K-Ar isotopic ages of volcanic rocks in the Reno 1x2° AMS sheet, western Nevada

E.J. Bell, L.A. Fultz, and D.T. Trexler

Isochron/West, Bulletin of Isotopic Geochronology, v. 40, pp. 13-16

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

K-Ar ISOTOPIC AGES OF VOLCANIC ROCKS IN THE RENO 1x2° AMS SHEET, WESTERN NEVADA

ELAINE J. BELL
LAWRENCE A. FULTZ
DENNIS T. TREXLER
} *Division of Earth Sciences, 255 Bell Street, Suite 200, Reno, NV 89503*

The K-Ar ages reported were determined as part of a study on the geochemistry, age, and strontium isotope composition of late Tertiary and Quaternary volcanic rocks in western Nevada (Fultz and others, 1984) under U.S. Department of Energy Contract AC03-82RA50075.

Mineral separates and whole-rock samples were prepared by L. A. Fultz and submitted to Krueger Enterprises, Inc., Geochron Laboratories Division. The determinations were run by Thomas Bills, K-Ar Lab Manager, Geochron Laboratories Division. All samples were treated with dilute HF and HNO_3 to reduce atmospheric argon. Argon analyses were performed by standard isotope dilution procedures (Dalrymple and Lanphere, 1969) using an AEI MS-10 mass spectrometer. Potassium analyses were performed by the lithium metaborate flux fusion-flame photometry technique (Ingamells, 1970). Samples were run in duplicate, except for triplicate argon analyses of sample no. H-3312 (plagioclase) and no. H-3344 (whole rock).

Ages supplied by Geochron Laboratories Division were recalculated using the following constants: $\lambda\beta = 4.963 \times 10^{-10}$ yr^{-1}; $\lambda_\epsilon = 0.572 \times 10^{-10}$ yr^{-1}; $\lambda_e = 8.78 \times 10^{-10}$ yr^{-1}; $^{40}K/K_{total} = 1.167 \times 10$.

These constants are based on data on the abundance of ^{40}K (Garner and others, 1975) and its decay constants (Beckinsale and Gale, 1969) and are refined compared to those used prior to 1976. The recalculated ages are designated in the following sections.

Sample locations are illustrated on the accompanying map (fig. 1).

SAMPLE DESCRIPTIONS

1. *H-3312* K-Ar
Porphyritic basaltic andesite (SW/4 S32,T18N,R20E; 39°22.6'N,119°46.0'W; Mt. Rose NE 7½' quad, Washoe Co., NV). Steamboat Hills basaltic andesite. *Analytical data:* (plagioclase) $K_2O = 0.425\%$, $*Ar^{40} = 8.39 \times 10^{-10}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 0.018$; (whole rock) $K_2O = 2.003\%$, $*Ar^{40} = 2.9 \times 10^{-10}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 0.008$. *Comment:* A problem arises with apparent excess Ar^{40}, caused by argon of magmatic origin, trapped within the mineral lattice at the time of crystallization, leading to an anomalously old apparent age of the plagioclase. Sporadic results of argon analyses show that there is no reason to assume homogeneous distribution of the excess argon throughout the different phenocrysts (T. Bills, pers. commun., 1983). The plagioclase age is therefore a maximum age. The discordancy in whole rock and plagioclase separate ages further suggests the possibility of groundmass argon loss (Damon and others, 1967). Silberman and others (1979) and Morton and others (1980, 1983) report isotopic ages of 2.1-2.5 Ma for the Steamboat Hills basaltic andesite. *Collected by:* L. A. Fultz.
(plagioclase)29.6 ± 2.0 Ma
(whole rock) 0.21 ± 0.07 Ma

2. *H-3344* K-Ar
Porphyritic basaltic andesite (NW/4 S3,T16N,R23E; 39°17.2'N,119°23.5'W; Churchill Butte 15' quad, Lyon Co., NV). Table Mountain basaltic andesite. $K_2O = 1.052\%$, $*Ar^{40} = 4.71 \times 10^{-10}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 0.042$. *Comment:* Twenty-foot-thick agglomerate flow. Age compatible with Lousetown Creek section type age (6.83 ± 0.16) of Lousetown volcanics (Morton and others, 1980, 1983). *Collected by:* L. A. Fultz and E. J. Bell.
(whole rock)6.7 ± 0.7 Ma

3. *H-3345* K-Ar
Porphyritic basaltic andesite (NE/4 NW/4 S31,T19N, R25E; 39°28.5'N,119°13.4'W; Silver Springs 15' quad, Lyon Co., NV). Silver Springs basaltic andesite. *Analytical data:* $K_2O = 1.443\%$, $*Ar^{40} = 1.141 \times 10^{-9}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 0.249$. *Comment:* Older than Lousetown volcanic rock ages (Morton and others, 1980, 1983) but comparable in age to the Washington Hill rhyolite dome (9.7 ± 0.3 to 10.9 ± 0.3) reported by Silberman and others (1979). *Collected by:* L. A. Fultz and E. J. Bell.
(whole rock)11.8 ± 0.7 Ma

4. *H-3347* K-Ar
Porphyritic olivine-bearing basaltic andesite (NE/4 NE/4 S25,T17N,R23E; 39°18.9'N,119°20.7'W; Churchill Butte 15' quad, Lyon Co., NV). Churchill Butte basaltic andesite. *Analytical data:* $K_2O = 1.205\%$, $*Ar^{40} = 3.45 \times 10^{-10}$ moles/gm, $Ar^{40}/\Sigma Ar^{40} = 0.126$. *Comment:* Younger than ages of Lousetown volcanics reported by Morton and others (1980, 1983). Comparable with K-Ar isotopic ages of 3.3 ± 0.2 and 3.5 ± 0.2 Ma obtained on basalt flow in same section location on Churchill Butte (H. A. Spellman, Jr., pers. commun., 1983; Tingley, 1981). *Collected by:* L. A. Fultz and E. J. Bell.
(whole rock)4.3 ± 0.6 Ma

5. *H-3348* K-Ar
Porphyritic basaltic andesite (NW/4 S33,T16N,R25E; 39°12.8'N,119°11.6'W; Wabuska 15' quad, Lyon Co., NV). Cleaver Peak basaltic andesite. *Analytical data:* $K_2O = 1.292\%$, $*Ar^{40} = 7.87 \times 10^{-10}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 0.155$. *Comment:* Thin vesicular flows overlying Tertiary (Kate Peak?) andesite. Age compatible with Mustang andesite (9.1-9.2 ± 0.3) and andesite at Glendale (8.7 ± 0.3) reported by Morton and others (1977) and is within the age range (7.35 ± 0.70 and 9.66 ± 0.30) for the Clark Mountain flows of the Lousetown Formation reported by Morton and others (1980, 1983). *Collected by:* L. A. Fultz and E. J. Bell.
(whole rock)9.2 ± 0.6 Ma

6. *H-3355* K-Ar
Black glassy rhyolite (SE/4 S2,T20N,R28E; 39°37.4'N, 118°48.2'W; Soda Lake 15' quad, Churchill Co., NV). Upsal Hogback rhyolite. *Analytical data:* $K_2O = 3.835\%$, $*Ar^{40} = 1.619 \times 10^{-9}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 0.518$. *Comment:* Block of glassy flow-banded rhyolite contained in basalt flow. The basalt at Upsal Hogback is interbedded with Wyemaha age sediments having a relative age of 0.04 to 0.1 million years (Morrison, 1964) and is comparable to

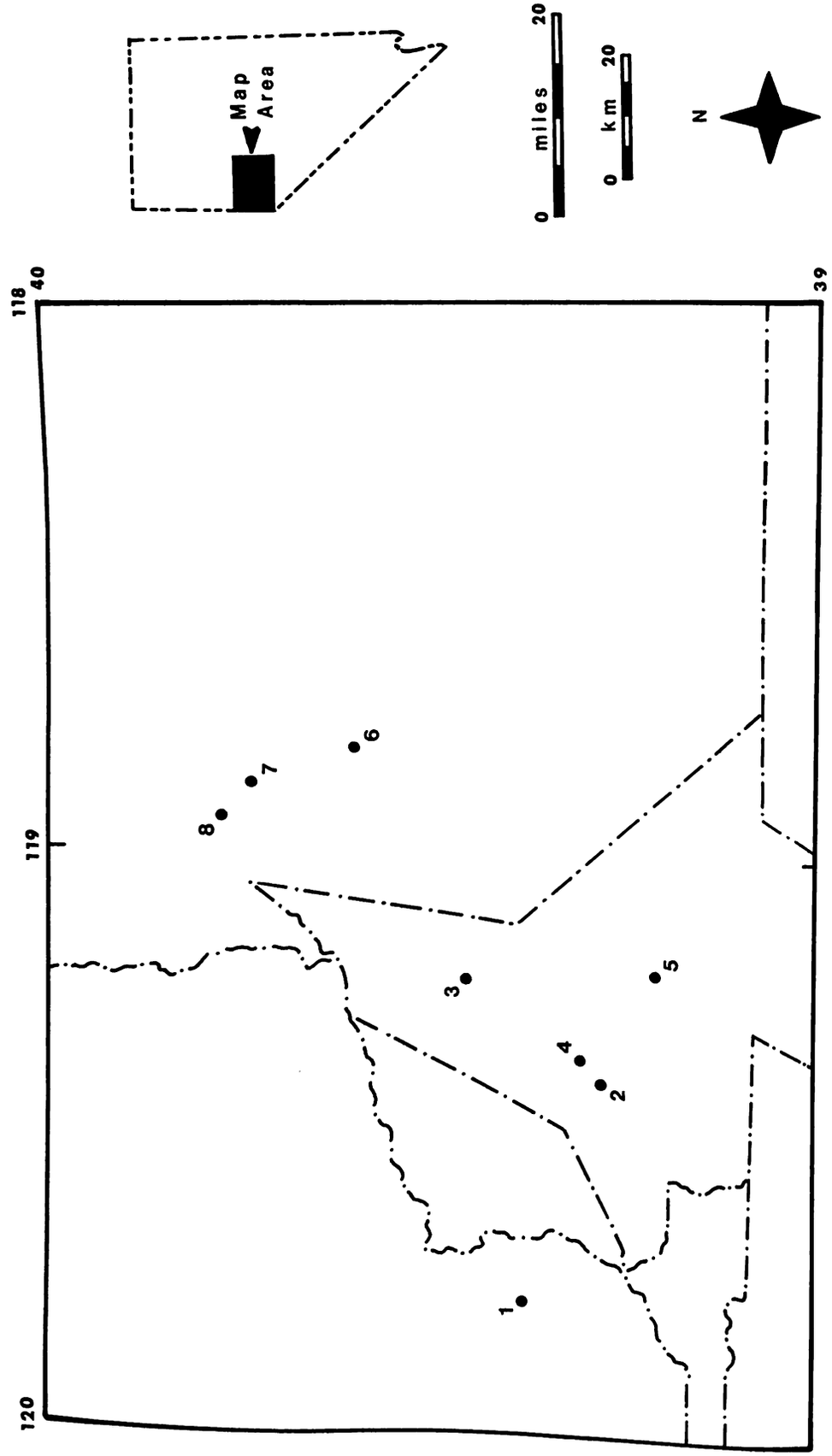

FIGURE 1. Map of Reno 1x2° AMS quadrangle showing sample localities. Numbers are keyed to sample descriptions.

the basalt at Soda Lake. A block of the basalt exploded from the maar at Upsal Hogback has been dated at 200,000 years (M. L. Silberman, pers. commun., 1983). The youngest identified activity of the Upsal Hogback vent is a basaltic tephra layer within the Sehoo Formation of pluvial Lake Lahontan that overlies the Wono ash bed (±25,000 years) (Davis, 1978). The K-Ar content of the rhyolite was probably reset by the younger basaltic volcanism (H. F. Bonham, Jr., pers. commun., 1983). Therefore, the 6.3 Ma isotopic age should probably be considered a minimum age for the rhyolite. *Collected by:* L. A. Fultz and E. J. Bell.

(whole rock)6.3 ± 0.3 Ma

7. *H–DP–2A* K-Ar
Vitrophyre of ignimbrite flow (SW/4 S30,T22N,R28E; 39°44.7'N,118°53.0'W; Churchill Butte 15' quad, Churchill Co., NV). Desert Peak ignimbrite. *Analytical data:* K_2O = 0.698%, $*Ar^{40}$ = 6.66 × 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 0.163. *Comment:* This ignimbrite has previously been identified as Desert Peak andesite, based upon field criteria; chemical analyses show that these rocks rnage from 69% to 71% silica. Discordant with ages of 12.0 ± 1.1 (recalculated to new constants), 4.1 and 4.6 (hornblende), and 2.3 (plagioclase) Ma reported by Hiner (1979) and Benoit and others (1982) for samples of the ignimbrite flow approximately 40% above the base of the flow. The 4.1, 4.6, and 2.3 Ma ages are somewhat suspect since the analyses showed very low argon contents and argon loss is possible (W. R. Benoit, pers. commun., 1983). The 12.0 ± 1.1 Ma age, however, is in chronostratigraphic agreement with the two isotopic ages obtained in this study. *Collected by:* L. A. Fultz and D. T. Trexler.

(plagioclase)14.3 ± 1.1 Ma

8. *H–3360* K-Ar
Basaltic andesite flow (NW/4 SW/4 S10,T22N,R27E; 39°47.2'N,118°56.8'W; Desert Peak 15' quad, Churchill Co., NV). Desert Peak basaltic andesite. *Analytical data:* K_2O = 1.277%, $*Ar^{40}$ = 8.66 × 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 0.161. *Comment:* Stratigraphically youngest flow on Desert Peak. See comment for sample H–DP–2A. *Collected by:* L. A. Fultz.

(whole rock)10.2 ± 0.7 Ma

REFERENCES

Beckinsale, R. D., and Gale, N. N. (1969) A reappraisal of the decay constants and branching ratio of ^{40}K: Earth and Planetary Science Letters, v. 6, p. 289–294.

Benoit, W. R., Hiner, J. E., and Forest, R. T. (1982) Discovery and geology of the Desert Peak geothermal field—a case history: Nevada Bureau of Mines and Geology Bulletin 97, 82 p.

Dalrymple, G. B., and Lanphere, M. A. (1969) K-Ar dating: San Francisco, W.H. Freeman and Co.

Damon, P. E., Laughlin, A. W., and Percious, J. K. (1967) Problems of excess argon-40 in volcanic rocks, *in* Radioactive dating and methods of low-level counting: International Atomic Energy Agency, Vienna, p. 463–481.

Davis, J. O., 1978, Quaternary tephrochronology of the Lake Lahontan area, Nevada and California: Nevada Archeological Survey, Research Paper no. 7, 168 p.

Fultz, L. A., Bell, E. J., and Trexler, D. T. (1984) Geochemistry, age and strontium isotope composition of late Tertiary and Quaternary basalts and andesites in western Nevada and their relation to geothermal potential: U.S. Department of Energy Report DOE–RA–50075–1, 91 p.

Garner, E. L., Murphy, T. J., Gramlich, J. W., Paulsen, P. J., and Barnes, I. L. (1975) Absolute isotopic abundance ratios and the atomic weight of a reference sample of potassium: Journal of Research, National Bureau of Standards-A, Physical Chemistry, v. 79A, p. 713–725.

Hiner, J. E. (1979) Geology of the Desert Peak geothermal anomaly, Churchill County, Nevada: M.S. thesis, University of Nevada Reno, Reno, Nevada, 84 p.

Ingamells, C. O. (1970) Lithium metaborate flux in silicate analysis: Analytica Chimica Acta, v. 52, p. 323–334.

Morrison, R. B. (1964) Lake Lahontan—geology of southern Carson Desert, Nevada: U.S. Geological Survey Professional Paper 401, 156 p.

Morton, J. L., Silberman, M. L., Thompson, G. I., and Brookins, D. G. (1980) New K-Ar ages and strontium isotopic data from late Miocene and younger volcanic rocks of the northern Virginia Range, Nevada: Geological Society of America, Abstracts, v. 12, no. 3, p. 143.

Morton, J. L., Silberman, M. L., Thompson, G. A., and Brookins, D. G. (1983) K-Ar ages of volcanic rocks, northern Virginia Range, Nevada: U.S. Geological Survey Professional Paper (in press), 7 p.

Morton, J. L., Silberman, M. L., Bonham, H. F., Jr., Garside, L. J., and Noble, D. C. (1977) K-Ar ages of volcanic rocks, plutonic rocks and ore deposits in Nevada and eastern California—determinations run under the USGS-NBMG cooperative program: Isochron/West, no. 20, p. 19–29.

Silberman, M. L., White, D. E., Keith, T. E. C., and Dockter, R. D. (1979) Duration of hydrothermal activity at Steamboat Springs, Nevada, from ages of spatially associated volcanic rocks: U.S. Geological Survey Professional Paper 458–D, 14 p.

Thompson, G. A. (1956) Geology of the Virginia City quadrangle: U.S. Geological Survey Professional Paper 1042–C, p. 45–75.

Thompson, G. A., and White, D. E. (1964) Regional geology of the Steamboat Springs area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458–A, 48 p.

Tingley, S. L. N. (1981) Age determinations from other publications—list 4: Isochron/West, no. 31, p. 3–13.