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Research Article

Mineralogical and Petrographic Characteristics of the Jurassic Kaban Dacite in the Eastern Sakarya Zone (Olur/Erzurum)

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Abstract

The volcanic rocks of the Kaban dacite, which is the subject of the study, are located in the Olur (Erzurum) region of the eastern Sakarya zone. This zone is divided into four tectonic slices Hopa-Borçka zone, Artvin Yusufeli zone, Olur Tortum zone and Erzurum Kars Ophiolite zone from north to south, east of the Eastern Pontides, and the investigated rocks are located within the Olur-Tortum zone. These rocks are represented by dacites and rhyolites in the study area. Petrographically, it is observed in fine-grained greyish, greenish, earthy colours. The main mineral contents are plagioclase, quartz and K-feldspars. Plagioclase, quartz and sanidine occur as phenocrysts but also in microlithic pastes. Plagioclases are characteristic of albite and polysynthetic twinning. Quartz is in the form of anhedral crystals and is distinguished from sanidine by its transparent colours in a single nicol.

Keywords: Mineralogy, Petrography, Kaban dacite, Olur, Erzurum

Sakarya Zonu'nun Doğusunda Konumlanan (Olur/Erzurum) Jura yaşlı Kaban Dasitinin Mineralojik ve Petrografik Özellikleri

Öz

İnceleme konusunu oluşturan Kaban dasitine ait volkanik kayaçlar Sakarya zonunun doğusunda Olur (Erzurum) bölgesinde konumlanmaktadır. Bu zon, Doğu Pontidlerin doğusunda, kuzeyden güneye doğru Hopa-Borçka zonu, Artvin Yusufeli Zonu, Olur Tortum Zonu ve Erzurum Kars Ofiyolit zonu olarak dört tektonik dilime ayrılmış olup incelenen kayaçlar Olur-Tortum zonu içerisinde konumlanmaktadır. Bu kayaçlar inceleme alanında dasit ve riyolitler ile temsil edilmektedir. Petrografik olarak ince taneli grimsi, yeşilimsi, toprağımsı, renklerde gözlenmektedir. Ana mineral içeriklerini plajiyoklas, kuvars ve sanidinler oluşturmaktadır. Plajiyoklas, kuvars ve sanidinler fenokristaller halinde görülmekle birlikte mikrolitik hamur içerisinde de gözlenmektedir. Plajiyoklaslar, albit ve polisentetik ikizlenmeleri ile karakteristiktir. Kuvars özşekilsiz kristaller halinde olup sanidinlerden tek nikolde şeşfaf renkleri ile ayrılmaktadır.

Anahtar Kelimeler: Mineraloji, Petrografi, Kaban dasiti, Olur, Erzurum

1. Introduction

The Kaban dacite, the subject of the study, is located in the Sakarya zone. This zone has been studied by many researchers [1-10]. This zone, which is bounded in the south by the East Anatolia Accretionary Complex [1], forms the western extension of the Trans Caucasians rocks [11]. Konak and Hakyemez [12,13] defined four different tectonic slices from north to south in the NE-SW direction, bounded by tectonic zones in the eastern part of the Eastern Pontides.

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These; (i) Hopa-Borçka zone, (ii) Artvin Yusufeli zone, (iii) Olur-Tortum zone and (iv) Erzurum Kars ophiolite zone. Studied rocks are located in the Olur-Tortum zone. The Olur Tortum Zone, located between the Artvin Yusufeli Zone in the north and the Erzurum Kars Ophiolitic Zone in the south, is divided into three tectonically related units. These units, which are located in the northwest-southeast direction as Olur, Aksu and Çardaklı units, respectively, are sliced irregularly along the northern edge of the Oltu-Narman Tertiary basin and form a wedged belt [14].

These rocks, which are thought to be the basis of the units within the Olur Totum Zone, include the Kışla Metamorphite consisting of low-grade metamorphics and gneiss amphibolite, metagabbro, metadiabase. It is the Güvendik Complex formed by the frequent cutting of the host rocks by metagranite, pegmatitic, dioritic, tonalitic dacitic and diabasic dykes and veins represented by volcanics [14]. Delta deposits containing Oxfordian Berriacian Oltu stone and submarine fan turbidites overlie these units with a quick contact. The Berriacian Aptian section of the succession is represented by semi-pelagic cherty carbonates, while the Aptian Santonian section is described by marl-siltstone-sandstone alternation (Figure 1).

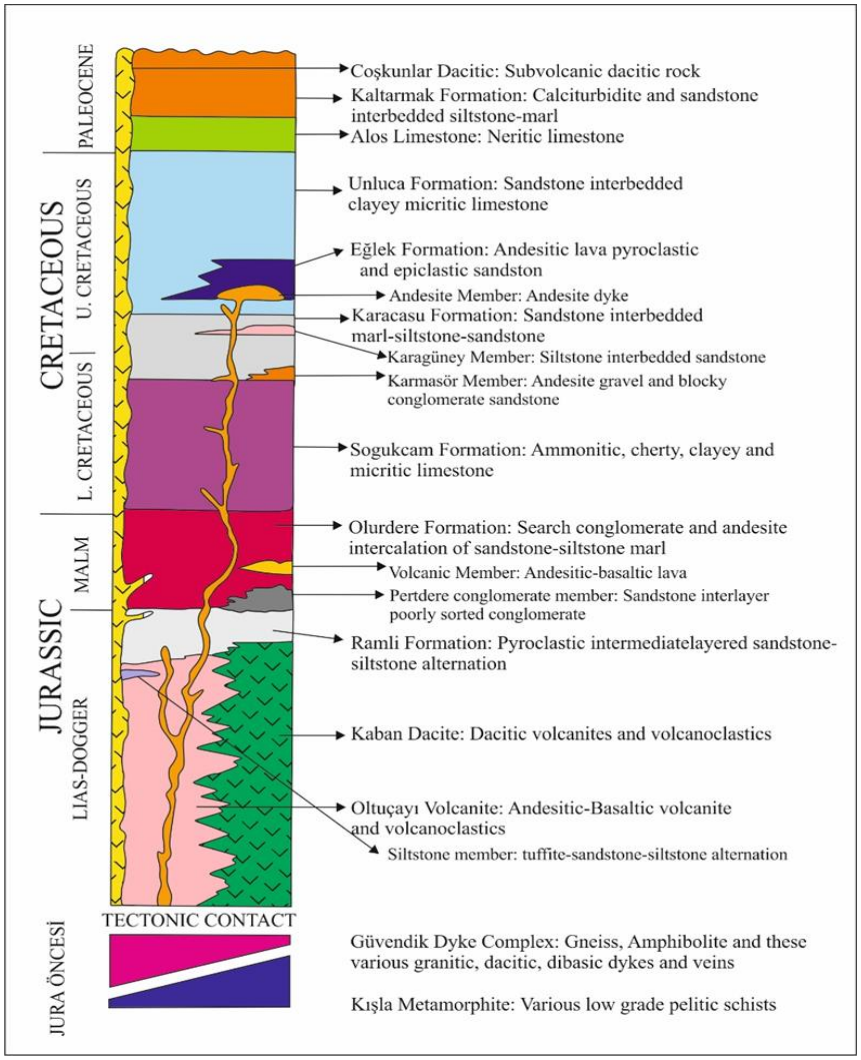

Figure 1. Tectonostratigraphic section of Olur (Erzurum) region [15].

Intermediate composition volcanics overlying these and wedging laterally are of Santonian. Continuing with the deposition of marl and clayey limestones during the Late Santonian Maastrichtian period, the succession passes into Paleocene conglomerate or Early Paleocene neritic limestones Late Paleocene turbiditic sandstone and limestone interbedded marl and siltstone. It is unconformably overlain by Eocene rocks starting with the Late Ipresian [14].

Kaban dacite was first named by Konak et al. [13]. The Kaban dacite shows transitional tectonic and laterally intermediate and basic composition Oltuçayı Volcanite in the lower contact It consists of dacitic composition lava and pyroclastics covered by the Ramli Formation at the upper levels.

Kaban Dacite crops out in and around Kaban, Köprübaşı, Olurdere and Belkaynak regions (Olur/Erzurum) (Figure 2). Macroscopically, it is observed in greyish, greenish, earthy colours (Figure 3). Its thickness is over 1000 meters. Considering that the Olurdere Formation, which covers the overlying Ramli Formation with a possible unconformity, started with Late Jurassic sediments, it is thought that the Kaban Dacite may be Early-Middle Jurassic [15].

This study aim to reveal the mineralogical and petrographic properties of the volcanic rocks belonging to the Jurassic Kaban dacite located in the Eastern Sakarya Zone.

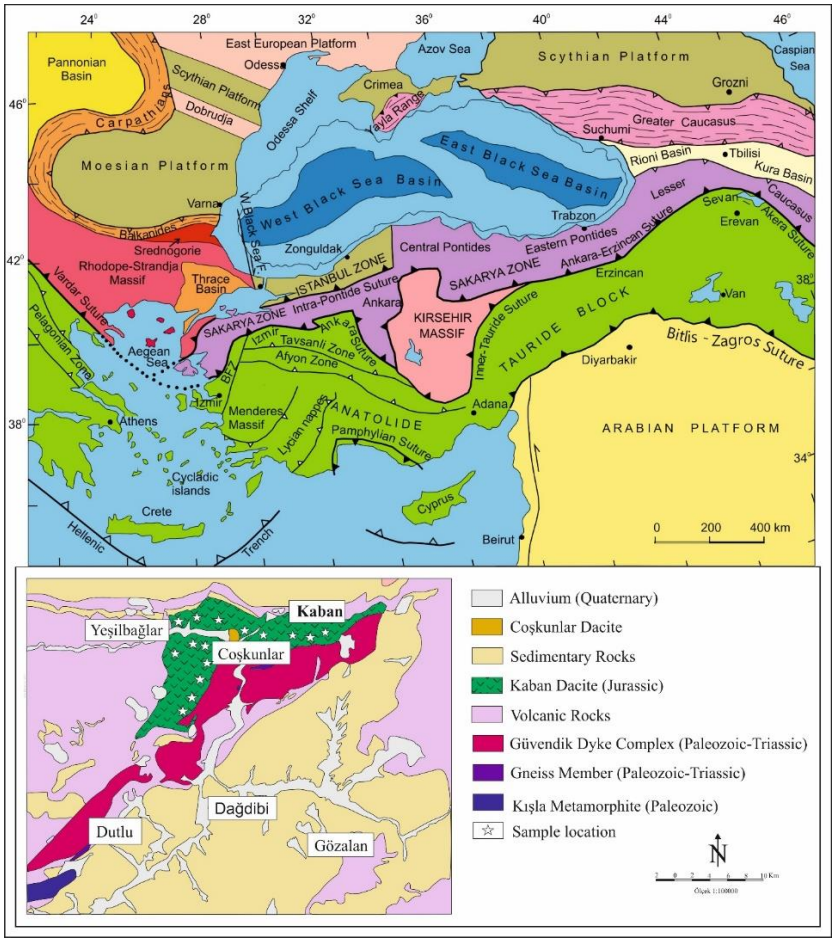

Figure 2. (a) Tectonic map of Turkey and the surrounding areas [16] (b) Geological map of the study area (simplified from [17])

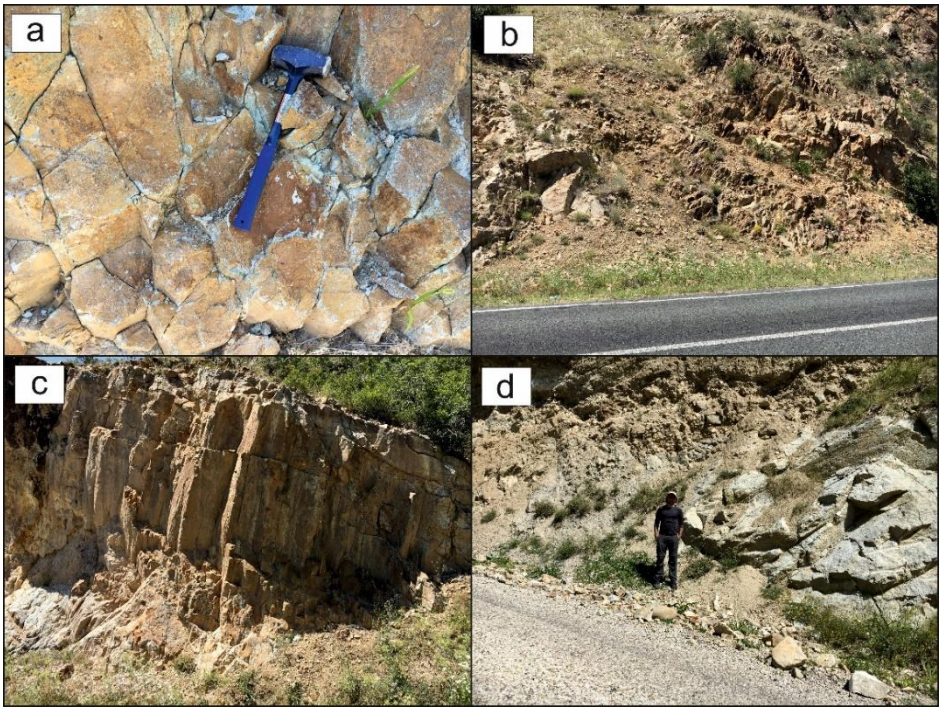

Figure 3. Field views of the Kaban dacite rocks.

2. Material and Methods

To determine the mineralogical and petrographic properties of the rocks of the Kaban Dacite around Olur, which represented the Jurassic volcanic units in the East Sakarya Zone and were chosen as the study area, 25 samples that were most unaffected or slightly affected by the alteration were compiled in the field study. These were examined under an optical microscope from thin sections, respectively.

These mineralogical-petrographic studies were carried out entirely in the Mineralogy-Petrography Thin Section Laboratory of the Geological Engineering, Department of Fırat University. Optical Microscope examinations were performed under a LEICA brand binocular backlit polarizing microscope. In addition to naming the rocks by defining the components and textural features by thin-section petrography; It has been tried to elucidate the alteration (alteration) and weathering (superficial) products, thus the origin of the minerals.

3. Research Findings

Volcanic rocks outcropping in the study area around Olur (Erzurum) is generally represented by dacite and rhyolite type rocks.

Dacite

Dacites are observed in greyish colours in macro samples in the study area. It contains quartz and plagioclase as the main minerals. Phenocrystal assemblage is characterised by 12-25 vol.% plagioclase and 10-28 vol.% quartz. Fine-grained groundmass assemblage is 47-78 vol.%. Texturally, porphyritic texture with coarse crystals in microlithic paste, glomeroporphyric texture and microcrystalline texture formed by the combination of plagioclase and quartz as closely packed crystal aggregates, are observed (Figure 4-5).

Plagioclases are generally observed in euhedral, subhedral and anhedral forms, as prismatic phenocrysts or microliths in the semi-crystalline paste. Twin lamellae are not seen in the crystals where alteration is observed very intensely. It is generally characterized by albite or polysynthetic twinning. The extinction angles vary between 20-24° and are plagioclases of andesine type. Quartz is observed in anhedral phenocrysts or microlithic paste.

Rhyolite

In rhyolites, the fine-grained groundmass forming the porphyritic texture consists of felsic minerals. The main felsic minerals such as plagioclase, quartz and sanidine that make up the rock also form the main component of the fine-grained groundmass in microlithic dimensions. Phenocrystal assemblage is dominated by 10–18 vol.% sanidine and 12–20 vol.% quartz and 18-25 vol. % plagioclase. Fine-grained groundmass assemblage is 37-60 vol.%. In general, as seen in all rocks in the region, the alteration observed in these rocks is also seen in the minerals forming the dough. Oxidation is common with alteration (Figure 6).

Quartz is similar in size to plagioclase and sanidine phenocrysts and is generally rounded and occasionally gnawed, sometimes angular. Since the alteration is intense throughout the rock, the quartzs are easily distinguished by their unaltered appearance on analysis and in polarized light.

Plagioclases; It is observed as prismatic crystals, usually in subhedral and anhedral forms. Albite, albite+karlsbate and polysynthetic twinning are seen. Alteration is observed, and in some crystals, twin lamellae cannot be observed due to alteration. The extinction angles vary between 20-22° and are plagioclases of andesine type.

Sanidines are generally euhedral phenocrysts with interference colours in grey tones, while typical karlsbate is twinned and appears in earthy colours in a single nicol. Especially argillization and sericitization type alterations are observed in feldspar group minerals.

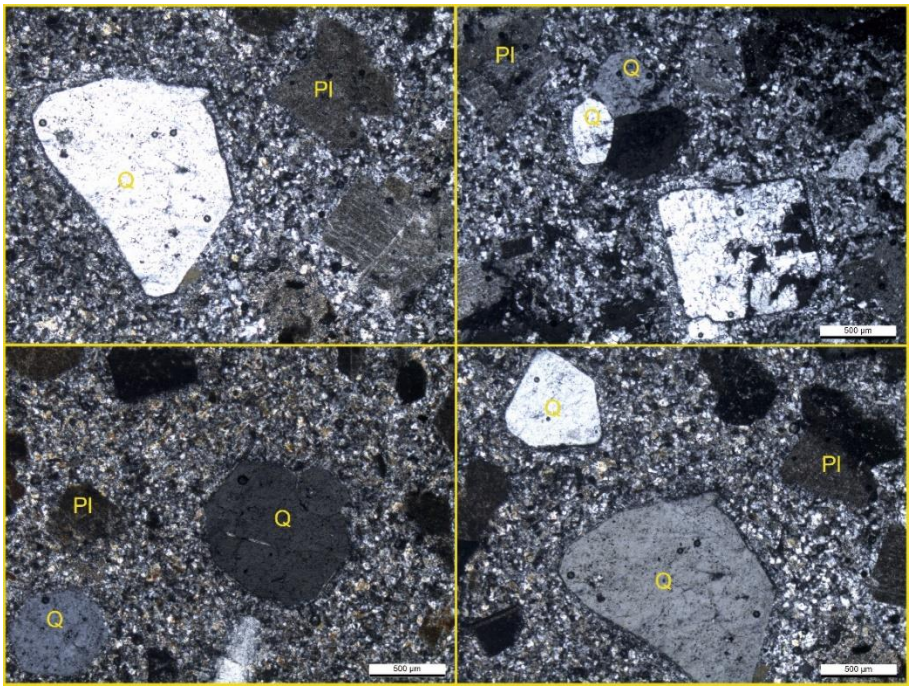

Figure 4. Thin section views of dacites belonging to Kaban dacite (a) porphyric texture (b) sieve texture observed in plagioclase minerals (c-d) porphyric texture (Pl: plagioclase; Q: quartz)

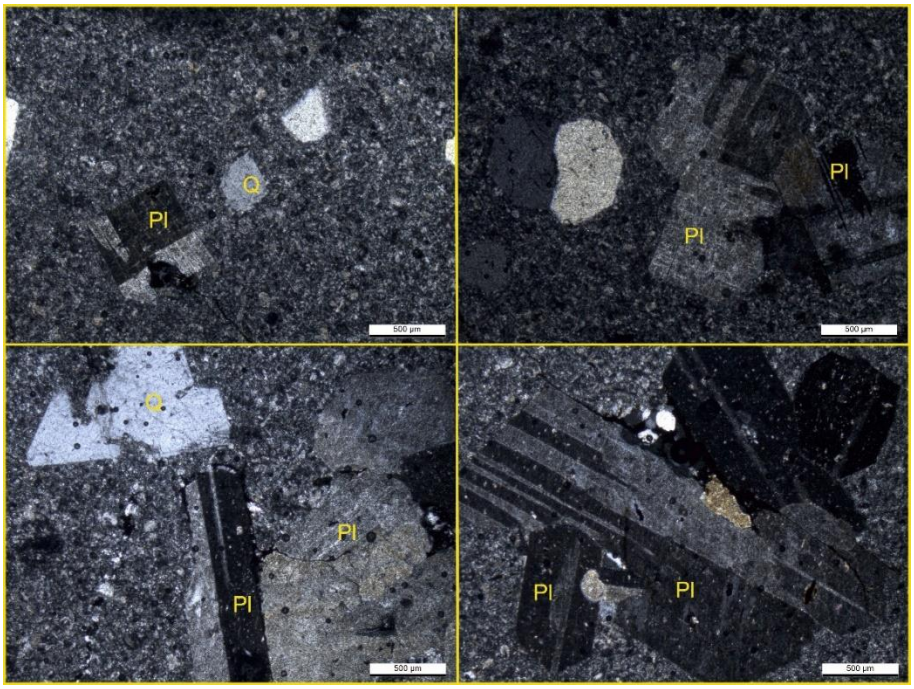

Figure 5. Thin section views of dacites belonging to Kaban dacite (a) porphyric texture (b-c-d) glomeraporphyric texture (Pl: plagioclase; Q: quartz)

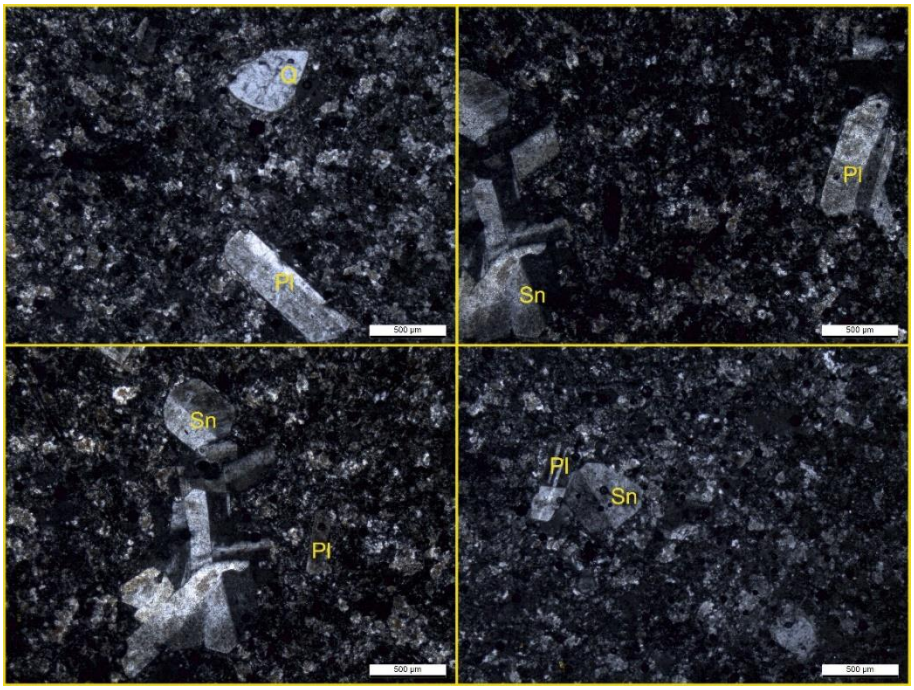

Figure 6. Thin section views of rhyolites belonging to Kaban dacite (a) porphyritic texture (b-c) glomeraporphyric texture (d) porphyric texture (Pl: plagioclase; Q: quartz; Sn: Sanidine).

4. Results and Discussion

Results and Discussion: This study aims to determine the mineralogical and petrographic properties of the Kaban dacite, which are commonly made of dacitic and rhyolitic rocks and outcrops in the region including Olur/Erzurum.

To determine the petrographic features of Kaban Dacite, thin sections were made from samples collected from unaltered rocks and examined under a polarizing microscope. According to this; Porphyric texture with coarse crystals in microlithic paste, glomeroporphyric texture and microcrystalline textureformed by the combination of plagioclase and quartz as closely packed crystal aggregates are observed.

The studied rocks contain a paste consisting of phenocrysts and microliths. The paste material consists of microcrystals sanidine, plagioclase and quartz. While plagioclase + quartz phenocrysts are observed in dacites in general, quartz, sanidine and plagioclase phenocrysts are observed in rhyolites. According to their phenocryst assemblage, the Kaban dacite is mostly in dacite and rhyolite composition .

Within the scope of this study, mineralogical and petrographic properties of rocks belonging to Kaban dacite were revealed. In addition, by comparing possible geochemical studies in the region with petrographic data, it will be possible to reach more detailed information about the formation conditions that form these rocks.

Ethics in Publishing

There are no ethical issues regarding the publication of this study

Author contributions

Abdullah Sar: Conceptualization, Methodology, Investigation, Writing-Original Draft, Writing-Review & Editing, Visualization Sevcan Kürüm: Methodology, Writing-Review & Editing

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