Geophysical Research Abstracts
Vol. 18, EGU2016-8261, 2016
EGU General Assembly 2016

The internal structure of eclogite-facies ophiolite complexes: Implications from the Austroalpine outliers within the Zermatt-Saas Zone, Western Alps

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The Western Alpine Penninic domain is a classical accretionary prism that formed after the closure of the Penninic oceans in the Paleogene. Continental and oceanic nappes were telescoped into the Western Alpine stack associated with continent–continent collision. Within the Western Alpine geologic framework, the ophiolite nappes of the Zermatt–Saas Zone and the Tsate Unit are the remnants of the southern branch of the Piemonte–Liguria ocean basin. In addition, a series of continental basement slices reported as lower Austroalpine outliers have preserved an eclogitic high-pressure imprint, and are tectonically sandwiched between these oceanic nappes. Since the outliers occur at an unusual intra-ophiolitic setting and show a polymetamorphic character, this group of continental slices is of special importance for understanding the tectono-metamorphic evolution of Western Alps.

Recently, more geochronological data from the Austroalpine outliers have become available that make it possible to establish a more complete picture of their complex geological history. The Lu-Hf garnet-whole rock ages for prograde growth of garnet fall into the time interval of 52 to 62 Ma (Weber et al., 2015, Fassmer et al. 2015), but are consistently higher than the Lu-Hf garnet-whole rock ages from several other locations throughout the Zermatt-Saas zone that range from 52 to 38 Ma (Skora et al., 2015). This discrepancy suggests that the Austroalpine outliers may have been subducted earlier than the ophiolites of the Zermatt-Saas Zone and therefore have been tectonically emplaced into their present intra-ophiolite position. This points to the possibility that the Zermatt-Saas Zone consists of tectonic subunits, which reached their respective pressure peaks over a prolonged time period, approximately 10-20 Ma.

The pressure-temperature estimates from several members of the Austroalpine outliers indicate a complex distribution of metamorphic peak conditions, without ultrahigh-pressure indications. By contrast, the peak conditions derived from the ophiolites of the Zermatt–Saas Zone are uniform, and close to or inside the coesite stability field. These results further underline that the oceanic lithosphere, which experienced its geodynamic evolution as a relatively coherent unit, may contain slices of continental rocks, which in turn show differences in the metamorphic evolution compared to the surrounding ophiolites.

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