P-T-t CONSTRAINTS FOR EO-ALPINE CONTINENTAL SUBDUCTION OF ECLOGITES IN THE AUSTROALPINE SCHOBER BASEMENT

by

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The aim of this study was the reconstruction of the P-T-t paths of eclogites and surrounding rocks in the Austroalpine basement S of the Tauern window. Basic eclogites and eclogitic amphibolites occur as lenses in the SW Schober basement within a sequence of paragneisses and micaschists. Orthogneisses are accompanying this eclogites that frequently contain concordant layers of metapelites.

Various eclogite types contain similar assemblages with different modal abundance. Garnet, omphacite, amphibole, epidote and quartz represent the main phases. Phengite and dolomite also appear frequently and biotite can also form part of the eclogite facies assemblage. Albite may be preserved as relics in eye-shaped domains.

Orthogneisses can be classified into different lithotypes, but only samples with garnet-bearing assemblages where investigated in more detail. The same was done for metapelitic rocks, where assemblages with garnet and staurolite were mainly investigated. Metapelites of the eclogite zone and metapelites of the country rock series, which contain no eclogitic rocks, contrast mainly in grain size, while the assemblages are quite similar.

Eclogites preserve prograde growth zoning in garnet, omphacite and amphibole and retrograde zoning in amphibole. Mn-fractionation accompanies initial garnet growth, which is succeeded by garnet with higher Ca content due to plagioclase breakdown. Higher X_{Mg}-ratios towards the rim point to further prograde garnet growth. Omphacite growth is documented by inclusions in garnet and cores of larger omphacite grains, which contain higher aegirine components than omphacites of the peak assemblage.

Amphiboles exhibit also a slight prograde zoning pattern. Increasing glaucophane substitution (magnesiohornblende to edenite, barroisite to magnesiokatophorite) due to pressure increase and overlapping edenite substitution due to temperature increase characterizes amphibole growth. Blue amphibole rims, which occur especially in contact to omphacite and garnet, indicate retrograde recrystallization. Albite component from omphacite breakdown is incorporated into amphiboles favouring edenite substitution. Hydration of garnet rims requires additionally tschermak substitution and results in Al-amphiboles with pargasitic and taramitic compositions.

Phengites of different eclogite types show variable compositions, but there is no significant zoning within the white micas. High Si-contents (2.88 ApF) characterizes the eclogite facies biotite, which can decrease at the rims due to recrystallization.
Amphibolite facies recrystallization dominates assemblages and mineral chemistry of metapelites and orthogneisses. Only garnets preserve parts of the prograde path and peak conditions are documented by garnet and phengitic muscovite. Metapelitic garnets of the eclogite zone and the country rock series display similar zoning and resorption pattern. In connection with resorption of garnets phengitic muscovites recrystallize to paragonitic muscovites. Paragonite decomposition in the country rock series can cause also garnet growth during recrystallization.
Thermobarometric data constrain three P-T stages for the HP rocks. Minimum conditions of 600°C and 12–14 kbar can be estimated from omphacite inclusions in garnet. Different eclogite types yielded peak metamorphic con-ditions of 630–690°C/16–18 kbar. For this stage low X_{CO2}-ratios, in the range of 0.015 to 0.040, can be calculated for dolomite bearing eclogites. The conditions of amphibolite facies recrystallization after the first phase of exhumation are derived from metapelites of the eclogite zone (630–680°C, 10–12 kbar). Significant lower conditions of recrystallization (510–590°C, 5–6 kbar) are recorded by the metapelites outside the eclogite zone.
The oxygen isotopes of the eclogite minerals document disequilibrium. In contrast, eclogitic amphibolites and interlayered paragneisses exhibit oxygen isotope equilibration across several layers (dm-scale). For these rocks a temperature peak of 660–690°C was estimated by oxygen isotope thermometry.
Sm-Nd and Rb-Sr data of the HP rocks indicate an eo-Alpine pressure peak (> 97 Ma), which was followed by amphibolite facies recrystallization before 86 Ma. The Upper Cretaceous cooling history is well defined by Rb-Sr mica ages of the eclogite zone and country rocks. White micas (T_C 500°C for Rb-Sr) close before 75 Ma and biotites (T_C 300°C) before 68 Ma. The more extended time span of white mica ages can be correlated with dynamic recrystallization during exhumation. On the other hand, the regional distribution of biotite ages points to minor late Alpine thermal influence.
The overall P-T-t path of the eclogite zone, representing the southern and tectonic upper part of the Schober basement, indicates eo-Alpine continental subduction and subsequent exhumation. Whereas subduction is marked by a steep P-T gradient, initial exhumation with isohermal decompression was followed by a main period of cooling. The P-T path of the country rock series, which comprises the northern and tectonic lower part of the Schober basement, gives no evidence for deep subduction.

Within the eo-Alpine high-pressure belt (THÖNI & JAGOUTZ, 1993) the Schober eclogites display a transitional P-T path between cooling (Kor/Saualpe, THÖNI & MILLER, 1996; MILLER & THÖNI, 1997) and heating after the pressure peak (SE Ötztal basement, HOINKES et al., 1991). This trend suggests low-compressional subduction (CHEMENDA et al., 1996) in the E (Kor/ Saualpe) passing into high-compressional subduction (CHEMENDA et al., 1995) towards the W (SE Ötztal basement).
In pegmatite gneisses the composition of garnet and muscovite points to primary pegmatitic origin of these minerals, thus precluding major metamorphic reactions in these rocks. Coarse grained muscovites preserve pre-Alpine Rb-Sr ages (> 200 Ma). A Permian age of the pegmatites seems probable.