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Petrography and Age Determinations of the Alkaline Volcanic Rocks and Carbonatite of Kızılcaören District; Beylikahır-Eskişehir, Turkey

by *Michel Delaloye*** and *İsmet Özgenç**

Abstract

Alkaline volcanic rocks at the Kızılcaören district are essentially phonolites. Igneous rocks are represented by carbonatite. According to the K/Ar data the carbonatite is Mid-Oligocene and the alkaline volcanites are late Oligocene (24.2 M.a.; s=1.8). It can be stated that the subduction zone of İzmir–Ankara region was still moving (active) during late Oligocene-early Miocene time if the alkaline volcanism is compared with the tectonic evolution of the Western Anatolia.

Keywords: carbonatite, phonolites, K/Ar ages, oligocene volcanism, Turkey

Résumé

Le volcanisme alcalin de la région de Kızılcaören, dans la zone İzmir–Ankara est représenté par des trachytes à biotite ou anorthose et par des phonolites à néphéline et leucite. Signalons la présence de filons de carbonatites. Des datations K-Ar ont permis de donner un âge Oligocène tardif aux trachytes et phonolites, tandis qu'un filon de carbonatite date de l'Oligocène moyen. Si l'on associe ce volcanisme alcalin à l'évolution tectonique de l'Anatolie occidentale, on peut affirmer que la subduction de la zone İzmir–Ankara était active à cette période.

Özet

İzmir–Ankara zonunun doğusunda yer alan Kızılcaören civarı alkalen volkanizması, biotit ve anortozlu trakit ile nefelin-Lösit fonolitlerden olusmaktadır. Bundan başka birkaç karbonatit damarı da saptanmıstır. K-Ar yaş tayinleri trakit ve fonolitlerde geç Oligosenerken Miosen yaşını vermektedir. Buna karşın bir karbonatit damarının yaşı orta Oligosen olarak tayin edilmistir. Bu alkalen volkanizmayı Batı Anadolunun tectonik evrimi ile bağdastırdığemız takdirde, İzmir–Ankara bölgesi subdüksiyonunun o yaslarda hareket halinde oldugunu belirtebiliriz.

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1. INTRODUCTION

The Kızılcaören is approximately 150 km. west of the capital city Ankara. According to ROMIEUX (1942), WEINGART (1954) and KUPFAHL (1954) the Kızılcaören district and adjacent terrains have essentially been containing clastic sediments of palaeozoic age, clay schists, basic volcanites and igneous rocks, green schists and marbles.

KULAKSIZ (1977) has mapped the Kızılcaören district and adjacent terrains in detail and determined the occurrence of the principal rock types.

The fluorite-barite, basteneazite deposits of Kızılcaören have been discovered by Kaplan and other geologists of the Mining Exploration Institute of Turkey (KAPLAN, 1977).

The fluorite-barite-basteneazite deposit of Kızılcaören was remapped by one of us (İ. Ö., 1982) in order to caracterize the occurrence conditions and genetic relationships between the alkaline volcanites and the ore deposit. These deposits are given in Fig. 1. The basement consists of serpentinite overlaid by highly deformed and locally variable anchimetamorphic sediments which are related to the Triassic. Dominant lithologies of the triassic formation include phyllite, phyllitic schist, lithic arenite, siltstones, slate and mudstones. This formation also contains limestone olistolites of permian age, diabasic dykes and lava flows including pillows.

Sandstone, conglomerate and massive fossiliferous limestones of jurassic age (KULAKSIZ, 1977) overlie the triassic formation.

The alkaline volcanites represented by biotitic trachyte, anorthoclase trachyte and nepheline-leucite phonolites outcrop as dykes, necks and domes. Carbonatite outcrops as a dyke with 50 m length and 1.5 m width.

2. PETROGRAPHY OF THE ALKALINE VOLCANITES AND THE CARBONATITE

Our field and microscopic observations demonstrate that the volcanites in Kızılcaören district are typically alkaline trachytes and phonolites.

The carbonatite shows typically holocrystalline texture. Liquid inclusions properties measured on calcite (5 data) indicate that the homogenizing temperature was 550 °C.

Biotite trachyte

Primary minerals are mainly sanidine, oligoclase and minor quantities of biotite, quartz and allanite are associated with variable amounts of glass. This rock outcrops as a lava dome near Zeyköy village. A trachytic tuff is underlying the biotite trachyte.

Anorthoclase trachytes

This rock consists mainly of sanidine and anorthoclase associated with microlites of the same minerals. It outcrops as a dyke southwest of Hüçük Höyülü Tepe and as a neck south of Devebağırtan Tepe.

Nepheline-leucite phonolites

Phonolites consist of sanidine, nepheline, leucite and aegirine-augite. Apatite and sphene can be present. These rocks are olive-green in colour depending on the degree of alteration. The texture of phonolites is prophyritic. Sanidine shows Carlsbad twinning. Phenocrysts consist of zoned nepheline and leucite. Euhedral zoned aegirine-augites are dark-green in colour. They are slightly elongated and oriented in flowlines.

Phonolites occur as dykes east of Yapatça Tepe and south of Küçük Höyüklü Tepe. They also occur as domes along the important fault zone oriented east to west in the south of the district. They built summits like Kocasivri Tepe, Karaburunsivri Tepe and Yalıncak Tepe.

Carbonatite

Carbonatite recognized in the studied area can be named as "SÖVITE" according to the definition of BRÖGGER (1921) and the classification of STRECKEISEN (1978). In the Kızılcaören district, carbonatites were first discovered during the present study. This rock consists mainly of coarse grained rhombohedral calcite containing liquid inclusions and minor quantities of euhedral diopside, biotite, magnetite and prismatic apatite. The rock shows typical holocrystalline texture. It outcrops as a small dyke with 50 m lenght and 1.5 m width at the southeast of Kocayayla Tepe.

3. AGE DETERMINATIONS

The absolute age determinations were made at the Department of Mineralogy, University of Geneva. For samples with more than 0.1 % K, the potassium content was measured in duplicate by flame photometry and by atomic absorption. The isotopic analysis of argon followed the procedure of DELALOYE and WAGNER (1974) using an AEI-MS-10.S mass spectrometer and ^{38}Ar spike from Schumacher, Berne. The constants used are those recommended by the Commission of Geochronology (STEIGER and JÄGER, 1977). The errors given for each

	Num.	% K	Age	40Ar*/s 10^{-10}	40Ar*/40Art	40Ar/36Ar	40K/36Ar 10^{3}
1	KA-1669	6.108	17.3 ± 0.5	18.45 ± 0.35	81.3 ± 0.4	1599.36 ± 32.47	1288.66 ± 43.70
2	KA-1670	4.489	24.3 0.7	19.06 0.35	62.0 0.3	779.01 5.45	339.83 9.44
3	KA-1671	4.031	25.8 0.7	18.16 0.34	53.1 0.3	630.66 3.57	222.05 6.11
4	KA-1672	4.387	22.2 0.6	17.02 0.34	36.8 0.3	468.01 2.32	132.69 3.63
5	KA-1673	4.008	26.3 0.7	18.40 0.33	82.8 0.1	1732.90 14.47	934.42 26.36
6	KA-1674	4.747	26.1 0.8	21.61 0.50	71.2 1.0	1029.37 36.22	481.12 21.33
7	KA-1675	0.206	28.7 1.0	1.03 0.03	18.2 0.4	361.30 1.98	39.10 1.07
8	KA-1676	11.055	25.8 0.7	49.82 0.92	52.0 0.2	615.95 2.47	212.22 5.79
9	KA-1677	4.395	23.4 0.6	17.93 0.34	67.7 0.4	918.55 11.51	455.84 13.57

Table 1 K-Ar dating analytical results and data for the isochrone plot.

measurement (see table 1) represent the absolute error (95% confidence level) according to the definition and calculation of FONTIGNIE (1980).

Nine samples were measured covering various types of volcanic rocks (see table 1). Individual measurements range from 17 to 26 M.a. except for the carbonatite giving 28 M.a. Seven whole rock determinations on phonolites range from 22 to 26 M.a. indicating a late Oligocene (Chattien) age according to the numerical time scale after ODIN and CURRY (1981). Plotted on a diagram $^{40}Ar/^{36}Ar$ vs $^{40}K/^{36}Ar$, all data except the KA-1669 Biotite are located on a single line (Fig. 2) indicating that they constitute an homogeneous group. This line has

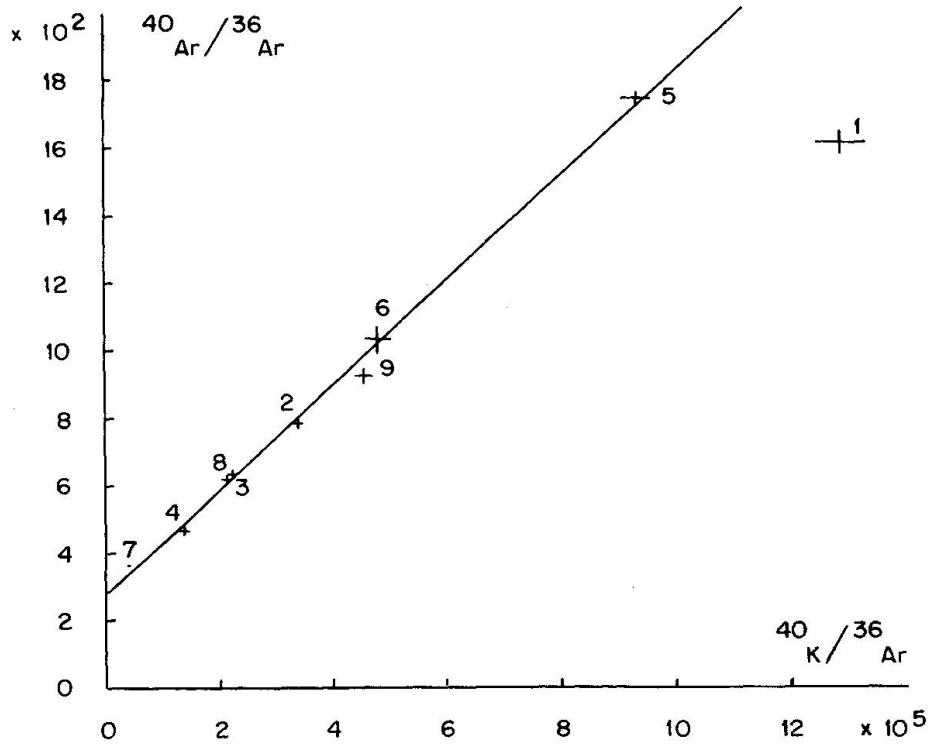

Fig. 2 Isochrone plot of the dated rocks showing the absence of inherited argon and the homogeneity of the set of samples.

an intercept on the $^{40}Ar/^{36}Ar$ coordinate of 282 ± 14 excluding any argon overpressure. Recalculating the isochrone age with the contraint of $^{40}Ar/^{36}Ar$ initial equals 292.5, the final age of these alkalin volcanic rocks of Kızılcaören district is 24.2 M.a. with a standard deviation at 95% confidence level of 1.8.

The studied area belongs to the so-called İzmir Ankara zone (BRINKMANN, 1966) between the Anatolide/Tauride Platform in the South and the Sakarya Continent in the North and represents the remnants of a Triassic to early Palaeocene ocean that closed along a north dipping subduction zone during the late Palaeocene-early Eocene (DÜRR, 1975; SENGÖR, 1979). The late Oligocene alkaline volcanism studied in the present paper is an evidence of the continuation of the volcanic activity in that area. It is worthwhile to notice that phonolite domes occur in various terranes like palaeozoic serpentinites, triassic phyllites and shales, jurassic sandstones. In Kocasivri Tepe and Devebarğırtan Tepe, the phonolitic domes crosscut the very important E-W fault evidencing the great stability of this major tectonic feature since Oligocene times.

The relation of this alkaline volcanism with the plate tectonic evolution of western Turkey (SENGÖR and YILMAZ, 1981) is difficult to characterize. However, this volcanism is evidence of an active subduction zone during late Oligocene.

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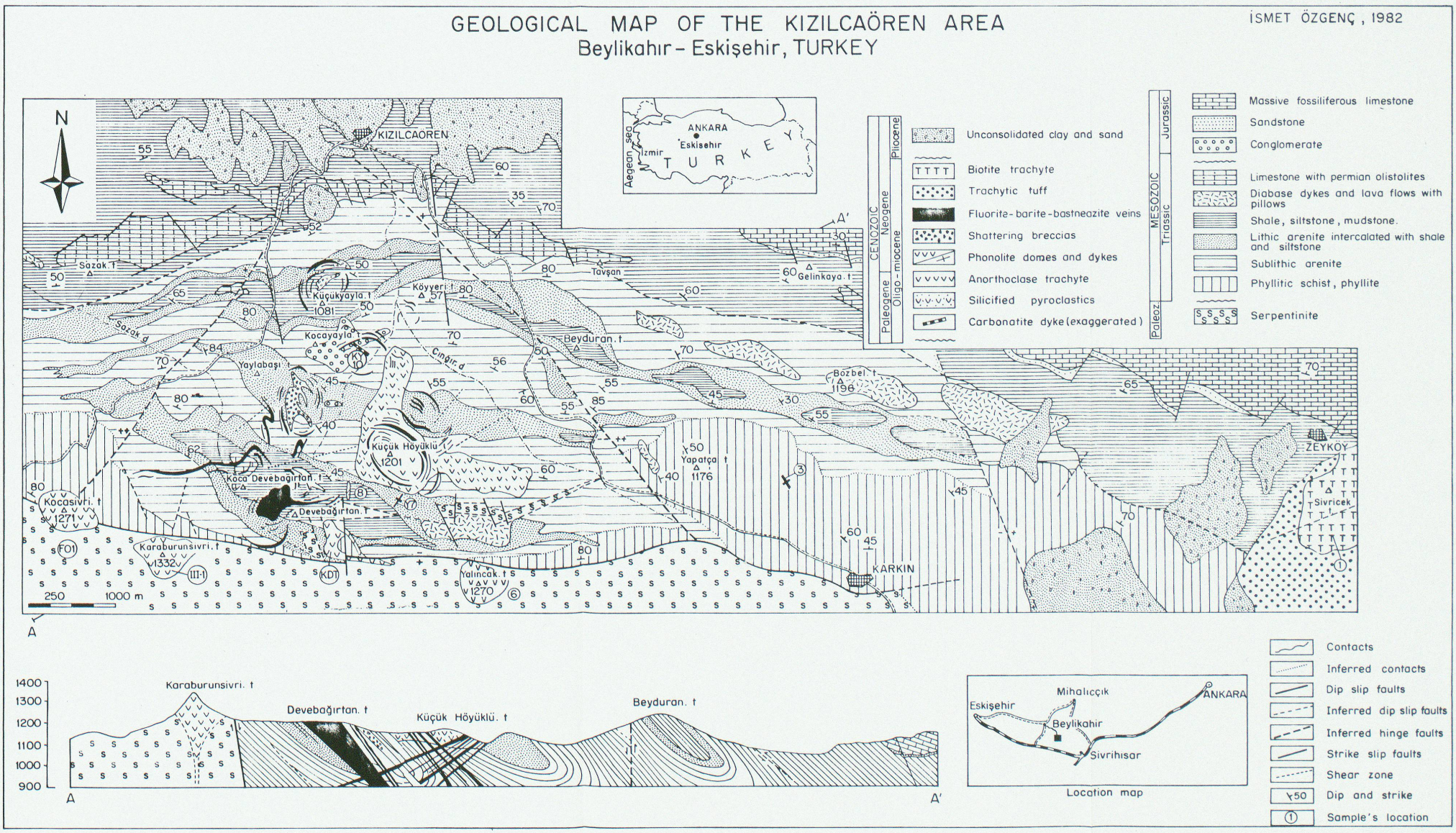

Fig. 1 Geological map of the Kızılcaören area with insets for location of the studied region.