Paleogene palaeogeography and tectonic evolution of the Salzburg-Reichenhall basin and adjacent units in northern Eastern Alps

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The Eastern Alps include the remnants of two continent-continent collisional orogens, which are superimposed to each other. The earlier orogen formed at about the Early to Late Cretaceous boundary and represents, after the closure of the Penninic oceanic basin, the overriding plate of the second Middle Eocene to Oligocene orogen. In terms of the palaeogeographic and tectonic evolution of the Eastern Alps, the Paleocene to early Eocene time represents a transitional stage between these two paroxysmal orogenic events.

This study provides new petrographic (Dickinson-Gazzi method) and single-grain Ar-Ar white mica ages from sandstones of Paleogene siliciclastic successions of two units of the central northern Eastern Alps, which were exposed in two tectonic plates during the closure of the Penninic ocanic basin. (1) The Upper Cretaceous to Eocene Salzburg-Reichenhall basin (SR basin) is exposed at the northern leading edge of the Northern Calcareous Alps (NCA) overlying the Cretaceous Austroalpine nappe complex. The SR basin is interpreted to have initially formed as Upper Cretaceous pull-apart-type collapse basin at a sinistral overstep within a regional E-trending wrench fault crossing Salzburg city and overstepping the folded Permian to Lower Cretaceous NCA succession. The Late Cretaceous stage is governed by longitudinal infilling, mainly from E to SE, and steep lateral basin margins. Later, during Santonian to Paleogene, marl deposition suggests loss of the pronounced palaeo-topography, which re-appears with siliciclastic turbidites of Late Paleocene/Eocene age. (2) In contrast, the Rhenodanubian Flysch zone (RFZ) represents the Lower Cretaceous–Eocene infilling of a deep sea basin deposited in part on Penninic ocean floor and in part on a distal continental (European/Helvetic) margin.

Sandstone compositions of Paleogene Nierental Fm. (Untersberg section of Egger et al., 2009) of the SR basin are dominated by carbonatic framework constituents and calcitic cement. Hybrid sandstones comprise monocrystalline and polycrystalline quartz, some plagioclase and K-feldspar, white mica and angular volcanic clasts with doleritic and microcrystalline quartz/feldspar fabrics. Most samples plot into fields of orogenic sources. Ar-Ar ages of detrital white mica from Paleogene formations mainly range from 87 to 104 Ma and indicate that mainly amphibolite facies-grade metamorphic units of the exhuming Cretaceous orogenic wedge contributed to the basin fill.

Paleogene RFZ sandstones have abundant carbonate clasts (up to 40 percent of framework constituents) including bioclasts like bryozoa, foraminifera and lamellibranchiata constraining their shallow water origin. The siliciclastic detritus is dominated by mono-crystalline quartz and subordinate clasts from highly metamorphic rocks (e. g. sillimanite-bearing gneiss) and lithic volcanic clasts (acidic, phenocryst-bearing components). Ar-Ar white mica ages are, in contrast to the underlying Lower Altlengbach Fm. (ca. Maastrichtian) with dominant Variscan (372, 331 – 312 Ma) and some minor contribution of Mesozoic ages (176 – 205, 122 Ma), single grain ages from the Acharting Subformation (Acharting brook) and Anthering Subformation (Anthering section of Egger et al. 2009) are within a narrow age Variscan group (339 – 363 Ma and 321 – 366 Ma, respectively).

Together, the new data confirm for the Paleocene/Eocene boundary: (1) the distinct palaeogeographic position of the SR basin and RFZ on two different plates, (2) significant exhumation of the Cretaceous-aged metamorphic Austroalpine nappe complex, and (3) a significant bimodal (acidic, mafic) volcanic contribution to the Penninic and SR basins.

References:

Egger, H., Heilmann-Clausen, C., Schmitz, B., 2009. From shelf to abyss: Record of the Paleocene/Eocene-boundary in the Eastern Alps (Austria). Geologica Acta 7, 215–227.