A Paleotethyan oceanic accretion complex in the Eastern Alps: the Plankogel and overlying Amphibolite-Micaschist complexes

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Oceanic accretion complexes along active continental margins contain a mixture of oceanic and potential continental tectonic elements, among which oceanic island volcanoes are the most prominent one. Here, we report an example from the pre-Alpine Austroalpine amphibolite-grade metamorphic basement of Eastern Alps, which contains several undated ophiolitic sutures and accompanying amphibolite-rich micaschist units. All of them have been considered to have formed not later than during Variscan plate collision. Major portions of this basement are then overprinted by Permian rift processes including Permian low-pressure metamorphism. The location of a Paleotethyan suture has not been considered to extend into the Alps.

Here we report preliminary results of an extensive survey with U-Pb zircon ages, Hf isotopes on zircon and whole rock geochemistry from the Plankogel and overlying Amphibolite-Micaschist complexes in Eastern Alps, which are directly overlying the Eclogite-Gneiss unit with Cretaceous high-pressure metamorphism. The Plankogel complex is composed of coarse-grained garnet-micaschist as a matrix and plagioclase-rich biotite schist, within which hectometer-sized lenses of marble, spessartine-quartzite, amphibolite and ultramafic rocks occur. According to the new data, the amphibolites have either (1) a N-MORB geochemical signature or (2) show ocean island basalt characteristics. Metasedimentary rocks like the garnet-biotite-micaschist show a large population of Early-Middle Triassic age, partly euhedral zircons implying an age of the sedimentary precursor rocks not older than Middle Triassic, and a significant Middle Triassic volcanic component. The manganese quartzites are explained as siliceous deep-sea sediments and show a large Permian to Early Triassic volcanic components (244±6 – 282±8 Ma) with a ~340 Ma peak and minor > 630 Ma peak ages of detrital zircons. Two N-MORB amphibolites exhibit late Permian/Early Triassic protolith ages (227±10 Ma-254±6.3 Ma). Positive εHf(t) values from zircons of Permian and Triassic age reveal uniform crustal model ages between 0.92 and 1.20 Ga.

Thick biotite-amphibolites from the overlying Amphibolite-Micaschist exhibit the geochemical
characteristics of ocean island alkali basalts and have U-Pb zircon ages of 415±11 Ma and 413 ± 13 Ma. Again, εHf(t) values of zircons indicate a uniform crustal model ages clustering at ca. 1.2 Ga. The youngest detrital zircons of accompanying metasediments is at 450 Ma revealing that the age of host rocks is Silurian or younger. Consequently, this succession is interpreted as part of the accretionary wedge with ocean island volcanoe relics at margin of the Paleotethyan ocean.

Our dating results are entirely unexpected and require a re-evaluation of the tectonic history of the Austroalpine units. Based on these results, we conclude that the Plankogel complex represents a Triassic ophiolite-bearing mélange with oceanic trench sediments and components from a deep-sea environment as well continental components. The detritus is rich in Permian to Middle Triassic volcanic components. The volcanic components indicate the subduction of the Paleotethyan Ocean, and oceanic lithospheric elements were incorporated into the trench sediments.

Together, the new data reveal the accretion of an ocean island into the Plankogel subduction complex. Furthermore, this accretionary system was active up to Triassic times and can be considered to relate to the Paleotethyan suture in Eastern Alps.