Petrographic characteristics of the mafic enclaves of Neogene lava dome around Sağlık and Yatağan area, Konya/TÜRKİYE

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Abstract

To the west of Konya, a widespread lava dome has evolved as a component of Neogene Erenlerdagi volcanism associated with subduction. Its formation involved assimilation-fractional crystallization (AFC) and/or magma mixing processes. The lava is characterized by occurrence well-developed Mafic Microcrystalline Enclaves (MME), which has variable sizes (from a few cm to a few meters) and shapes (ellipse/rounded-angular).

The enclave comprises phenocrysts of plagioclase (10-50%), green amphibole (10-15%), quartz (ocelli) (0-10%), biotite (0-5%), epidote (0-5%), and opaque minerals (5-50%). The matrix consists of plagioclase, chlorite, light green epidote, green amphibole, biotite, and opaque iron ore.

Keywords: *Neogene, volcanism, enclave, lava, Konya*

1. Introduction & Geological Setting

The Neotectonic stage in Anatolia, initiated by the collision between Eurasia and Arap plates, induced westward movement, which results development of East and North Anatolian faults [1-3]. The Neotectonic period witnessed extensive volcanic activity covering 85.000 km^2 in central and west Anatolia [4], with distinct calcalkaline volcanic products apparent in the area around Konya (Figure 1).

[5-8] have provided significant insights into the geological features of the area. Notable findings include the identification of Tertiary rocks, a geological map proposing an Ordovician metamorphic basement, and the suggestion of a tectonic phase between the Palaeozoic and Mesozoic in Konya and Akşehir region.

Further investigations by [9-11] revealed the "Bozdağ formation", a Pre-Triassic region, and detailed stratigraphic units in the Karadag region. Keller [12] dated volcanic rocks, while Temel [13] proposed a correlation between calc-alkaline volcanism in Konya and Africa plate subduction in the Middle-Late Miocene. [14] identified crystallization patterns, and [15] suggested a subduction-related origin for volcanics. [16] report hydrothermal alteration effects emphasized high enrichment in altered rocks, exhibiting kaolinitic and alunitic alteration. [17] studied geochemical characteristics of the lava and its enclaves in the region and proposed that MMEs is possibly originated through the hybridization of mafic magma physically mixed with partially crystallized felsic magma. [18] evaluate Neogene Erenlerdağı volcanism, and suggested the volcanics are likely to be formed by Assimilation-Fractional Crystallization (AFC) and/or magma mixing process.

Volcanic activity occurred in the region between 13.72 and 3.35 my ago, as documented by [12,19]. The geological composition of the study area is diverse, including a Pre-Miocene basement composed of metamorphic, ophiolitic, and marine sediments, as well as Upper Miocene-Pliocene lake-fluvial sediments, volcanics, and Quaternary deposits (Figure 1).

Situated to the east of Sağlık town and west of Yatağan in western Konya, the study area features two rock quarries that serve as prime locations for closely examining the relations between Neogene lava and its MME. The enclave is finer-grained than its host and has variable sizes (from a few cm to a few meters) and shapes (ellipse/rounded-angular). A well-defined chilly zone develops between MME and its host. The region also shows intensive hybridization and the occurrence of MME within MME (Figure 2). The smaller MME tends to be finer-grained and more uniform than the larger ones.

It is aimed at to determine petrographical characteristics of the mafic enclave forming within Neogene lava dome.

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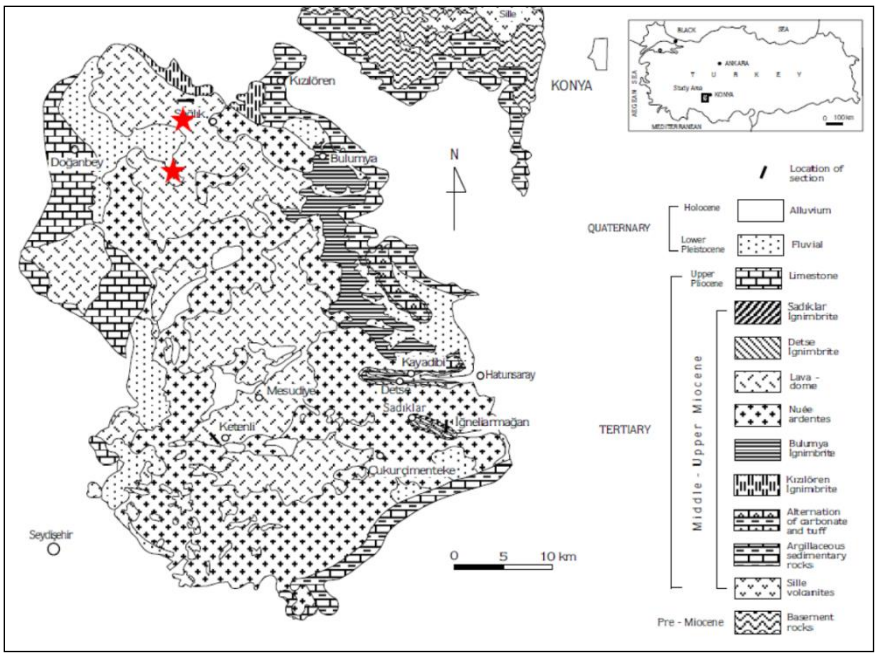

Figure 1. Location and geological maps of the study area [12]. ★ : Rock quarries studied

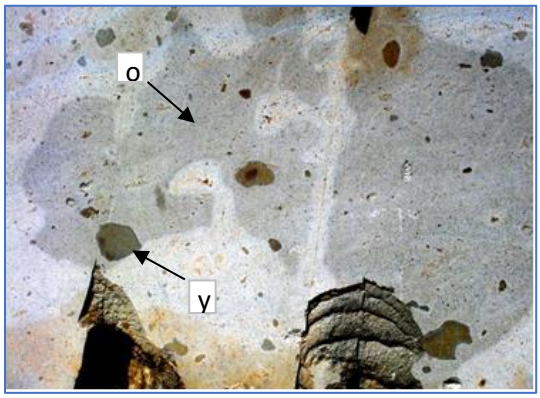

Figure 2. a) Two generation (O: older, and Y: younger) enclaves (enclave in enclave) and their relationships with their host(h) at west of Sağlık rock quarry. The young enclave pointed by arrow has a diameter of 10 cm.

2. Materials and Methods

Around 75 samples were collected during field studies, 50 thin sections were made from selected fresh samples, which were studied their petrographical characteristics under polarizing microscope at Department of Geological Engineering, Konya Technical University.

3. Results and Discussion

3.1. Petrography

In general, MMEs has more amphibole and opaque iron ore than its host.

The enclave is composed of phenocrysts of plagioclase (10-50%), amphibole (10-15%), quartz (0-10%), biotite (0-5%), epidote (0-5%), and consists of opaque mineral (5-50%) and accessory apatite in a holocrystalline porphyric texture.

The plagioclase crystal is mostly subhedral and characterized by oscillatory zoning structure and sieve texture. Figure 3a shows an oscillatory zoned plagioclase phenocryst at the rim and sieve texture at the core. The plagioclase also shows saussuritization and sericitization. Amphibole crystals exhibit colours and pleochroism in the shades of green, while those that have undergone opacification have brown color. They altered to the epidote along their cleavage. The biotite and epidote are rarely found in the samples. The quartz is sometimes included as "ocelli quartz" in the samples.

Its matrix consists of plagioclase, chlorite, light green epidote, green amphibole, biotite, and opaque iron ore. The matrix in enclaves generally have coarser crystals compared to the host rocks, but their phenocrysts are smaller.

The samples include intersertal texture, in where space between the plagioclase laths is filled by chlorite, sericite, and epidote.

Enclaves showing granular texture are composed of smaller-grained crystals and consist of amphibole (25%), plagioclase (20%), quartz (10%), epidote (10%) and opaque iron ore (35%). Amphibole is yellow brown in color and shows chloritization. Hypidiomorphic granular texture dominates.

There is also older enclave within the enclave, "enclave in enclave". These are finer grained, have more epidote minerals (20-25%), less opaque minerals (10-15%) and plagioclase microliths are more prominent.

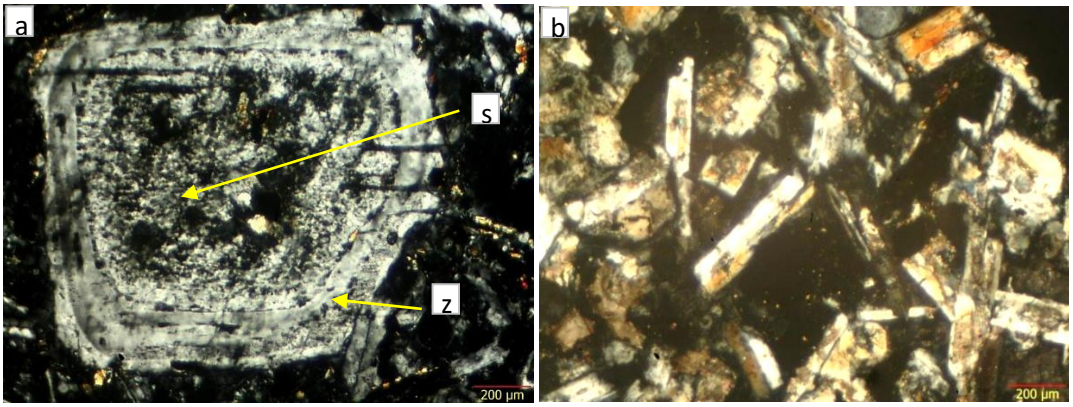

Figure 3. Photomicrographes exhibiting a) Plagioclase exhibiting sieve (s) texture at the centre and zoned (z) texture at the rims. (XN, 40a) . b) Intersertal texture (XN, 7b) in older enclaves

4. Conclusion

In the western Konya region, extensive lava domes formed through subduction-related Neogene Erenlerdağı volcanism, driven by assimilation-fractional crystallization (AFC) and/or magma mixing. The domes feature well-defined MMEs of variable sizes and shapes, with distinct chilly zones. The enclave composition includes plagioclase (10-50%), green amphibole (10-15%), quartz (ocelli) (0-10%), biotite (0-5%), epidote (0-5%), and opaque minerals (5-50%) in a porphyric texture. The matrix consists of plagioclase, chlorite, light green epidote, green amphibole, biotite, and opaque iron ore.

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