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# Subduction related metamorphism in the Alps: Review of isotopic ages based on petrology and their geodynamic consequences

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The Alpine belt formed during a long process of convergence, subduction and collision between the European and Adria continental plate margins during Mesozoic and Cenozoic times. The intervening oceanic crust progressively deformed and partially accreted to the continental margins, which are sandwiched between units of the overlying Austroalpine nappes and rocks of the underlying European domains. The occurrence of high pressure–low temperature metamorphism (HP/LT) in major parts of the oceanic and some adjacent continental units is now well known from many parts of the Alps. Nevertheless, different opinions exist about the age and paleogeographic position of some HP/LT units (e.g. Cretaceous vs. Tertiary, number of subduction sites) partly due to conflicting age determinations of metamorphism and partly due to a fragmentary view of the Alpine belt.

We summarize ages of the high pressure/low temperature (HP/LT) metamorphic evolution of the Central and the Western Alps. The individual isotopic mineral ages are interpreted as: (1) early growth of metamorphic minerals on the prograde path, (2) timing close to peak metamorphism and (3) retrograde resetting of the chronometers at still elevated pressures. Therefore, each individual age cannot easily transferred to a geodynamic setting at a certain time. Most interpretable are $^{40}$Ar-$^{39}$Ar ages of micas in blueschist facies (LT) rocks. These different data indicate a subduction related metamorphism between 62 and 40 Ma in different metasediments (e.g., Voltri Massif, Schistes Lustrés of the Western Alps, Bündnerschiefer in the Central Alps as in the Tauern window).

Ophiolite and continental basement units show isotope ages related to eclogitic or

blueschist facies metamorphism between 75 and 40 Ma, with younger ages only in the Dora Maira nappe (35 Ma). Most of these ages may record equilibration along the retrograde path, except of some Lu/Hf garnet ages, which will give information along the prograde path. These different isotope ages will be interpreted as different steps along pressure-time paths and so may give some evidence for the geodynamic evolution. The data record a continuous subduction, which is ongoing for several tens of millions years.

The Alps are suitable to combine large data sets in order to compare geodynamic numeric models with nature.