of the eastern Tauern Window and the brittle-behaving Austroalpine basement units with its Neogene basins on top. We use published apatite fission track (AFT) and (U-Th)/He data from two sections of the Hohe Tauern to the east to constrain the E-W exhumation gradient. We also consider partitioning of translation of the Austroalpine crust by ca. ENE-trending orogen-parallel Oligocene faults separating the Hohe Tauern from the Northern Calcareous Alps, respectively the combined Hohe Tauern/Niedere Tauern block from the Nock/Gurktal/Murau Mts. domains. For comparison, we include an E-W section along the southern Northern Calcareous Alps and sections along the SEMP and Mur fault zones. Assuming a thermal gradient of 30 ºC/km, we find a similar gradient of ca. 0.04 for both basement sections. This low gradient is close to a gradient typical for viscous material with low shear strength. These relationships imply that gravitational collapse alone might be sufficient to explain the eastward motion of the brittle Austroalpine crust over a thick viscous layer. Flow above a low-friction viscous layer also explains the eastward tilting of blocks like the Saualpe and Koralpe blocks along antithetic high-angle normal faults. Together, the area east of the Tauern window could be explained by intra-orogenic raft tectonics.

Deformation within a subduction channel at eclogite facies conditions and consecutive exhumation: The Eclogite Zone of the Tauern Window, Austria

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Many recent models for the exhumation of subducted oceanic crust assume corner flow in a subduction channel and exhumation of the very dense metabasites, i.e. eclogites, within a buoyant melange of serpentinites or metasediments. The Eclogite Zone of the Tauern Window represents a paleo-subduction channel in the Eastern Alps, which formed during the subduction of the Penninic ocean beneath the Adriatic continent in the Tertiary. It comprises metasediments as well as large metabasite lenses. Since serpentinites are very rare and occur only in small patches in the western Tauern Window, the metasediments are likely to be the buoyant medium for the exhumation of the eclogites. The Eclogite Zone was exposed to P/T-conditions of 20 - 25 kbar and 600±30°C and exhumed in a very short time span of 1 - 2 Ma. Most of the deformation of this rapid exhumation was presumably concentrated in the metasediments almost exclusively displaying the retrograde mylonitization. This is due to the rheological weakness of gneisses, schists, and marbles in comparison to the metabasites. In addition, the large strains required for exhumation caused a penetrative amphibolite to greenschist facies overprinting. Although only weakly deformed, the metabasites show almost the complete deformation history comprising localized eclogite facies shear zones and the whole amphibolite to greenschist facies deformation sequence during exhumation. The foliation consistently dips to the SSE with 70-85° demonstrating the long-standing operation of this shear plane orientation. However, the omphacite stretching lineation plunges SW, while the hornblende stretching lineation is WSW-plunging to sub-horizontally W-trending.

The structural field mapping is completed by microstructural analyses and crystallographic preferred orientation (CPO) measurements. The variable foliation intensity corresponds to a wide range of CPO intensities. In eclogites indicative of dynamic recrystallization of omphacite and garnet, omphacite exhibits a pronounced CPO. Weaker CPOs of other eclogite samples reveal strain gradients and localized deformation. Occasionally, the hornblende CPO mimics the omphacite CPO arguing for a static overprint. In contrast, differing omphacite and hornblende CPOs indicate ongoing deformation during exhumation. The metasedimentary rocks show a strong mica foliation with a pronounced muscovite CPO. The quartz CPO in the metasediments indicates simple shear deformation with top to the NE sense of shear.

From the mineral CPOs and particular elastic moduli and volume fractions, the CPO-related contribution to bulk rock elastic anisotropy was estimated. P-wave velocity distributions of the eclogite samples exhibit rather low anisotropies of 1-2 %, which are mainly caused by the omphacite CPO. The growth of retrogressed mineral assemblages, specifically hornblende, causes a slight anisotropy increase up to 3 %. P-wave anisotropy of the paragneisses approximates 7 %. It is mainly caused by the muscovite CPO, because the minimum velocity parallels the foliation normal. In metasediments containing only very small amounts of muscovite the elastic anisotropy is around 5 % and mainly caused by the quartz CPO.

From the compilation of all these data comprehensive information on the internal architecture, elastic anisotropy, accumulated bulk strain and strain partitioning within the Tauern Window subduction channel is expected. A more detailed model of subduction channel deformation may result, which could be compared to already existing models.

Alpine metamorphism in the continental Etirol-Levaz slice (Western Alps, Italy) – Insights from petrological, thermodynamic and geochronological investigations

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The Etirol-Levaz slice in the western Valtournenche of Italy is a continental fragment trapped between two oceanic units, the eclogite-facies Zermatt-Saas Zone in the footwall and the greenschist-facies Combin Zone in the hanging wall. It has been interpreted as an extensional allochthon derived from the Adriatic continental margin and stranded inside the Piemont-Ligurian oceanic domain during Jurassic rifting. The slice consists of pre-Mesozoic high-grade gneisses, micaschists and metabasics which have been overprinted under eclogite-facies conditions during Early Tertiary Alpine subduction. We analyse metabasic and metasedimentary rocks in terms of their chemical and mineral compositions and focus on mafic eclogites of which two samples are dated with the Lu-Hf geochronometer. Distribution maps of major bivalent cations in garnets are used to identify zonation patterns and to distinguish between different garnet generations.

Eclogites generally consist of the assemblage garnet + omphacite ± epidote ± amphibole ± phengite ± quartz. In one sample, garnets have compositions of Alm52-61 Grs18-41 Prp5-22 Sps0.5-2 and display typical growth zoning. Some garnet grains are brittlely fractured, strongly corroded and overgrown by epidote. Amphibole occurs as a major phase in the matrix and shows a progressive evolution from glaucophane in the core to pargasitic hornblende towards the rim. Amphibole grains are often truncated by epidote veins. Another sample shows a particular Ca-rich bulk composition (18.3 wt% Ca) and displays two distinct garnet generations. Perfectly euhedral cores show compositions of Grs42-45 Alm47-51 Prp3-6 Sps2-7 and typical prograde growth zoning. These cores are overgrown by irregularly shaped rims characterised by an initial rise in Mn and the Fe-Mg ratio. Omphacite in this sample with jadeite-contents of 19-28 mol% apparently has been fractured and annealed by jadeite-poor (7-12 mol%) omphacite suggesting brittle behaviour at eclogite-facies conditions or brittle deformation between two high-pressure stages.

We constrain pressure and temperature conditions for prograde, peak and retrograde mineral assemblages using equilibrium phase diagrams. Preliminary results suggest that high-pressure rocks of the Etirol-Levaz slice record equilibration at different metamorphic stages along a single Alpine metamorphic cycle. We also use thermodynamic modelling of mineral growth during prescribed PT paths to unravel the significance of observed garnet zonation patterns. Application of Lu-Hf geochronometry is used to further constrain the timing of Alpine high-pressure metamorphism in the Etirol-Levaz slice.