Preliminary geochemical data on the Neogene post-collisional volcanic rocks in the Yükselen area, NW Konya, Turkey

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Abstract: Small volumes of volcanic rocks outcrop in the Yükselen area located in NW of Konya, Turkey. Volcanic rocks are represented by basaltic lava flows and dacitic dome/pyroclastics. Basaltic flows and pyroclastic rocks are interlayered with the Neogene fluvio-lacustrine sedimentary units, while dacitic rocks cut the pre-Neogene basement in the area. The investigated basalts are slightly porphyritic, and have olivine and clinopyroxene phenocrysts with groundmass composed of plagioclase, clinopyroxene and Fe-Ti oxide. On the other hand, dacites are strongly porphyritic and include phenocrysts of plagioclase, quartz, biotite and amphibole in a groundmass with same minerals as in the phenocryst phase plus Fe-Ti oxide and volcanic glass. Dacites have also mm-to dm sized mafic magmatic enclaves composed of plagioclase +amphibole. Basaltic rocks are hawaiite according to TAS (total alkali vs. silica) classification scheme. They have a sodic alkaline tendency (Na2O/K2O: ~ 4). The basalts are characterized by Ocean Island Basalt (OIB)-type incompatible trace element patterns with significant enrichment in LILE (Rb, Ba, K, Sr), HFSE (Nb, Zr, Ti, Y) and LREE (La, Ce, Nd) relative to MREE (Sm, Eu, Dy, Ho) and HREE (Yb, Lu) in N-MORB-normalized diagram. However, dacites are calc-alkaline and metaluminous. The dacites are characterized by orogenic-type incompatible trace element patterns with high LILE/HFSE ratios and negative Nb-Ti anomalies in N-MORB-normalized diagram. Field observation and preliminary geochemical data suggest that investigated volcanic rocks are the product of post-collisional geotectonic setting.

Keywords: Hawaiian, Alkaline, OIB, Dacite, Calc-alkaline, Metaluminous, Post-collision,

1 Introduction
The Neogene volcanic rocks cover large areas along to the NW of Konya city in the Central Anatolia, Turkey. Earlier studies have shown that the rocks are basaltic andesitic to dacitic in composition, and calc-alkaline products of the convergence system between the African and Anatolian plates [1, 2, 3]. Recent studies have also shown that post-collisional potassic alkaline lamprophyric rocks (e.g., minette) intruded into the basement rocks of the Konya region in the Miocene time [4]. However, this study reveals that the Neogene igneous rocks are not restricted to
those of the mentioned rocks, and sodic alkaline type basaltic volcanics outcrop in the Yükselen area of Konya city.

In this study, we present the first whole-rock geochemistry (major and trace elements) data for the sodic alkaline type basaltic and spatially associated calc-alkaline dacitic rocks from the Yükselen area of Konya city in the Central Anatolia, with the aim to elucidate the first-order origin of them.

2 Material and methods

Volcanic rock hand samples were collected from the Yükselen area of Konya in Central Anatolia for petrography and geochemical analysis. After petrographic examination, a representative subset of the freshest samples was selected for whole-rock geochemical analysis (major oxides and trace elements including lanthanides).

Following removal of weathered surfaces, samples were crushed in a jaw-crusher, and then powdered in an agate ball mill in preparation for whole-rock major, trace, and rare earth elements. Major elements were analyzed by inductively coupled plasma-atomic emission spectroscopy (ICP-AES), following a lithium borate fusion and dilute acid digestion of a 0.2 g sample powder. After 0.2 g samples of rock powder were dissolved by four acid digestions at AcmeLabs (Vancouver, Canada), trace and rare earth elements were determined by ICP-MS. In-house standards were analyzed together with the samples, and they were used for calibration of the dataset.

3 Geological setting

The study area is located approximately 40 km to the northwest of Konya, (Central Anatolia) on the Anatolide-Tauride block (Fig. 1a). It consists of Paleozoic to Mesozoic meta-sedimentary, meta-igneous and ophiolitic basement rocks overlain by Neogene-Quaternary continental sedimentary and volcanic cover rocks [5, 6, 7, 8, 9, 10].
In the Yükselen area, volcanic rocks are represented by two different units as basalt and dacite (Fig. 1b). Basalts are seen as small volume of sill/lava in the Neogene sedimentary units. They are black-coloured, weakly porphyritic and moderately weathered. However, dacites outcropped as dome by cutting the basement rocks in the area. Dacites are pale-coloured, strongly porphyritic with plagioclase, amphibole and biotite phenocrysts and relatively fresh. In addition to, they have abundant enclaves sized cm to dm. There is no physical contact between basalts and dacites in the field.

4 Results

4.1 Petrography
Basalts have microlithic porphyritic texture and include olivine and clinopyroxene phenocrysts with groundmass composed of plagioclase, clinopyroxene and Fe-Ti oxide (Fig. 2a). The groundmass texture of basalts is

Fig. 1. (a) Simplified tectonic map of Turkey showing the major sutures (heavy lines with filled triangles) and continental blocks [11], (b) Simplified geological map of the Yükselen area, NW Konya [12].
intergranular. Additionally, some of them has
amigdaloidal texture filled with calcite, zeolite
etc (Fig. 2b). On the other hand, dacites have
hyalo-microlithic porphyritic texture and
contain phenocrysts of plagioclase, quartz,
amphibole and biotite (Fig. 2c,d). Groundmass
phases consist of the same mineral assemblage
as those characteristic of the phenocrysts plus
volcanic glass and Fe-Ti oxide. The
groundmass occasionally displays felsitic
texture because of devitrification. Also,
glomeroporphyritic texture is observed in the
investigated dacites.

![Fig. 2. (a) Microlithic porphyritic texture in basalts, (b) Olivine phenocryst and vesicule-filling zeolite in basalts,
(c) Corroded quartz phenocryst and (d) twinned plagioclase phenocryst in dacites.]

**4.2. Geochemistry**

Basaltic rocks are hawaiite according to TAS
(total alkali vs. silica) classification scheme
(Fig. 3a). They have a sodic alkaline tendency
(Na₂O/K₂O~4) and are slightly undersaturated
(normative nepheline up to 6%) in silica.
Basalts have relatively low MgO (6.0-9.0
wt%), Cr (250-350 ppm) and Ni (150-200
ppm) contents, suggesting they don’t represent
mantle-derived primary magmas. However,
dacites are calc-alkaline (Fig. 3b), silica
oversaturated (normative quartz up to 20%)
and metaluminous.

The basalts are characterized by Ocean Island
Basalt (OIB)-type incompatible trace element
patterns with significant enrichment in LILE
(Rb, Ba, K, Sr), HFSE (Nb, Zr, Ti, Y) and
LREE (La, Ce, Nd) relative to MREE (Sm, Eu,
Dy, Ho) and HREE (Yb, Lu) in N-MORB-
normalized diagram. But, the dacites are
characterized by orogenic-type incompatible
trace element patterns with high LILE/HFSE
ratios and negative Nb-Ti anomalies in N-MORB-normalized diagram (Fig. 4).

Fig. 3. (a) Total alkali versus silica (TAS) diagram of the Yükselen area volcanic rocks [13]. Dashed line separates alkaline and subalkaline fields [14]. (b) AFM plot of the studied dacitic volcanic rocks [14].

Fig. 4. N-MORB normalized [15] incompatible trace element patterns of representative samples from the Yükselen area volcanic rocks.

5 Conclusions

The Neogene aged volcanic rocks are represented by basaltic flows and dacitic domes in the Yükselen area of Konya in the Central Anatolia. Basalts are seen as small volume of sill/lava in the Neogene sedimentary units, but dacites cut the basement rocks in the area. Basalts include olivine and clinopyroxene phenocrysts, whereas dacites are composed of plagioclase, quartz, amphibole and biotite phenocrysts. Major and trace element data show that basalts are OIB-type alkaline, while dacites are orogenic-type calc-alkaline volcanic rocks. Field observation and
preliminary geochemical data suggest that investigated volcanic rocks are the product of post-collisional geotectonic setting.

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