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K-AR AGES OF ORE DEPOSITION AT TONOPAH, NEVADA[1]

Harold F. Bonham, Jr., and Larry J. Garside
Nevada Bureau of Mines and Geology,
University of Nevada
Reno, NV 89107

Miles L. Silberman
U. S. Geological Survey
Menlo Park, CA 94025

This preliminary report describes one of a series of K-Ar geochronological studies of epithermal precious metal vein deposits in Tertiary volcanic rocks of Nevada and eastern California. The immediate objective of each study is to determine the absolute age relations of the host rocks, veins, and postore volcanic rocks. The study applies K-Ar measurements to hypogene vein minerals and alteration minerals within the wallrocks in order to determine the age and duration of the hydrothermal systems responsible for ore deposition and alteration. Ultimately, the objective of the district studies is to discover the regional relation of the above-mentioned factors in order to better assess the economic mineral potential of the region.

Analytical equipment and procedures are the same as those described in McKee and others (1971). The analytical uncertainties given for the determined ages are calculated at one standard deviation.

Constants used in the calculation of the K-Ar ages are: $\lambda_e = 0.585 \times 10^{-10}$ yr^{-1}; $\lambda_\beta = 4.72 \times 10^{-10}$ yr^{-1}; $K^{40}/K_{total} = 1.22 \times 10^{-4}$ gm/gm.

Abbreviations used: $^{*}Ar^{40}$ = radiogenic argon-40; ΣAr^{40} = total argon-40.

GEOLOGIC DISCUSSION

The Tonopah mining district, located in the southern part of the San Antonio Mountains, Nye and Esmeralda Counties, Nevada, has a recorded production from 1901 to 1972 of approximately $150 million, practically all of which was in silver values with appreciable gold.

Volcanic, plutonic, metamorphic, and sedimentary rocks present in the San Antonio Mountains range in age from early Paleozoic to late Tertiary. Metallization in the Tonopah district occurs in Tertiary volcanic rocks which are part of a complex, composite pile of extrusive and intrusive volcanic rocks interbedded with sedimentary rocks of chiefly volcaniclastic origin.

Nolan (1935), who has described the subsurface geology of the Tonopah district in detail, lists the preore formations, from youngest to oldest, as follows:

West End Rhyolite:	intrusive sills
Extension Breccia:	lithic-rich, rhyolite intrusive
Mizpah Trachyte:	flows and minor breccia
Sandgrass Andesite:	flows interlayered with Tonopah Formation
Tonopah Formation:	rhyolite tuff, flows, and pyroclastic breccia

Of the preore formations, only the Mizpah Trachyte crops out within the district. Surface outcrops of productive veins in the district are confined to an area of altered Mizpah Trachyte covering less than 0.6 km^2. Within this area the Mizpah Trachyte has been altered so that it consists largely of quartz, sericite, and adularia. The quartz-sericite-adularia alteration is spatially and genetically related to the productive veins in the Tonopah district (Nolan, 1935, p. 45).

The oldest postore formation is the Fraction Tuff, a composite ash-flow tuff, which unconformably overlies mineralized Mizpah Trachyte (Nolan, 1935, p. 12).

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A 20.4-m.y. K-Ar age of unaltered Mizpah Trachyte places a lower limit on the time of mineralization in the heart of the Tonopah district, and a 17-m.y. K-Ar age of the overlying Fraction Tuff places an upper limit. The 19.1-m.y. K-Ar age on adularia in vein material from the Belmont mine appears to be reasonable for the time of mineralization.

SAMPLE DESCRIPTIONS

1. Silberman and McKee (1972) K-Ar (biotite) 17.1±0.3 m.y. (sanidine) 16.9±0.3 m.y.

Fraction Tuff. Rhyolitic welded tuff (NE/4 Sec. 2, T2N, R42E; 38°3′38″N, 117°13′37″W; at Heller Butte, Nye Co., NV). Collected by: F. J. Kleinhampl, U. S. Geol. Survey.

2. USGS(M)-Tv-1 K-Ar (adularia) 19.1±0.4 m.y.

Vein material consisting of adularia with intergrowths of sericite, sulfides, and quartz (W/2 Sec. 36, T3N, R42E; 38° 4′17″N, 117°12′53″W; Nye Co., NV). Analytical data: K_2O = 12.07%; $\overset{*}{Ar}^{40}$ = 3.419 x 10^{-10} ppm; $\overset{*}{Ar}^{40}/\Sigma Ar^{40}$ = 83.1%. Collected by: H. F. Bonham and L. J. Garside, Nev. Bureau of Mines and Geology; dated by: M. L. Silberman, U. S. Geological Survey.

3. USGS(M)-T219 K-Ar (biotite) 20.4±0.6 m.y.

Mizpah Trachyte. Porphyritic biotite-hornblende andesite (SE/4 SE/4 Sec. 15, T3N, R42E; 38°6′39″N, 117°14′4″S; Nye Co., NV). Analytical data: K_2O = 7.71%; $\overset{*}{Ar}^{40}$ = 2.339 x 10^{-10} mole/gm; $\overset{*}{Ar}^{40}/\Sigma Ar^{40}$ = 69.1%. Collected by: H. F. Bonham and L. J. Garside, Nev. Bureau of Mines and Geology; dated by: M. L. Silberman, U. S. Geological Survey. Comment: This sample of unaltered Mizpah was collected about 3 miles from the center of the Tonopah district.

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