

K-AR DATES FROM ARIZONA, MONTANA, NEVADA, UTAH, AND WYOMING

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This paper reports the results of geochronometric investigations in several western states. These results were obtained between 1967 and 1973 at Yale University, have not yet been published, and are not certain to be included with full documentation in any papers planned or in progress. We feel that the information provided will be of use in future regional and local studies.

The K-Ar data were obtained using standard analytical techniques as described by Armstrong (1970a). Argon was determined by isotope dilution, potassium by atomic absorption spectrophotometry. The dates are computed using the following constants: $K^{40} = 0.0119$ atom percent; $K\lambda_{\beta} = 4.72 \times 10^{-10} \text{ yr}^{-1}$, $K\lambda_{e} = 0.584 \times 10^{-10} \text{ yr}^{-1}$. Analyses of standards indicate that calibrations are accurate within 2%. Uncertainties reported are for analytical error only and represent one standard deviation, or the standard error for averaged dates.

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SAMPLE DESCRIPTIONS

WESTERN NEVADA

A suite of samples, listed below in order of decreasing geologic age, was dated to supplement the information reported by Speed and Armstrong (1971). The results further document the predominantly Middle to Late Jurassic age of tectonic and magmatic events in that region. The dates will be utilized in local and regional tectonic studies by R. C. Speed and coworkers.

1. YU-Acme 30 K-Ar (biotite) 142 ± 3 m.y.

Dunlap Formation, metatuff ($38^{\circ}29'0''\text{N}$, $118^{\circ}20'10''\text{W}$; SW/4NE/4NE/4 sec. 7, T7N, R33E; Mable Mountain quad.; Mineral Co., Brown biotite occurs in probable air-fall tuff unit about 100 m above horizon yielding only dated fossil (Toarcian) from the Dunlap Formation (Ferguson and Muller, 1949; S. W. Muller, written communication to R. Speed, 1971). The tuff is slightly recrystallized although the biotite appears fresh. The date is probably a minimum value for the time of crystallization, and perhaps reflects the time of recrystallization and regional tectonism. Analytical data: $K = 5.30, 5.33\%$; $^{40}\text{Ar} = 31.3 \times 10^{-6} \text{ cc/gm}$ ($93\% \Sigma \text{Ar}^{40}$). Collected by: R. C. Speed, Northwestern U.; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

2. YU-379 - *309 Colorado* K-Ar (hornblende) 161 ± 3 m.y.
(biotite) 146 ± 3 m.y.

Humboldt lopolith, hornblende picrite ($40^{\circ}6'25''N$, $118^{\circ}20'30''W$; SW/4NW/4SW/4 sec. 24, T26N, R32E; West Humboldt Range, Lovelock quad.; Pershing Co., NV). Sample from ultramafic differentiate in layered sheet that is the earliest emplaced body of the lopolith along its western margin (Speed, 1963). The rock is similar to specimen 2 (fig. 1, table 1) of Speed (1963). The hornblende separate contains about 30% intergrown hornblende and pyroxene grains. Other published dates for the lopolith range from 150 to 165 m.y. (Speed and Armstrong, 1971). The lower date for biotite probably reflects protracted cooling and/or complexities of emplacement and later tectonism. Analytical data: (hornblende) $K = 0.398$, 0.388%; $*Ar^{40} = 2.66$, 2.60×10^{-6} cc/gm (61, 11% ΣAr^{40}); (biotite) $K = 6.13$, 6.12%; $*Ar^{40} = 36.5$, 37.6×10^{-6} cc/gm (87, 90% ΣAr^{40}). Collected by: R. C. Speed, Northwestern U.; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

3. YU-SW 312 K-Ar (plagioclase) 115 ± 3 m.y.

Olivine basalt ($39^{\circ}58'05''N$, $118^{\circ}9'10''W$; SE/4SE/4SE/4 sec. 4, T24N, R34E; Humboldt Salt Marsh quad.; Churchill Co., NV). Fresh basalt lava occurs in a section of deformed fragmental mafic volcanic rocks and volcanic sedimentary rocks that constitute the roof of the Humboldt lopolith. The dated plagioclase has lost argon, judging by the dates for intrusive phases of the lopolith. See YU-379 (sample 2). Analytical data: $K = 0.429$, 0.427%; $*Ar^{40} = 2.03 \times 10^{-6}$ cc/gm (37% ΣAr^{40}). Collected by: R. C. Speed, Northwestern U.; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

4. YU-Rock Hill Syenite K-Ar (biotite) 139 ± 2 m.y.

Dike cutting metavolcanic rocks near Rock Hill ($38^{\circ}7'50''N$, $117^{\circ}58'40''W$; SE/4NW/4NE/4 sec. 9, T3N, R36E; Rock Hill quad.; Esmeralda Co., NV). Olive-brown biotite occurs as a poikilitic phase in syenite dikes that invade a klippe of metavolcanic rocks (Rock Hill complex) originally assigned to the so-called Excelsior Formation (Ferguson and Muller, 1949; Speed, 1973). The dikes also intrude the lower plate rocks of the Palmetto Formation (Ordovician). The biotite date gives a minimum age of thrust emplacement of the klippe. See Rock Hill basalt (sample 5). Analytical data: $K = 5.27$, 5.32%; $*Ar^{40} = 30.4$, 30.7, 30.3×10^{-6} cc/gm (76, 44, 94% ΣAr^{40}). Collected by: R. C. Speed, Northwestern U.; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

5. YU-Rock Hill basalt K-Ar (whole rock) 73.6 ± 1.0 m.y.

Vesicular basalt(?) ($38^{\circ}9'15''N$, $117^{\circ}58'50''W$; NE/4SE/4NE/4 sec. 27, T4N, R36E; Rock Hill quad.; Esmeralda Co., NV). Biotite-bearing, somewhat recrystallized basalt lies with apparent depositional contact on Palmetto Formation (Ordovician) at this locality. The basalt was included in the so-called Excelsior Formation by Ferguson and Muller (1949). The date may be much younger than the stratigraphic age of the unit. Analytical data: $K = 5.61$, 5.53%; $*Ar^{40} = 16.3$, 16.5, 17.3×10^{-6} cc/gm (87, 82, 84% ΣAr^{40}). Collected by: R. C. Speed, Northwestern U.; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

NORTHEASTERN NEVADA -- NORTHWESTERN UTAH

Several volcanic rocks from the thesis area of A. R. Young were dated and three familiar events were recognized: basalt correlative with the Columbia episode (Watkins and Baksi, 1974), and rhyolites of early and late Idavada ages correlative with similar rocks in Idaho. In addition an anomalously old and very inaccurate result was obtained for a feldspar from another rhyolite unit. In that case the exceptionally large amount of atmospheric Ar obtained from a feldspar separate leads us to suspect Ar fractionation during pumpdown and bakeout (Baksi, 1974), a process that produces anomalously old dates. The dates are listed in order of increasing stratigraphic age.

6. YU-1A-AY (vitrophyre) K-Ar (feldspar) 8.6 ± 0.17 m.y.
 YU-1-AY (devitrified) (feldspar) 8.2 ± 0.16 m.y.

Rhyolite porphyry ($41^{\circ}28'32''N$, $113^{\circ}59'15''W$) (1A) and $13''(1)W$; NE corner, SW/4NE/4 sec. 26, T9N, R19W; Lucin NW quad.; Box Elder Co., UT). Sample 1 from 23 m above an 18 m-thick black vitrophyre (1A) that overlies bedded vitric tuff and massive tuff breccia. This unit is the same age as the rhyolite at Rhyolite Butte, northern Pilot Range (Armstrong, 1970a) and the rhyolite ash flows of the Goose Creek area and Cassia Mountains in Idaho (Armstrong and others, 1975). Analytical data: $K = 7.39$, 7.35%; $*Ar^{40} = 2.53 \times 10^{-6}$ cc/gm (74% ΣAr^{40}); $K = 7.50$, 7.50%; $*Ar^{40} = 2.46 \times 10^{-6}$ cc/gm (66% ΣAr^{40}). Collected by: A. R. Young, U. of Utah; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

7. YU-3-AY K-Ar (feldspar) 13.1 ± 0.3 m.y.

($41^{\circ}52'30''N$, $113^{\circ}54'57''W$; SE/4SW/4NW/4 sec. 4, T13N, R18W; just N of Hardesty Creek, Cotton Thomas Basin quad.; Box Elder Co., UT). Sample from 3 m above base of a 10 m-thick rhyolite that unconformably overlies bedded vitric tuff. Sampled unit lies stratigraphically above YU-2-AY. These units are interbedded with the upper Salt Lake Formation of Mapel and Hail (1956). Analytical data: $K = 6.86$, 6.78%; $*Ar^{40} = 3.58 \times 10^{-6}$ cc/gm (47% ΣAr^{40}). Collected by: A. Y. Young, U. of Utah; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

8. YU-2-AY K-Ar (feldspar) 19.9 ± 4.0 m.y.

($41^{\circ}52'40''N$, $113^{\circ}56'55''W$; sec. 6, T13N, R18W; about 1 km E of Simplot Grouse Creek Ranch, Cotton Thomas Basin quad.; Box Elder Co., UT). Sample from 5 m above a 12 m-thick vitrophyre that overlies vitric tuff with interbedded conglomerate and peat beds 30 to 50 m below the base of the vitrophyre. Age should be the same or only slightly older than sample YU-3-AY. The atmospheric argon yield was exceptionally large. Isotopic fractionation of this contaminating gas might easily explain the anomalously high date (Baksi, 1974). This date should be cited only with reservation because of its doubtful validity. Analytical data: $K = 3.48$, 3.50%; $*Ar^{40} = 2.80$, 2.76×10^{-6} cc/gm (5.4% ΣAr^{40}). Collected by: A. Y. Young, U. of Utah; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

9. YU-4-AY K-Ar (whole rock) 16.3 ± 2.0 m.y.

Basalt ($41^{\circ}38'43''N$, $114^{\circ}5'45''W$; NE/4SE/4NW/4 sec. 1, T43N, R69E; Dairy Valley quad.; Elko Co., NV). Flow about 15 m thick interbedded with conglomerate. Older than rhyolite YU-1-AY. The date suggests correlation with Columbia River Basalt, making this the easternmost known locality for basaltic lavas of that age. Analytical data: $K = 1.04$, 1.06%; $*Ar^{40} = 0.715$, 0.652×10^{-6} cc/gm (7.6% ΣAr^{40}). Collected by: A. R. Young, U. of Utah; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

MISCELLANEOUS VOLCANIC UNITS – ARIZONA, NEW MEXICO, UTAH AND WYOMING

The following samples were dated to assist geologic work in progress and are reported here to insure that complete documentation becomes part of the public record.

10. YU-NR-LH K-Ar (biotite) 26.8 ± 0.4 m.y.

Needles Range Formation, Wah Wah Springs Tuff Member ($38^{\circ}52'50''N$, $113^{\circ}17'30''W$; sec. 22, T22S, R13W; Millard Co., UT). Locality shows on USGS Misc. Field Inv. Map MF-633. Discussed by Best and others (1973). Analytical data: $K = 4.48$, 4.50%; $*Ar^{40} = 4.88$, 4.81×10^{-6} cc/gm (63, 61% ΣAr^{40}). Collected by: L. Hintze, Brigham Young U.; dated by: R. L. Armstrong and P. N. Taylor, Yale U.

11. YU-CP-LH K-Ar (biotite) 33.9 ± 0.5 m.y.
 (feldspar) 39.0 ± 1.0 m.y.

Tunnel Spring Tuff at Crystal Peak ($38^{\circ}47'30''N$, $113^{\circ}36'0''W$; sec. 24, T23S, R16W; Millard Co., UT). Locality shows on USGS Misc. Field Inv. Map MF-635. Discussed by Bushman (1973). Analytical data: (biotite) $K = 5.96$, 5.97%; $*Ar^{40} = 8.17$, 8.09×10^{-6} cc/gm (62, 59% ΣAr^{40}); (feldspar) $K = 0.491$,