretaceous thrust belt. In the early 20th century, three major units have been distinguished, that are, from bottom to top, the Allgäu-, Lechtal- and Inntal thrust sheets (Fig. 1A). From the very beginning, this subdivision was controversial: The Zugspitze block of the Wetterstein mountains is continuous with the Lechtal thrust sheet toward the NE, but is also seen to sit on top of the Zugspitze thrust that emplaces the Triassic of the Zugspitze on Albian syntectonic sediments. Therefore, a backthrust at the base of Zugspitze block had been proposed. However, the base of the Inntal thrust sheet is very close to the south and emplaces Triassic on Albian sediments as well. The opponents of the backthrust hypothesis suggested the continuity of the Inntal and Zugspitze thrusts.

We present a new structural analysis of the area of the Zugspitze block and the southerly adjacent Inntal thrust sheet. The key results are:

- The Inntal and Zugspitze thrusts have the same structural characteristics –emplacement of Triassic onto the Albian, NW- to NE-directed transport from s-c-fabrics and dm-scale folds.
- To the N and NE, the Zugspitze thrust is dissected and exhumed by the out-of-sequence Obermoos thrust that disappears into a tightly folded zone toward the east.
- As a consequence of (2), the Lechtal and Inntal thrust sheets are part of the same thrust sheet, that is dissected by laterally discontinuous out-of-sequence thrusts.

To avoid confusion of different subdivisions, we propose the following new nomenclature (Fig. 1B; see Kilian and Ortner, 2019 in press, Austrian Journal of Earth Sciences): The **Tannheim thrust sheet** includes the former Allgäu thrust sheet and two windows NW and NE of Innsbruck. The **Karwendel thrust sheet** merges the former Lechtal and Inntal thrust sheets. Westward increasing offset across out-of-sequence thrusts causes emplacement of the **Imst half-klippe** and **klippen**, that are part of the Karwendel thrust sheet. The age of syntectonic sediments below the thrust sheets supports such a subdivision. The entire Karwendel thrust sheet is emplaced on Albian sediments. Only the Imst (half)klippen west of the WNW-striking Telfs tear fault between Imst and Innsbruck lie on Cenomanian deposits.

The controversy on the tectonic position of the Zugspitze block was unsolvable, because the basic requirements for definition of a thrust sheet were never explicitly formulated. All involved parties implicitly assumed that a thrust sheet should be bounded by a throughgoing thrust on all sides. However, none of the NCA thrust sheets meets this requirement. Instead, thrusts loose offset toward the tips, and end (see, e.g., the Lechtal thrust of Fig. 1; Therefore, we rather use the term ‚thrust sheet‘ instead of ‚nappe‘).

The controversy is resolved employing two ideas:

- The distinction of in-sequence thrusts, that always emplace old on young rocks, from of out-of-sequence thrusts, that may also emplace young on old rocks and cross-cut the first.
- Thrusts end laterally.

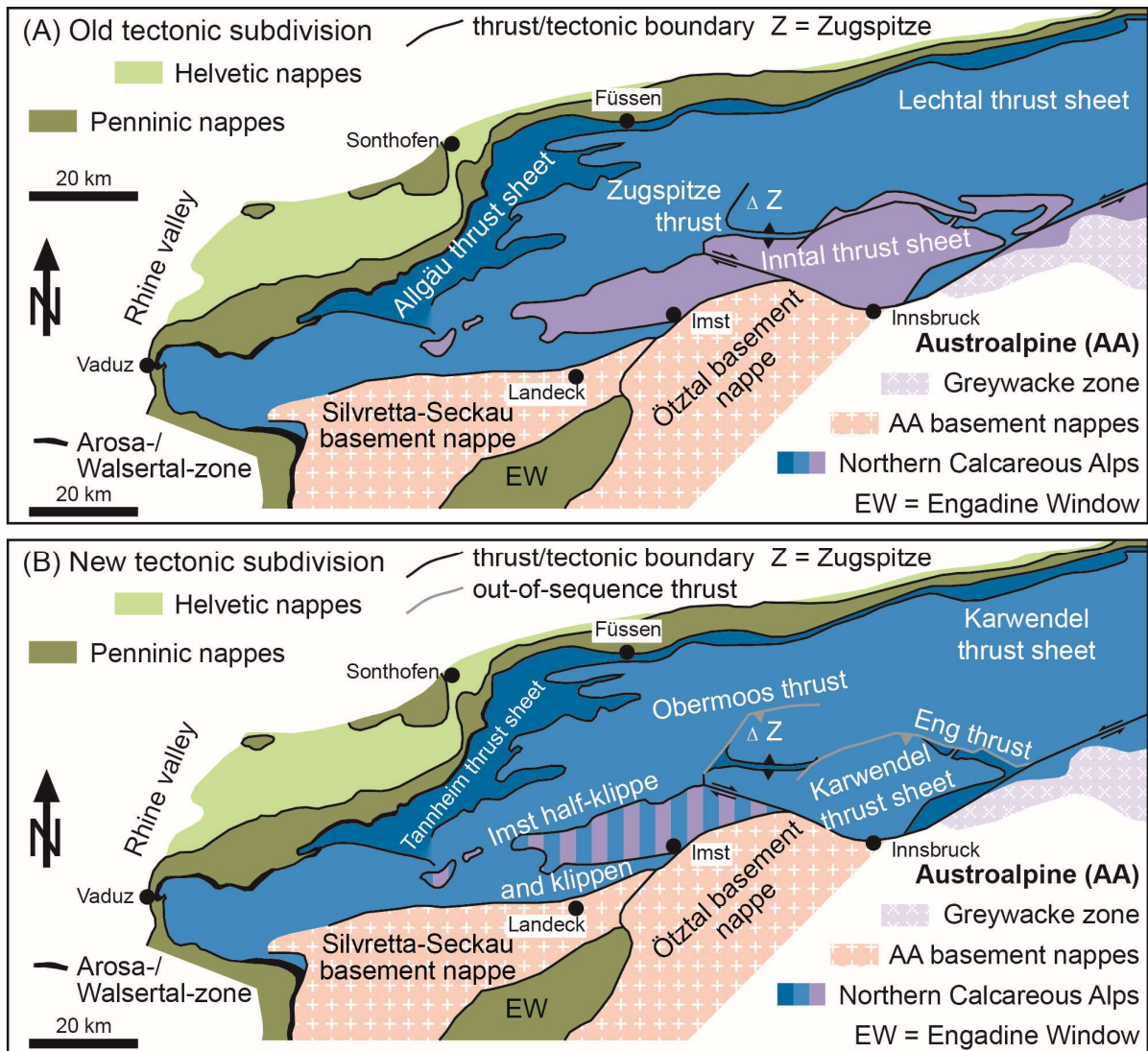


Fig. 1: (A) the old and (B) the new tectonic subdivision of the NCA