

Mafic sill/dykes intruding into late Maastrichtian-early Paleocene calciclastic units, NE-Turkey: Petrographical and geochemical features of latest magmatic activity before collision in the eastern Sakarya zone

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We present here new petrographical, mineralogical and whole-rock geochemical data for mafic sill/dykes intruding into late Maastrichtian-early Paleocene calciclastic units in the Düzköy (Trabzon) and Cankurtaran (Artvin) areas (NE Turkey) of the eastern Sakarya zone (ESZ) in order to decipher the latest magmatic activity in the final stage of subduction-related magmatism of the ESZ. U-Pb zircon dating for the mafic sill/dykes in the region yielded ages varying from 83.6 to 78.5Ma (i.e. Early Campanian). Mafic sill/dykes consist of mostly basalts and lesser basaltic-andesites with komatiitic basalts. Most of the dyke samples display aphyric to porphyritic texture with phenocrysts of plagioclase (mostly replaced by calcite), clinopyroxene (partly uralized), olivine (almost serpentinized), and amphibole (partly chloritized).

Based on the MgO, Nb and Zr contents with Nb/Y ratio, the mafic dykes from Düzköy area are mainly classified as two subgroups (basalts and basaltic andesites) while those of Cankurtaran can be divided into three different groups (low- and high-Nb normal basalts and komatiitic basalts). Düzköy basaltic dykes have higher MgO (3.8-7.8%) and lower Nb (3-4ppm) and Zr (53-62ppm) contents with Nb/Y ratio (~ 0.2) than those of Düzköy basaltic-andesitic dykes (MgO: $\sim 1.8\%$, Nb: 6-15ppm, Zr: 106-145ppm, Nb/Y: 0.3-0.6). On the other hand, Cankurtaran mafic sill/dykes have relatively high MgO contents ($\sim 4-20\%$). These sill/dykes with 15-20% of MgO and $<1\%$ TiO₂ contents are called as komatiitic basalt which has relatively low K₂O ($<1\%$), Nb (~ 1 ppm), Zr (23-26ppm) and Y (8ppm) contents with Nb/Y ratio ($\sim 0.1-0.2$). However, normal basalts from Cankurtaran have quite lower MgO contents ($\sim 4-9\%$) than that of the komatiitic basalt. Also, they can be divided into two subgroups in terms of MgO (5.7-8.7% for group 1 and 4.0-4.4% for group 2), Nb (3-14ppm for group 1 and 19-21ppm for group 2), Zr (94-111ppm for group 1 and 125-140ppm for group 2) contents, and Nb/Y ratio ($\sim 0.2-0.8$ for group 1 and $\sim 1.0-1.2$ for group 2).

Although the studied mafic sill/dykes have generally subalkaline composition, they show a geochemical character changing from mostly tholeiitic to rarely calc-alkaline and show typical features of late Cretaceous subduction-related magmatic rocks as in the ESZ. On the chondrite-normalized REE patterns, the sill/dykes show enrichment in LREEs, and show variable LREE/HREE fractionation (La/Yb)_N=6.6-10.5 for Düzköy and 6.2-24.5 for Cankurtaran) but similar Eu anomalies (Eu/Eu*= $\sim 0.9-1.0$ for all the dykes). On the N-MORB normalized diagrams, the mafic sill/dykes are generally enriched in LILEs and depleted in HFSEs with Nb and Ti, suggesting that the mantle source has compositional similarity with metasomatized mantle wedge. These data reflect a genetic relationship between the komatiitic-basaltic and basaltic-andesitic sill/dykes through fractional crystallization process with some crustal contamination.

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