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Petrology and Geochemistry of Volcanic Rocks from Hisarlıkaya region (SW of Ankara) Central Anatolia, Turkey

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Abstract

The study area is located in Hisarlıkaya region, Southwest (SW) of Ankara, Central Anatolia. Units cropping out throughout large areas consist of different sized and shaped xenoliths having a polygenetic origin in certain areas. Macroscopically blackish-greenish-greyish-greenish colored and porphyritic textured rocks contained mainly plagioclase, amphibole, opaque microlites and rarely pyroxene crystals. Plagioclases are generally euhedral in shape and are predominantly zoned. They show sieved texture at the rims and/or cores. The amphiboles have been completely or partly replaced by Fe-Ti oxides. According to the microprobe analysis, it was determined that the plagioclases in the host rocks are andesine and the amphiboles are calcic-chermakite in characters. As a result of geochemical analyses, volcanic rocks have been identified as trachytic rocks with calc-alkaline character. Major, trace element Harker variation diagrams indicate an effective fractional crystallization process in the formation of these rocks. SiO_2 (62.6-63.7%), Al_2O_3 (16.5-17.2 %), Na_2O (4.9-5.6 %), Sr (1249-1397 ppm), Y (13.1-14.2 ppm) contents of these trachytic rocks indicate typical adakitic rocks features. Previous works in the study and vicinity areas revealed the presence of volcanic products carrying the evidences of post collisional Early Miocene magmatism. It is thought that the Hisarlıkaya volcanic rocks, having trachytic character, were formed in this period.

Introduction

Hisarlıkaya region is located in SW of Ankara, Central Anatolia is about 45 km from the city center, and situated at the northern part of İzmir - Ankara - Erzincan suture zone which formed by the closure of the northern branch of Neotethys. The volcanism that develops with the closure of the northern branch of the Neo-Tethys, convergence, subduction and collision, has been spreading in large areas in many parts of Central Anatolia (Şengör and Yılmaz, 1981; Okay and Tüysüz, 1999). The aim of this study is to investigate the mineralogical-petrographic and geochemical characteristics of the Hisarlıkaya volcanic rocks which are thought to be formed during the Neogene period.

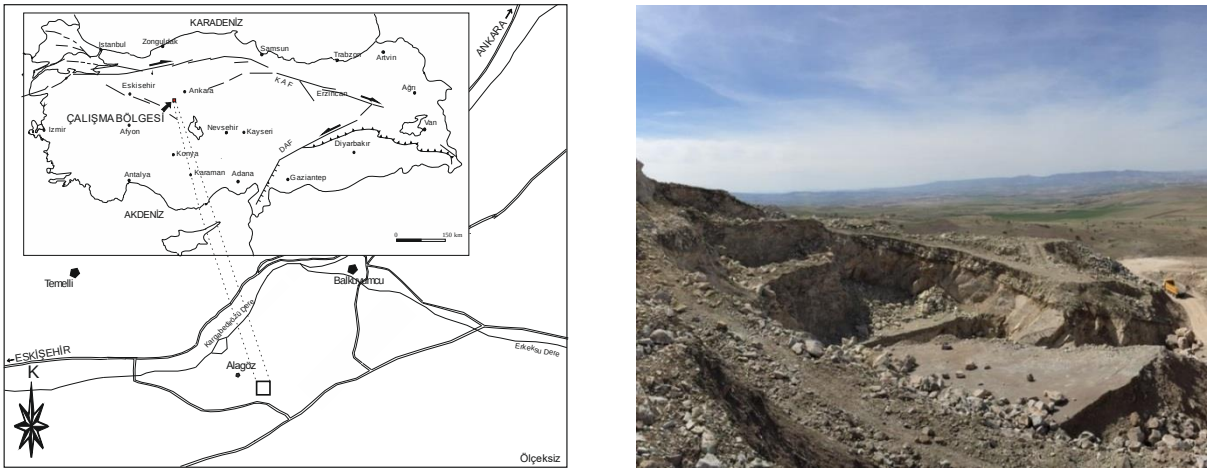

Figure 1. Simplified map and a general view of the study area (Hisarlıkaya, Ankara, Central Anatolia)

Mineralogy

The Hisarlıkaya volcanic rocks are macroscopically blackish-grayish-greenish colored and show porphyritic texture. These rocks mostly contain plagioclase, amphibole, opaque microlites and rarely pyroxene. Plagioclases are generally euhedral and are zoned. They show sieved texture at the rims and/or cores. Amphiboles are opaque completely or as from the edges. According to microprobe analyzes, it was determined that the plagioclase crystals are andesine and the amphiboles are calcic-chermakite. These volcanic rocks, which are cropped out in Hisarlıkaya region, contain polygenetic xenoliths in different sizes and compositions. They consist of pyroxene, garnet and plagioclase phenocrysts. The garnets observed in xenoliths are macroscopically red-brown colored and their size varies between 0.2 mm to 1 cm. According to the microprobe analysis of xenoliths, pyroxenes are diopside and hedenbergite; plagioclases are labrador and andesine and garnets are andradite-grossular in compositions.

Figure 2. The host rock and the xenoliths.

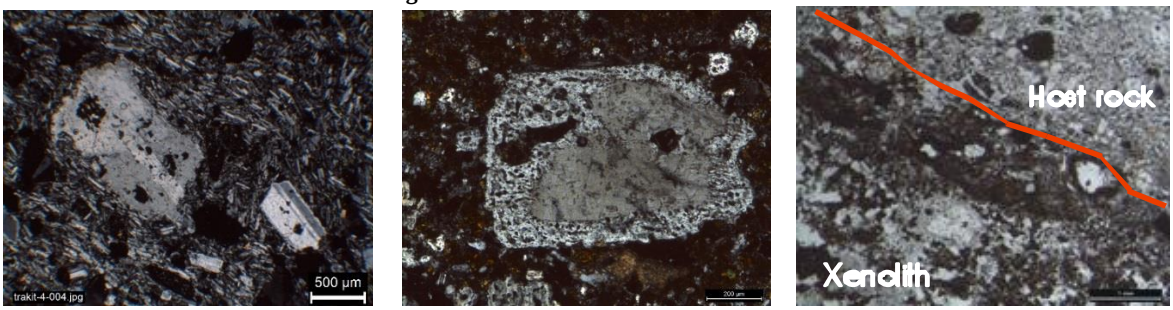

Figure 3. Photomicrographs from the host rocks and the xenolith

Geochemistry

As a result of the geochemical analyses on the Hisarlıkaya volcanic rocks, the SiO_2 contents ranges from 62.6 to 63.7% and the LOI values were between 0.23-0.96 %. According to the total alkali-silica diagram (Le Bas et al., 1986), it was determined that the samples have sub-alkaline trachytic character due to the normative quartz value being <20%. FeO_t-Na_2O + K_2O-MgO diagram shows that all of them have a calc-alkaline in character. It has been observed that fractional crystallization is an effective process during the formation of these Hisarlıkaya volcanic rocks according to the major and trace element Harker variation diagrams. SiO_2 (62.6-63.7 %), Al_2O_3 (16.5-17.2 %), Na_2O (4.9-5.6 %), Sr (1249-1397 ppm), Y (13.1-14.2 ppm) values reveal that samples have features similar to adakitic rocks.

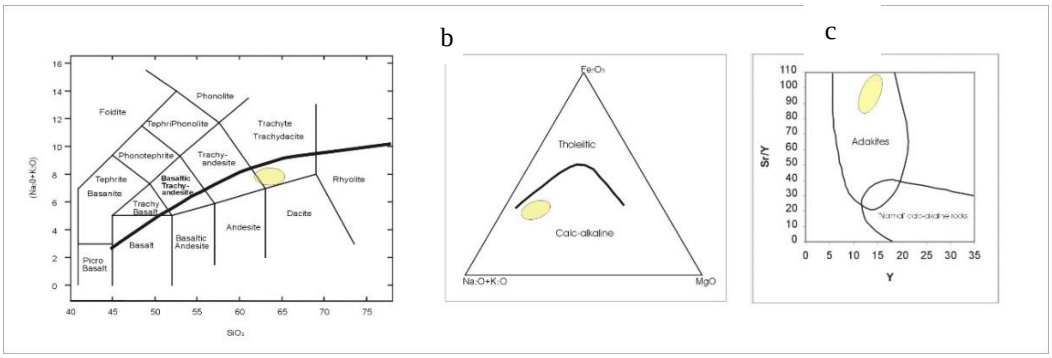

Figure 4. a)Total alkali-silis (Le Bas and others 1986), b)AFM (Irvine and Baragar, 1975), c) Sr/Y vs Sr (Defant and Drummond, 1990) diagrams

Conclusion

Hisarlıkaya calc-alkaline trachytic rocks consist of polygenetic xenoliths. They have adakitic features and fractional crystallization process is significant process during their formation.

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