Petrographic characteristics of the Neogene lava dome around Sağlık and Yatağan area, Konya/TURKİYE

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Abstract

To the west of Konya, an extensive lava dome has formed as a component of Neogene Erenlerdagi volcanism, possibly resulting from assimilation-fractional crystallization and/or magma mixing processes associated with subduction. Petrographic studies show that the phenocryst phase of the lava is represented by plagioclase (15-45%), amphibole (3-15%), opaque iron ore (3-20%), rare brown biotite (5-10%), quartz (0-5%), sanidine (0-5%), clinopyroxene (0-5%), and epidote (0-8%). The matrix is primarily composed of plagioclase, pyroxene, epidote, opaque iron ore, and occasional volcanic glass. The lava contains Mafic Microcrystalline Enclaves (MME). A chilly zone may develop between MME and its host, containing phenocrystals of plagioclase (25%) and amphibole (5%).

Keywords: *Neogene, volcanism, lava, Konya*

1. Introduction&Geological Setting

The Neotectonic stage in Anatolia, initiated by the collision between the Eurasian and Arabian plates, led to westward movement, resulting in the development of the East and North Anatolian faults [1-3]. During the Neotectonic period, extensive volcanic activity covered 85.000 km^2 in central and western Anatolia [4], with distinct calc-alkaline volcanic products observed around Konya (Figure 1).

Studies by [5-8] provided insights into the geological features of the area, identifying Tertiary rocks, proposing a geological map with an Ordovician metamorphic basement, and suggesting a tectonic phase between the Paleozoic and Mesozoic in the Konya and Aksehir region. Further investigations by [9-11] revealed the "Bozdağ formation" in a Pre-Triassic region and detailed stratigraphic units in the Karadag region. Keller [12] dated volcanic rocks, while Temel [13] correlated calc-alkaline volcanism in Konya with Africa plate subduction in the Middle-Late Miocene. [14] identified crystallization patterns, and [15] suggested a subduction-related origin for volcanics. [16] reported hydrothermal alteration effects, emphasizing high enrichment in altered rocks with kaolinitic and alunitic alteration. [17] studied the geochemical characteristics of lava and its mafic microcrystalline enclaves, proposing that MMEs possibly originated through the hybridization of mafic magma physically mixed with partially crystallized felsic magma. [18] evaluated Neogene Erenlerdağı volcanism, suggesting that volcanics likely formed through Assimilation-Fractional Crystallization (AFC) and/or magma mixing processes.

The geological composition of the study area includes a diverse Pre-Miocene basement of metamorphic, ophiolitic, and marine sediments, as well as Upper Miocene-Pliocene lake-fluvial sediments, volcanics, and Quaternary deposits (Figure 1). Neogene Erenlerdagi volcanism in the region occurred between 13.72 and 3.35 million years ago [12,19]. The lava is characterized by existence of MME, with chilly zone.

The study aims to determine the petrographical characteristics of the Neogene lava dome.

2. Materials and Methods

During field studies, approximately 75 samples were collected, and 50 thin sections were made from chosen fresh samples. The petrographical characteristics of these sections were examined using a polarizing microscope at the Department of Geological Engineering, Konya Technical University.

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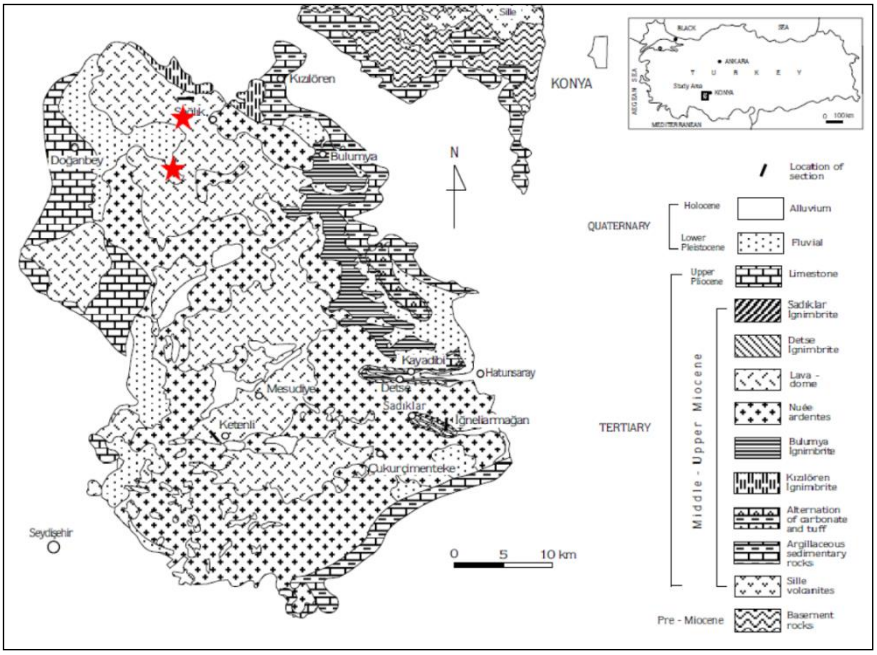

Figure 1. Location and geological maps of the study area [12]. ★ : Rock quarries studied

3. Results and Discussion

3.1. Petrography

3.1.1. Lava dome

In general, the host lava has less amphibole and opaque iron ore than its MME.

Phenocrystal phase in lava is represented by plagioclase (10-45%), amphibole (3-15 %), opaque iron ore (2-20%), rare biotite (5-10%), quartz (0-5%, (Figure 2), sanidine (%0-5), clinopyroxene (0-5%) and epidote (0-8%) while apatite and zircon occur as accessory phase in the sample.

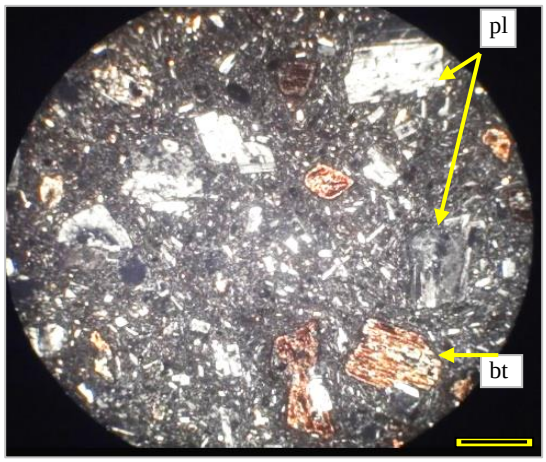

Figure 2. A photomicrograph of porphyritic texture developed in the host rock, pl: plagioclase, bt: biotite. (Cross Nicols , XN). Scale bar is 0.2 mm.

The plagioclase crystal is mostly subhedral, and exhibits simple albite and Carlsbad twinning, albite-pericline twinning, oscillatory zoning, and sieve texture. Sericitization and saussuritization are widespread alteration types, but minor calcitization also form at the core. The amphibole shows commonly opacitization, as pseudomorph crystals which have yellowish-, reddish- and blackish-brown color, with hexagonal shape. As a

result of intense alteration, it changes to an aggregate, including opaque iron ore, chlorite, and epidote. The epidote also forms as a rim around opaque minerals (Figure 3).

The biotite has brownish colour, and mostly replaced to the amphiboles. It is replaced with a reaction rim including plagioclase, epidote and quartz crystals (Figure 4).

The quartz is sometimes euhedral and resorbed. The pyroxene is rare and colourless. The epidote has low birefringence and high optical refractive indice. The apatite has typical needle shape.

The matrix is composed predominantly of plagioclase, pyroxene, epidote, opaque iron ore and rare volcanic glass.

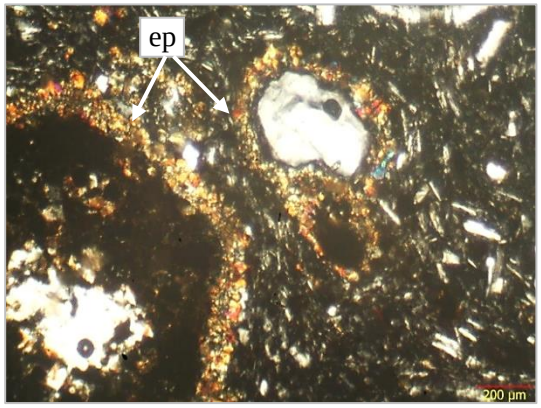

Figure 3: A photomicrograph of the host rocks, showing epidot (ep) rim developed around opaque mineral (XN).

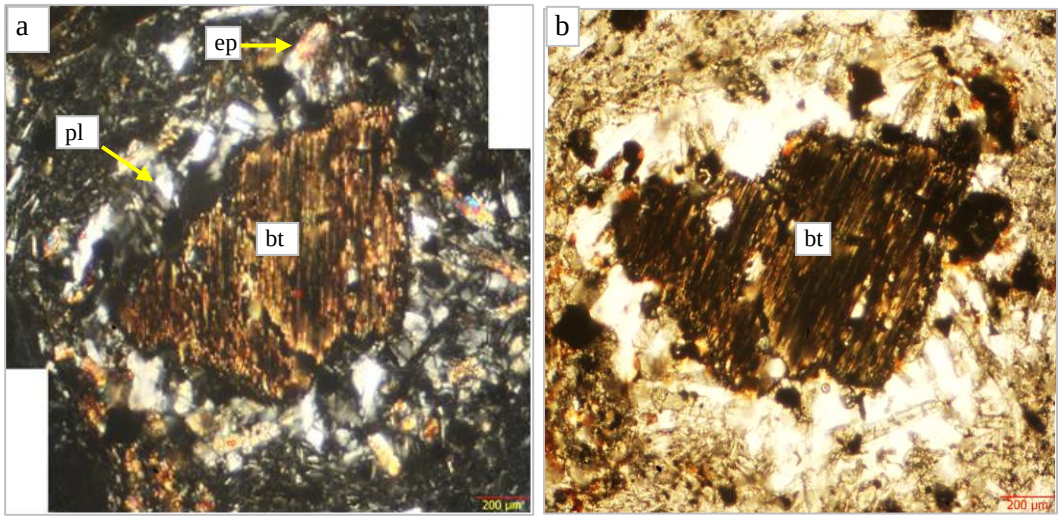

Figure 4: A photomicrograph of the host rocks; Rims of plagioclase (pl) and epidote(ep) formed around chloritised biotites (bt) a) XN, b) single Nicol, /N.

3.1.2. Chilly zone

The zone (Figure 5) consists mainly of plagioclase (25%) and amphibole (5%) as phenocrystals. The amphibole exhibits opacification and calcitization. The matrix consists of plagioclase, amphibole, epidote and opaque minerals in a holocrystalline porphyric texture.

4. Conclusions

The extensive lava dome situated west of Konya is a prominent feature within the Neogene Erenlerdagi volcanism, attributed to assimilation-fractional crystallization and/or magma mixing processes associated with

subduction. The lava exhibits feature such as MME and a distinct chilly zone. The phenocryst phase in the lava comprises plagioclase (15-45%), amphibole (3-15%), opaque iron ore (3-20%), rare biotite (5-10%), quartz (0-

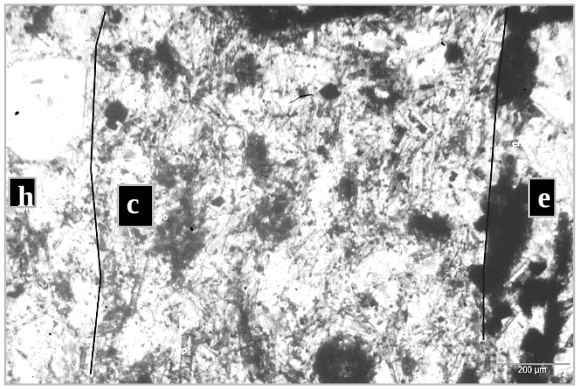

Figure 5. A photomicrograph of the chilly zone(c) developed between the enclave(e) and its host(h) lava, /N.

5%), sanidine (0-5%), clinopyroxene (0-5%), and epidote (0-8%). Concurrently, the matrix is predominantly composed of plagioclase, pyroxene, epidote, opaque iron ore, and occasional volcanic glass. Notably, the chilly zone is characterized by phenocrystals of plagioclase (25%) and amphibole (5%), with the amphibole demonstrating opacification and calcitization, while the matrix encompasses plagioclase, amphibole, epidote, and opaque minerals.

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