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POTASSIUM-ARGON AGES OF VOLCANIC ROCKS FROM NEAR ANKARA, CENTRAL TURKEY

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Volcanic rocks of various ages and compositions are widespread throughout Turkey, but have been dated infrequently by isotopic means. More complete age control on volcanism in northern and central Turkey is necessary to better constrain plate tectonic models for these regions.

The Ankara volcanics are an informally named group of silicic, calc-alkaline lava flows, ash-flow tuffs, and volcanic breccias that crop out north and northeast of Ankara, central Turkey (Ach, 1982) and cover an area of approximately 180 km² (fig. 1). The chemical composition of this suite of rocks varies from andesite to rhyolite, with dacitic compositions predominating. Very minor, possibly younger, high-potassium basaltic andesite is also present. The andesites, dacites, and rhyolites are all crystal-rich, with 10 to 60 volume percent phenocrysts of plagioclase, orthopyroxene, clinopyroxene, hornblende, biotite, and lesser quartz. These phenocryst phases occur in various proportions and combinations in the different rock types. Previous investigators assigned ages ranging from post-Cretaceous to late Neogene to this group of rocks (see Buyukonal, 1971). An Eocene age was assigned by Ach (1982) on the basis of a single K-Ar determination. This age assignment is validated by the additional K-Ar age determinations presented here (along with analytical data from the previously cited date); K-Ar ages range from 38.8 ± 1.2 m.y. to 44.7 ± 1.0 m.y. (middle to late Eocene).

The Ankara volcanics unconformably overlie several different rock units (fig. 1). Paleozoic (mostly Permo-Carboniferous) greywacke and minor sandstone, conglomerate, and limestone are exposed south of the volcanic rocks. To the north, Mesozoic (primarily Jurassic) fossiliferous limestones and minor quartzite are exposed. A distinctive brick-red, coarse conglomerate of possible lower Tertiary age occurs beneath the volcanic rocks along their northeast margin. Thinly bedded lacustrine and fluvial sandstones, shales, and claystones are found above, beneath, and interbedded with the volcanic rocks.

ANALYTICAL METHODS

These new age determinations were done in the laboratories of the U.S. Geological Survey, Menlo Park, California, using standard isotope-dilution procedures as described by Dalrymple and Lanphere (1969). The analyses were performed on pure mineral concentrates (98% purity by grain count) prepared by heavy-liquid, magnetic, electrostatic, and hand-picking procedures. Potassium analyses were performed by lithium metaborate flux fusion-flame photometry techniques, the lithium serving as an internal standard (Ingamells, 1970). Argon analyses were performed using a 60-sector, 15.2 cm-radius, Nier-type mass spectrometer (Duckworth, 1958).

The precision of the data, shown as the ± value, is the estimated analytical uncertainty in the measurement of radiogenic ^{40}Ar and K_2O in the sample and is based on experience with replicate analyses in the Menlo Park laboratories. The decay constants used for ^{40}K are $\lambda_\epsilon = 0.572 \times 10^{-10}$ year^{-1}, $\lambda_\beta = 4.963 \times 10^{-10}$ year^{-1}, $\lambda_{\epsilon'} = 8.78 \times 10^{-13}$ year^{-1}; $^{40}K/K_{total} = 1.167 \times 10^{-4}$ atom percent.

The previously cited age determination (sample 9-10; Ach, 1982) was made by Geochron Laboratories, Cambridge, Massachusetts, on a mineral concentrate (90% estimated purity) prepared by Geochron. The isotopic age presented below for sample 9-10 was recalculated using the analytical data from Geochron and the constants listed above.

ACKNOWLEDGMENTS

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SAMPLE DESCRIPTIONS

1. *21-5* — K-Ar
Dacite (43°59.95'N,33°00.10'E; 4 km ENE of Huseyingazi Tepe, central Turkey). *Analytical data:* K_2O = 0.518%; $^{40}Ar^*$ = 2.8753×10^{-11} mol/g, 2.9701×10^{-11} mol/g; avg. 2.9227×10^{-11} mol/g; $^{40}Ar^*/\Sigma^{40}Ar$ = 0.645, 0.726; avg. 0.685.
(hornblende) 38.8 ± 1.2 m.y.

2. *15-9* — K-Ar
Dacite (40°00.02'N,32°53.56'E; 8 km SE of Baglum, central Turkey). *Analytical data:* (biotite) K_2O = 8.43%; $^{40}Ar^*$ = 5.4857×10^{-10} mol/g; $^{40}Ar^*/\Sigma^{40}Ar$ = 0.824; (hornblende) K_2O = 0.491%; $^{40}Ar^*$ = 3.1827×10^{-11} mol/g; $^{40}Ar^*/\Sigma^{40}Ar$ = 0.681.
(biotite) 44.7 ± 1.0 m.y.
(hornblende) 44.5 ± 1.0 m.y.

3. *22-2* — K-Ar
Dacite (39°59.92'N,32°54.13'E; 1.9 km NNW of Huseyingazi Tepe, central Turkey). *Analytical data:* (biotite) K_2O = 8.62%; $^{40}Ar^*$ = 5.2714×10^{-10} mol/g; $^{40}Ar^*/\Sigma^{40}Ar$ = 0.752; (hornblende) K_2O = 0.499%; $^{40}Ar^*$ = 3.0267×10^{-11} mol/g; $^{40}Ar^*/\Sigma^{40}Ar$ = 0.480.
(biotite) 42.0 ± 1.0 m.y.
(hornblende) 41.7 ± 1.0 m.y.

4. *9-10* — K-Ar
Rhyolite (44°19.57'N,32°51.83'E; 1.5 km ENE of Baglum, central Turkey). *Analytical data:* K_2O = 8.029%; $^{40}Ar^*$ = 4.62×10^{-10} mol/g, 5.49×10^{-10} mol/g; avg. 5.055×10^{-10} mol/g; $^{40}Ar^*/\Sigma^{40}Ar$ = 0.600, 0.800; avg. 0.700.
(biotite) 43.2 ± 1.6 m.y.

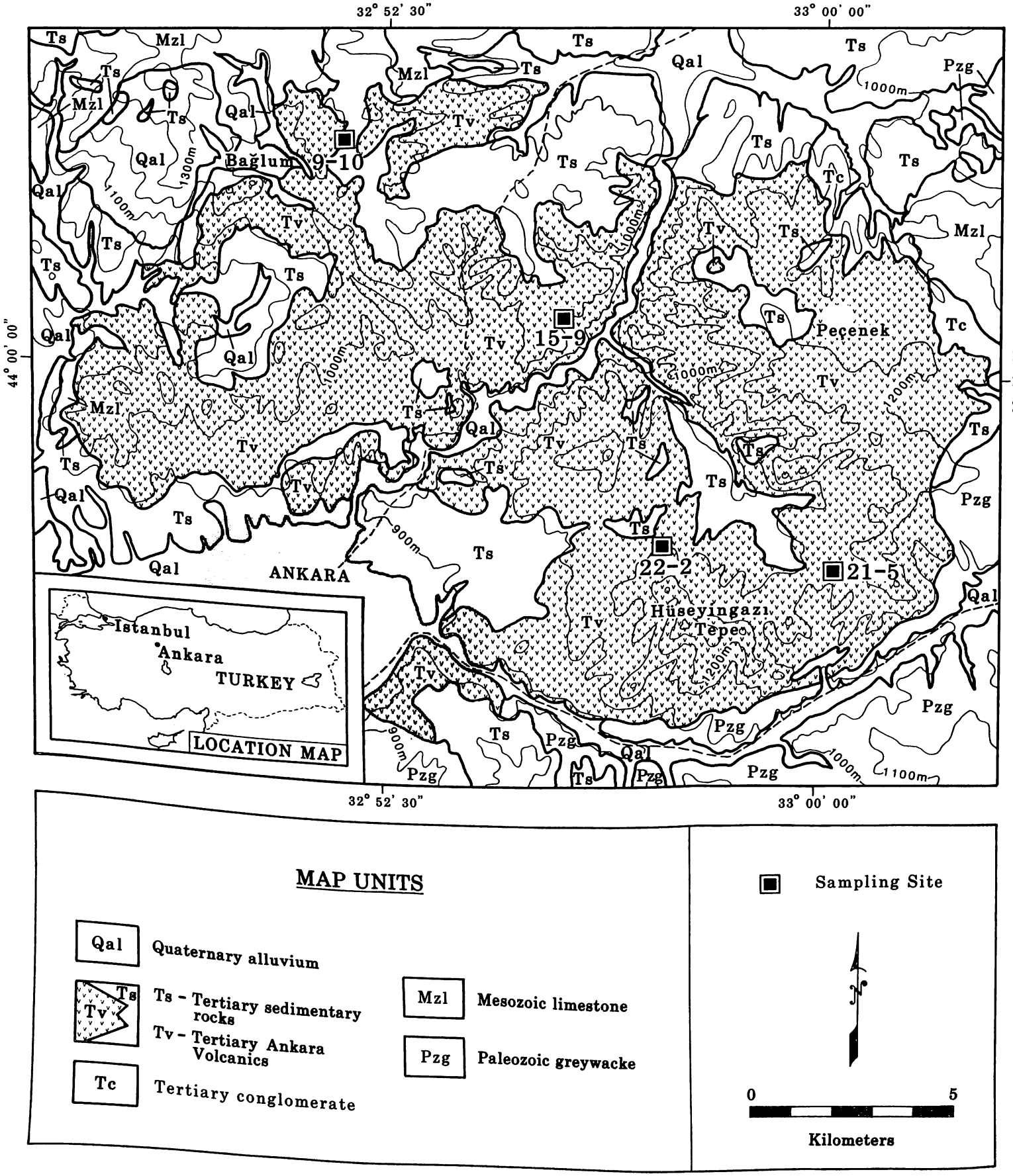

FIGURE 1. Geologic map of the Ankara area, central Turkey, showing locations of sampling sites.

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