



Volcanological, petrographical and geochemical characteristics of Late Cretaceous volcanic rocks around Borçka-Artvin region (NE Turkey)

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This study presents volcanological, petrographical and geochemical data for late Cretaceous volcanic rocks from the Borçka-Artvin region (NE Turkey) in order to investigate their origin and magmatic evolution. Based on the previous ages and recent field studies, the late Cretaceous time in the study area is characterized by two different bimodal volcanic periods. The first bimodal period of the late Cretaceous volcanism is mainly represented by mafic rock series (basaltic-basaltic andesitic pillow lavas and hyaloclastites) in the lower part, and felsic rock series (dacitic lavas, hyaloclastites, and pyrite-bearing tuffs) in the upper part. The second bimodal period of the late Cretaceous volcanism begins with mafic rock suites (basaltic-andesitic lavas and dikes-sills) and grades upward into felsic rock suites (biotite-bearing rhyolitic lavas and hyaloclastites), which are intercalated with hyaloclastites and red pelagic limestones. All volcano-sedimentary units are covered by Late Campanian-Paleocene clayey limestones and biomicrites with lesser calciturbidites.

The mafic volcanic series of the study area, which comprise basaltic and andesitic rocks, generally show amygdaloidal and aphyric to porphyritic texture with phenocrysts of calcic to sodic plagioclase and augite in a hyalopillitic matrix of plag+cpx+mag. Zircon and magnetite are sometimes observed as accessory minerals, whereas chlorite, epidote and calcite are typical alteration products. On the other hand, the felsic volcanic series consisting of dacitic and rhyolitic rocks mostly display porphyritic and glomeroporphyritic textures with predominant feldspar, quartz and some biotite phenocrysts. The microgranular to felsophyric groundmass is mainly composed of aphanitic plagioclase, K-feldspar and quartz. Accessory minerals such as zircon, apatite and magnetite are common. Typical alteration products are sericite and clay minerals.

Late Cretaceous Artvin-Borçka bimodal rock series generally display a transition from a tholeiitic to calc-alkaline character with typical arc geochemical signatures. In N-MORB-normalised multi-element plots, these samples are characterized by an enrichment of LILEs such as Rb, Ba, Th and a depletion of HFSEs (e.g. Hf, Zr) with clear negative Nb and Ti anomalies. Based on the chondrite-normalised REE patterns, the studied rocks are enriched in LREEs and display weak concave-upward HREE patterns with variable negative Eu anomalies. All these geochemical data indicate typical characteristics of subduction-related magmas and are commonly attributed to a depleted mantle source, which has been previously metasomatized by fluids or sediments.

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