Markedly discordant K-Ar ages for coexisting biotite and muscovite from a two-mica granite in the Toana Range, Elko County, Nevada

D.E. Lee and R.F. Marvin

Isochron/West, Bulletin of Isotopic Geochronology, v. 32, pp. 19-20

This page is intentionally left blank to maintain order of facing pages.

MARKEDLY DISCORDANT K-Ar AGES FOR COEXISTING BIOTITE AND MUSCOVITE FROM A TWO-MICA GRANITE IN THE TOANA RANGE, ELKO COUNTY, NEVADA

DONALD E. LEE
RICHARD F. MARVIN
U.S. Geological Survey, Denver, CO 80225

Markedly discordant K-Ar radiometric age results have been obtained for coexisting muscovite and biotite from a two-mica granite from the Toana Range, Elko County, Nevada. The muscovite gave an age of 71.7 ± 2.0 m.y., the biotite, 15.4 ± 0.5 m.y.

The rock from which these micas were recovered is typical of other two-mica granites in northeastern Nevada in that it is peraluminous, contains a relatively simple suite of accessory minerals, and has a high initial $^{87}Sr/^{86}Sr$ ratio (Lee and others, 1981). Muscovite 415 is phengitic and is chemically similar to muscovite recovered from other two-mica granites in northeastern Nevada. However, biotite 415 is chemically distinct from other biotites recovered from two-mica granites, in that it is a hydrobiotite with H_3O^+ substituting for K^+ in the interlayer X-group. These characteristics have lead Lee and others (1981) to suggest that the composition of this biotite was altered by post-magmatic processes. Such an alteration would also account for the low K-Ar age (15.4 m.y.) found for this biotite.

About one km northeast of sample 415, at 41°0'55"N, 114°17'30"W, Prospect Mountain Quartzite is exposed in intrusive contact with the two-mica granite. Two samples of metamorphic muscovite recovered from this quartzite gave K-Ar ages of 72.5 ± 2.0 and 75.6 ± 2.1 m.y. (Lee and others, 1980), in good agreement with results for muscovite 415. The map of Stewart and Carlson (1978) shows the two-mica granite as a Tertiary–Jurassic pluton intruding Cambrian Prospect Mountain Quartzite, with Cambrian carbonate thrust over the quartzite. The igneous muscovite age of 71.7 m.y. indicates that the two-mica granite might have crystallized during the Late Cretaceous. The metamorphic muscovite ages (72.5 and 75.6 m.y.) might then reflect degassing resulting from the thermal contact action on the Cambrian Prospect Mountain Quartzite. If on the other hand the two-mica granite is actually Jurassic in age, the Late Cretaceous K-Ar ages just discussed may result from stresses related to late movement on the overlying thrust fault. Such resetting of K-Ar ages by late movement on a thrust fault has been observed in the southern Snake Range (Lee and others, 1970) and elsewhere in eastern Nevada (Lee and others, 1980).

Jurassic K-Ar ages have been reported for the granodiorite present in the Silver Zone Pass area (Coats and others, 1965), about 11 km south of two-mica granite sample site 415. If the granodioritic mass is Jurassic in age, and the two-mica granite to the north is indeed Cretaceous (71.7 m.y.), the granodiorite and granite bodies would indicate an evolution of igneous types in the Toana Range similar to that observed about 225 km to the south in the southern Snake Range, Nevada, where Jurassic granodiorite (Lee and others, 1968) is exposed in close proximity to a two-mica granite of Cretaceous age (Lee and others, 1981).

Additional data are needed to determine with certainty the age of the two-mica granite of the Toana Range. However, the 15.4 m.y. date determined for biotite 415 would seem to indicate the time of a post-crystallization event that altered the biotite present in this two-mica granite but failed to affect significantly the coexisting muscovite.

SAMPLE DESCRIPTION

1. *415* K-Ar
Granite (41°0'25"N, 114°18'15"W; Toana Range, Elko Co., NV). *Analytical data:* (Muscovite) K_2O = 10.52%; $*Ar^{40}$ = 11.08 x 10^{-10} moles/gm; $*Ar^{40}$ = 70%. (Biotite) K_2O = 6.10%; $*Ar^{40}$ = 1.360 x 10^{-10} moles/gm; $*Ar^{40}$ = 11%; analyzed by R. F. Marvin, H. H. Mehnert, E. L. Munson (Potassium determinations by gravimetric analysis. Constants used: $K^{40}\lambda_\epsilon$ = 0.581 x 10^{-10}/yr; $\lambda\beta$ = 4.962 x 10^{-10}/yr. Atomic abundance: K^{40} = 1.167 x 10^{-4}). *Comment:* 15 m.y. date would seem to indicate the time of a post-crystallization event that affected the biotite but not the coexisting muscovite.
(muscovite) 71.7 ± 2.0 m.y.
(biotite) 15.4 ± 0.5 m.y.

REFERENCES

Coats, R. R., Marvin, R. F., and Stern, T. W. (1965) Reconnaissance of mineral ages of plutons in Elko County, Nevada, and vicinity: U.S. Geological Survey Professional Paper 525-D, p. D11–D15.

Lee, D. E., Kistler, R. W., Friedman, I., and Van Loenen, R. E. (1981) Two-mica granites of northeastern Nevada: Journal of Geophysical Research, in press.

Lee, D. E., Marvin, R. F., and Mehnert, H. H. (1980) A radiometric age study of Mesozoic–Cenozoic metamorphism in eastern White Pine County, Nevada, and nearby Utah: U.S. Geological Survey Professional Paper 1158-C, p. 17–28.

Lee, D. E., Marvin, R. F., Stern, T. W., and Peterman, Z. E. (1970) Modification of potassium-argon ages of Tertiary thrusting in the Snake Range, White Pine County, Nevada: U.S. Geological Survey Professional Paper 700-D, p. D92–D102.

Lee, D. E., Stern, T. W., Mays, R. E., and Van Loenen, R. E. Accessory zircon from granitoid rocks of the Mount Wheeler mine area, Nevada: U.S. Geological Survey Professional Paper 600-D, p. D197–D203.

Stewart, J. H., and Carlson, J. E. (1978) Geologic map of Nevada: U.S. Geological Survey.