METAMORPHIC EVOLUTION OF THE EASTERN ALPS

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The Eastern Alps are the product of two orogenies, a Cretaceous orogeny followed by a Cenozoic one (FROITZHEIM *et al.,* 1996). The former is related to the closure of an embayment of the Neotethys ocean into Apulia (Meliata Ocean), the latter is due to the closure of the Alpine Tethys oceans between Apulia and Europe. The result of the orogenic movement is a complex nappe stack, which is built up from north to south and from bottom to the top by the following units (Plate 1 in SCHMID *et al.*, 2004): The proximal parts of the Jurassic to Cretaceous European margin built up the northern Alpine foreland and the Helvetic nappes, whereas the distal margin is represented by the Subpenninic nappes. The Penninic nappes comprise the Piemont-Ligurian and Valais Ocean (Alpine Tethys) and the Briançonnais Terrain. Apulia consists of the northern Austroalpine nappes and the Southern Alpine unit (STAMPFLI & MOSAR, 1999). Remnants of the Neotethys embayment occur as slices within the eastern part of the Austroalpine nappe stack. Both orogenic events are accompanied by regional metamorphism of variable extent and P-T conditions. The Cretaceous (Eo-Alpine) metamorphism affects mainly the Austroalpine Nappes, the Penninic domain by the Cenozoic metamorphism, some units of the Lower Austroalpine Nappes show signs of both events.

The distribution of the metamorphic facies zones in the Eastern Alps is mainly controlled by the northwards transport of the Austroalpine nappes. They show a Cretaceous metamorphism and are thrusted over the Penninic domains with Tertiary metamorphism. The latter are exposed in the Eastern Alps only as tectonic windows.

The **eo-Alpine (Cretaceous) metamorphic event** is widespread within and restricted to the Austroalpine unit. It is related to the continental collision following the closure of an embayment of the Tethys Ocean during late Jurassic to Cretaceous times. Recent investigations indicate that the northern part of the Austroalpine unit forms the tectonic lower plate. The southern parts and the north-eastern margin of the Southalpine unit acted as the tectonic upper plate during the continental collision following the disappearance of the oceanic embayment (SCHMID *et al*., 2004). The peak of the eo-Alpine metamorphic event was reached at about 100 Ma, the youngest cooling ages are recorded at 65 Ma (THÖNI, 1999). The eo-Alpine metamorphism starts at the base of the lower plate with greenschist facies and increases structurally upwards the nappe piles until eclogite facies is reached. It decreases again in the uppermost nappes to sub greenschist facies. The whole section represents a transported metamorphism. An overprint of the Variscan crystalline of the lower plate, prior to the eo-Alpine metamorphic event, controlled by a thermal Permian event is widespread.

The **Tertiary Alpine metamorphic event** is due to the closure of the Jurassic to early Cenozoic Briançonnais and Valais oceans (Alpine Tethys). According to WAGREICH (2001) the re-arrangement of the Penninic-Austroalpine border zone from a passive to an active continental margin starts at about 120 Ma. From that time on the oceanic lithosphere and slices from the northern margin of the Austroalpine unit (Lower Austroalpine units) were subducted towards the south below (Upper) Austroalpine units. The Tertiary event reaches blueschist facies conditions in some Mesozoic parts of Penninic windows and some units of the Lower Austroalpine (Tarntal nappe). Eclogite facies conditions followed by a blueschist event occur only in a narrow zone of the Tauern Window. The thermal peak ranges from greenschist to amphibolite facies, the latter was only reached in the central part of the Tauern Window. After the thermal peak at about 30 Ma (BLANKENBURG *et al.*, 1989) uplift and cooling is recorded by K-Ar and Ar-Ar ages on white micas and fission track ages on zircon and apatite (GRUNDMANN & MORTEANI, 1985; FÜGENSCHUH *et al*., 1998). In the lower nappes of the Lower Austroalpine units the Tertiary Alpine metamorphism overprints the Cretaceous metamorphic event.

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