Stratigraphy, geochemistry, and petrology of the Upper Cretaceous volcanic arc sequence north of Istanbul, Pontides, NW Turkey

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Upper Cretaceous arc-related volcanic and volcanoclastic units overlying the Paleozoic sedimentary rocks of the Istanbul Zone are a key unit related to the opening of the Black Sea as a back-arc basin. They formed as a result of north dipping subduction of the Neo-Tethys Ocean beneath Laurasia. We studied the Upper Cretaceous volcanic units north of Istanbul along several stratigraphic sections, and present new geochemical data from the volcanic rocks in order to understand Cretaceous geodynamic evolution of the Istanbul Zone.

The Upper Cretaceous volcanic units north of Istanbul are divided into two formations. At the base there is a fore-arc turbidite succession, the Ishaklı Formation, which is made up of volcaniclastic sandstone, shale, marl, tuff, debris flow horizons and epiclastic rocks of Turonian age. The Ishaklı Formation is conformably overlain by the volcanoclastics, tuffs, andesite and basalt lavas and agglomerates-the Riva Formation, which represents the arc/ intra-arc series.

Geochemically, basalts and basaltic andesites of the Riva Formation are low K calc-alkaline to medium-high K calc-alkaline and with magnesium numbers ranging from 32.6% to 51.5%. Primitive mantle normalized spider diagram of trace elements show enrichment in LILE elements (K, Rb, Sr, Cs, Ba, Th and U) and depletion in HFS elements (Nb, Ta and Ti). The high ratio of LILE/HFS and negative Nb-Ta anomalies indicate that the volcanism evolved in subduction setting. Chondrite-normalized REE pattern display slight negative Eu anomalies and the La/Yb ratios of the samples range between 2.76 and 4.89. Our new geochemical, stratigraphical and the regional geological data suggest that north of Istanbul there was a transition from fore-arc deposition to arc volcanism during the Late Cretaceous opening of the Western Black Sea. Considering the whole Pontide – Sredna-Gora Upper Cretaceous magmatic arc, it can be stated that calc-alkaline volcanism developed in relation to northward subduction of the Neo-Tethys oceanic lithosphere during the Turonian, and may have passed into high-K calc alkaline and shoshonitic magmatism as a result of the progressive extensional tectonism during the Campanian.