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THERMAL EVOLUTION OF AN EXTENSIONAL DETACHMENT AS CONSTRAINED BY ORGANIC METAMORPHIC DATA AND THERMAL MODELING: GRAZ PALEOZOIC NAPPE COMPLEX (EASTERN ALPS)

Rantitsch, G.[1], Sachsenhofer, R.F.[1], Hasenhüttl, C.[2], Russegger, B.[3] & Rainer, T.[1]

[1]Department of Applied Geosciences and Geophysics, University of Leoben, Austria, A-8700 Leoben, Austria
[2]Library of the University of Leoben, A-8700 Leoben, Austria
[3]Library of the University of Graz, A-8100 Graz, Austria
e-mail: gerd.rantitsch@notes.unileoben.ac.at

The thermal regime of extensional orogens has been studied mainly by numerical models of shearing along extensional fault zones which were calibrated by thermochronological data. In this contribution we model an extensional detachment within the Eastern Alps by using reliable temperature estimates in a section cutting through a low- to high-grade metamorphic basement, a very low- to low-grade metamorphic cover and a synchronously subsiding collapse basin on top of the section. Following Early Cretaceous nappe stacking, the Eastern Alps were affected by late-orogenic extension during the Late Cretaceous. In the eastern segment of this range a Late Cretaceous detachment exposes a very low- to low-grade metamorphic cover (Graz Paleozoic Nappe Complex, GPNC) above a low- to high grade metamorphic basement. Synchronously, a collapse basin (Kainach Gosau Basin, KGB) subsided on top of the section.

Metamorphism of organic matter within this section has been investigated using vitrinite reflectance data and Raman spectra of extracted carbonaceous material. In the southern part of the GPNC vitrinite reflectance indicates a decrease in organic maturity towards the stratigraphic hangingwall. The remaining part of the GPNC is characterized by an aureole of elevated vitrinite reflectance values and Raman R2 ratios which parallels the margins of the GPNC. Vitrinite reflectance in the KGB shows a steep coalification gradient and increases significantly towards the western basin margin. The observed stratigraphic trend in the southern GPNC is a result of deep Paleozoic to Early Cretaceous burial. This maturity pattern was overprinted along the margins by advective heat and convective fluids during Late Cretaceous to Paleogene exhumation of basement rocks. During shearing the fault zone was heated up to ca. 500°C. This overprint is explained by a two-dimensional thermal model with a ramp-flat fault geometry and a slip rate of 1 to 1.5 cm/a. The collapse basin above the detachment subsided in a thermal regime which was characterized by relaxing isotherms.

The reconstructed thermal history resembles the P-T-path of the eastern Greywacke Zone (RANTITSCH et al., Int. J. Earth Sci. 93, 959-973, 2004), which represents a detachment of the same age. Therefore, this study underlines the importance of advective heat transfer and convective fluid circulation during late-stage orogenic processes.