



Geochemistry and LA-ICPMS zircon geochronology of the pre-Alpine rocks in the Biga Peninsula, NW Anatolia

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The Biga Peninsula in northwestern Anatolia is the junction including remnants of crustal and oceanic fragments and their genetic relations are not fully understood yet. The Biga Peninsula has Variscan basement affected by Alpine tectonics which is mainly composed of metavolcanic rocks. These pre-Alpine rocks occur on the basement of the Çamlıca metamorphic association located on the westernmost part of the Biga Peninsula. The common mineral assemblages of the metavolcanic rocks are mainly composed of quartz + chlorite + epidote + albite + actinolite + calcite \pm sphen \pm zircon, which indicates that these metavolcanic rocks experienced greenschist-facies metamorphism.

The metavolcanic rocks have compositions of andesites with calc-alkaline character. Chondrite-normalized REE patterns are moderately fractionated ($\text{LaN/YbN} \sim 2.2$ to 8.9). Europium anomalies are slightly variable ($\text{Eu/Eu}^* 0.6$ to 0.7) and generally negative (average $\text{Eu/Eu}^* 0.68$). The metavolcanic rocks have a distinct negative Nb anomaly with negative Sr, Ba, Hf anomalies in extended multi-element diagrams. The large negative Nb, Sr, Ba and Hf anomalies in the metavolcanic rocks exhibit a crustal involvement in their derivation. All metavolcanic rocks cluster within the volcanic arc field away from either the within plate or ocean ridge fields based on tectonic discrimination diagrams. Those within the volcanic arc field indicate calc-alkaline magma type.

Zircon grains from these pre-Alpine metavolcanic rocks, which are euhedral with typical magmatic morphologies, were dated by LA-ICPMS. Zircon ages of two samples yielded 328.6 ± 3.5 Ma and 343.2 ± 2.6 Ma, respectively. These ages are interpreted as the time of protolith crystallization of metavolcanic rocks. In terms of age of the crystalline basement and geological evolution, the Sakarya Zone in the northwest Anatolia is comparable to the Armorican terrane assemblage in central Europe. Geochemical and isotopic data indicate that Early Carboniferous Variscan basement within the Sakarya Zone may form the eastern continuation of the Armorican terrane assemblage.