

A summary of radiometric ages of Tertiary volcanic rocks in Nevada and eastern California. Part III: Southeastern NM

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A SUMMARY OF RADIOMETRIC AGES OF TERTIARY VOLCANIC ROCKS IN NEVADA AND EASTERN CALIFORNIA. PART III: SOUTHEASTERN NEVADA*

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K-Ar dating of volcanic samples from 182 separate sampling localities in southeastern Nevada (fig. 1) has resulted in a total of 250 age determinations. Of these, 165 were published (12 publications) during the period 1968-72; 85 are unpublished. Sample information, listed by locality number (keyed to map, fig. 1), includes age, type of rock, and locality, and, for new ages, the analytical data used in their calculation.

For each K-Ar age, the argon was determined by standard isotope dilution procedures, the potassium by flame photometry or atomic absorption. (For details of analytical procedure, refer to literature sources given with sample descriptions.) The 85 age determinations not previously published were made in the laboratories of the U. S. Geological Survey in Denver, Colo., and Menlo Park, Calif.; University of California, Berkeley; Geochron Laboratories, Inc., Cambridge, Mass., and Isotopes, Inc., Westwood, N. J. Within the U. S. Geological Survey laboratories, potassium was determined by flame photometry using a lithium internal standard by Violet Merritt and Wayne Mountjoy (Denver) and by Lois Schlocker (Menlo Park). Constants used in the calculation of the K-Ar ages are: $\lambda_e = 0.585 \times 10^{-10}/\text{yr}$, $\lambda_p = 4.72 \times 10^{-10}/\text{yr}$, $K^{40}/K_{\text{total}} = 1.22 \times 10^{-4}$ gm/gm. (Abbreviations used: $^*Ar^{40}$ = radiogenic argon⁴⁰; $^{\infty}Ar^{40}$ = total argon⁴⁰.) (We gratefully acknowledge the mineral separation work of G. T. Cebula and J. W. Groen, both of Denver.)

REGIONAL LIMITS

The region included in this summary lies entirely within the State of Nevada, from longitudes 114° to 117°, and from latitudes 35° to 39°, an area of approximately 34,000 square miles that includes Lincoln and Clark Counties, most of Nye County, and a small part of White Pine County. (Two samples, Nos. 3 and 4, were collected just outside the above geographic limits.)

ROCKS DATED

Almost all rocks discussed in this report are volcanic; a few are from feeder(?) dikes or sills. The rocks vary in composition from rhyolite to basalt. Most of the age determinations were made on biotite or sanidine; a few were on plagioclase, pyroxene, glass, or whole-rock.

In general, silicic rocks (rhyolite to rhyodacite) are more abundant within this area than basic rocks (andesite to basalt).

GEOLOGIC AND CHRONOLOGIC SKETCH

Volcanic activity began about 37 m.y. ago with the first in a series of silicic extrusions (mostly extensive ash-flow sheets) that were erupted at various places in the region during the following 15 to 20 million years (fig. 2).

*Publication authorized by the Director, U. S. Geological Survey.

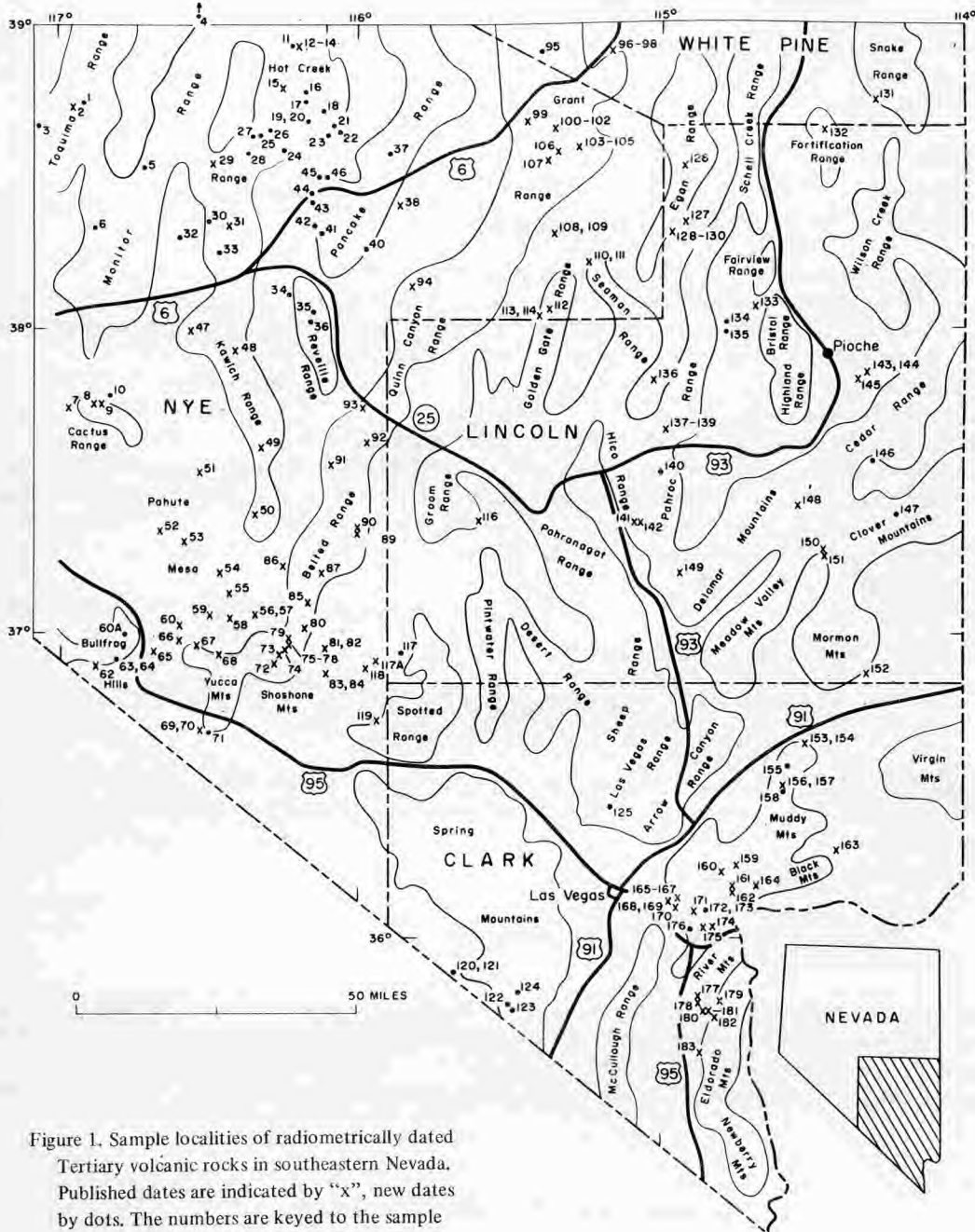


Figure 1. Sample localities of radiometrically dated Tertiary volcanic rocks in southeastern Nevada. Published dates are indicated by "x", new dates by dots. The numbers are keyed to the sample descriptions.

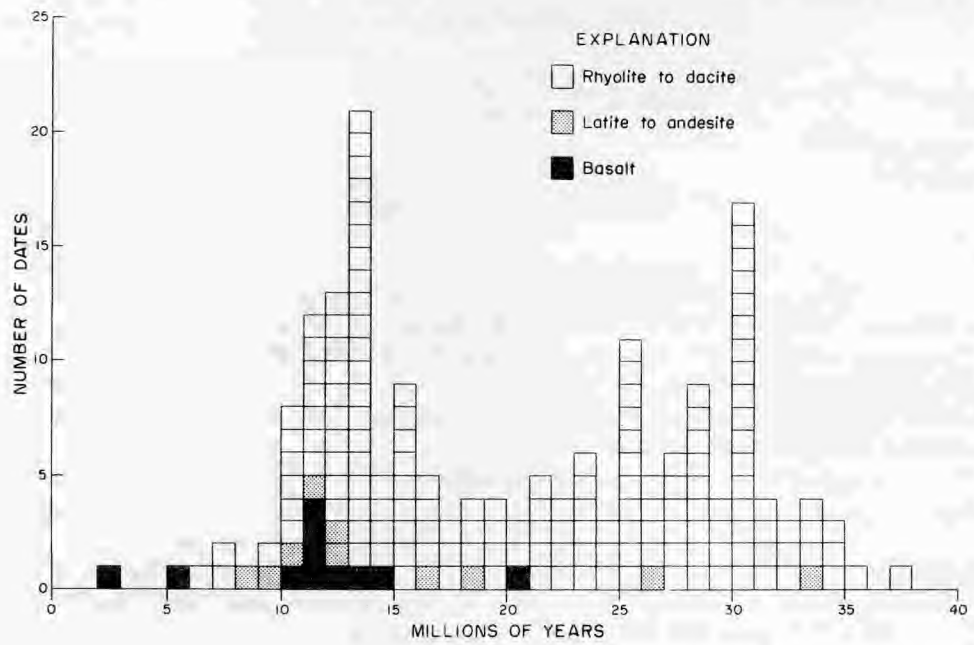


Figure 2. Histogram of radiometric ages of volcanic rocks in southeastern Nevada.

Eruption of these ash flows usually led to surface collapse and formation of a caldera, many of which have been located and described—the Timber Mountain caldera (Byers and others, 1968; Ekren and others, 1971), the Kane Springs Wash caldera (Noble, 1968), the Silent Canyon caldera (Noble and others, 1968; Ekren and others, 1971), the Black Mountain caldera (Christiansen and Noble, 1965; Ekren and others, 1971), Mount Helen caldera (Ekren and others, 1971), and Cathedral Ridge caldera (Ekren and others, 1971). Several unnamed calderas have been recognized in the northern part of this region. Only the far southeast corner of this region seems to have been comparatively quiescent during the time between 37 and 18 m.y. ago.

Igneous activity from about 15 to 2 m.y. ago was characterized by eruption of lava and ash flows and by emplacement of shallow intrusive bodies, many of which were feeders for the extrusive rocks. These rocks are more basic than the earlier volcanic rocks and are mainly quartz-latitude, dacite, and andesite with some basalt. During this time, volcanic activity greatly increased in the southeast corner of this region.

SAMPLE DESCRIPTIONS

Toquima Range

Number shown on Figure 1.

1. P. P. Orkild (written communication) K-Ar (biotite) 15.0±0.8 m.y.
(sanidine) 21.6±1.2 m.y.

Tuff of Mt. Jefferson. Welded tuff (38°45'N, 116°55'W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.23%, $\bar{A}r^{40}$ (avg.) = 1.826×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 43% and 59%; (sanidine) K₂O = 10.66%, $\bar{A}r^{40}$ (avg.) = 3.453×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 61% and 76%. Collected by: F. N. Houser, U. S. Geological Survey; dated by: Geochron Laboratories, Inc. Comment: These ages appear to be too young in comparison to other radiometric ages on the same tuff.

2. Marvin (1968) K-Ar (biotite) 26.1±0.8 m.y.
(sanidine) 24.7±0.7 m.y.

Tuff of Mt. Jefferson. Welded ash flow (38°44'N, 116°57'W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.52%, $\bar{A}r^{40}$ = 3.304×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 75%; (sanidine) K₂O = 4.56%, $\bar{A}r^{40}$ = 1.673×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 85%. Collected by: F. J. Kleinhampl, U. S. Geological Survey; dated by: (biotite) R. F. Marvin and H. H. Mehnert, (sanidine) R. W. Kistler, U. S. Geological Survey.

3. D. R. Shawe (oral communication) K-Ar (sanidine) 34.3±0.9 m.y.

Rhyolite dike (38°40'00"N, 117°04'20"W; Nye Co., NV). Analytical data: K₂O = 12.56%, $\bar{A}r^{40}$ = 6.419×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 97%. Collected by: D. R. Shawe, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

Monitor Range

4. P. P. Orkild (written communication) K-Ar (biotite) 35.2±1.1 m.y.
(sanidine) 32.5±1.0 m.y.

Tuff of Summit Mountain, top unit. Welded tuff (39°19'20"N, 116°32'20"W; Eureka Co., NV). Analytical data: (biotite) K₂O = 8.23%, $\bar{A}r^{40}$ (avg.) = 4.353×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 64% and 67%; (sanidine) K₂O = 11.97%, $\bar{A}r^{40}$ (avg.) = 5.805×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40}$ = 89% and 95%. Collected by: C. L. Rogers, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

5. P. P. Orkild (written communication) K-Ar (nonhydrated glass) 24.8±1.5 m.y.

Rhyolite of McCann Canyon. Basal vitrophyre (38°32'20"N, 116°43'W; Nye Co., NV). Analytical data: K₂O = 4.79%, $\bar{A}r^{40} = 1.776 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 84\%$. Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

6. P. P. Orkild (written communication) K-Ar (biotite) 20.5±1.0 m.y.
(sanidine) 20.6±1.0 m.y.

Tuff of Kawich Range. Welded tuff (38°20'N, 116°52'35"W; Nye Co., NV). Analytical data: (biotite) K₂O = 7.72%, $\bar{A}r^{40}$ (avg.) = 2.372×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 40\%$ and 49%; (sanidine) K₂O = 10.52%, $\bar{A}r^{40}$ (avg.) = 3.253×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 88\%$ and 44%. Collected by: K. A. Sargent, U. S. Geological Survey; dated by: Geochron Laboratories, Inc. Comment: Tuff probably correlates with tuff of White Blotch Spring of Nellis Air Force Base Bombing and Gunnery Range.

Cactus Range

7. Marvin and others (1970) K-Ar (sanidine) 15.7±0.5 m.y.
No. 10, Tables 1, 2, and 8 (sanidine) 16.4±0.5 m.y.
Ekren and others (1971), No. 17, Table 5

Fraction Tuff, lowest unit. Welded tuff (37°45'N, 116°58'W; Nye Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: J. D. Obradovich, U. S. Geological Survey.

8. Marvin and others (1970) K-Ar (K-feldspar) 27.7±1.2 m.y.
No. 15, Tables 1, 2, and 8 (biotite) 26.2±1.2 m.y.
Ekren and others (1971), No. 26, Table 5

Tuff of Antelope Spring, upper unit. Welded tuff (37°46'12"N, 116°53'W; Nye Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

9. Marvin and others (1970) K-Ar (sanidine) 22.9±0.7 m.y.
No. 12, Tables 1, 2, and 8 (sanidine) 21.8±0.7 m.y.
Ekren and others (1971), No. 23, Table 5

Tuff of White Blotch Spring (?), highest unit. Devitrified welded tuff (37°44'46"N, 116°51'47"W; Nye Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: J. D. Obradovich, U. S. Geological Survey. Comment: Latitude, longitude location stated in Table 1 (Marvin and others, 1970) is not correct.

10. P. P. Orkild (written communication) K-Ar (sanidine) 21.4±0.8 m.y.

Tuff of White Blotch Spring. Welded tuff (37°47'15"N, 116°49'50"W; Nye Co., NV). Analytical data: K₂O = 10.49%, $\bar{A}r^{40}$ (avg.) = 3.378×10^{-10} mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 68\%$ and 66%. Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

Hot Creek Range

11. P. P. Orkild (written communication) K-Ar (biotite) 28.6±1.1 m.y.
(sanidine) 27.3±1.0 m.y.

Tuffs of Crested Wheat Ridge, middle unit of five units. Rhyolitic welded tuff (38°56'05"N, 116°12'46"W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.30%, $\bar{A}r^{40}$ (avg.) = 3.553×10^{-10} mole/gm; $\bar{A}r^{40}/\Sigma Ar^{40} = 49\%$ and 52%; (sanidine) K₂O = 11.42%, $\bar{A}r^{40}$ (avg.) = 4.679×10^{-10} mole/gm; $\bar{A}r^{40}/\Sigma Ar^{40} = 82\%$ and 72%. Collected by: W. D. Quinlivan, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

12. Sargent and McKee (1969) K-Ar (sanidine) 25.1 ± 1.0 m.y.
No. 5, Table 6
Bates Mountain Tuff, unit 1. Rhyolite tuff ($38^{\circ}56'N$, $116^{\circ}12'W$; Nye Co., NV). Collected by: W. D. Quinlivan, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey.
13. Sargent and McKee (1969) K-Ar (sanidine) 24.5 ± 1.0 m.y.
No. 4, Table 6
Bates Mountain Tuff, unit 2. Rhyolite tuff ($38^{\circ}56'N$, $116^{\circ}12'W$; Nye Co., NV). Collected by: W. D. Quinlivan, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey.
14. Sargent and McKee (1969) K-Ar (sanidine) 22.8 ± 0.9 m.y.
No. 2, Table 6
Bates Mountain Tuff, unit 4. Rhyolitic tuff ($38^{\circ}56'N$, $116^{\circ}12'W$; Nye Co., NV). Collected by: W. D. Quinlivan, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey.
15. Grommé and others (1972) K-Ar (sanidine) 30.9 ± 0.8 m.y.
No. W1, Table 5
Windous Butte Formation, lower member. Rhyolite welded tuff ($38^{\circ}47'24''N$, $116^{\circ}14'24''W$; Nye Co., NV). Collected by: C. S. Grommé, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey.
16. P. P. Orkild (written communication) K-Ar (biotite) 32.8 ± 1.3 m.y.
(sanidine) 30.7 ± 0.9 m.y.
Windous Butte(?) Formation. Basal vitrophyre ($38^{\circ}46'52''N$, $116^{\circ}11'00''W$; Nye Co., NV). Analytical data: (biotite) $K_2O = 8.44\%$, $^{*}Ar^{40}$ (avg.) = 4.118×10^{-10} mole/gm, $^{*}Ar^{40}/^{*}Ar^{40} = 72\%$ and 68% ; (sanidine) $K_2O = 11.72\%$, $^{*}Ar^{40}$ (avg.) = 5.384×10^{-10} mole/gm, $^{*}Ar^{40}/\Sigma Ar^{40} = 88\%$ and 48% . Collected by: D. Hedlund, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
17. P. P. Orkild (written communication) K-Ar (biotite) 37.2 ± 1.3 m.y.
Rhyolite lava flow ($38^{\circ}45'10''N$, $116^{\circ}10'45''W$; Nye Co., NV). Analytical data: $K_2O = 8.26\%$, $^{*}Ar^{40}$ (avg.) = 4.604×10^{-10} mole/gm, $^{*}Ar^{40}/\Sigma Ar^{40} = 61\%$ and 62% . Collected by: G. L. Dixon, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
18. P. P. Orkild (written communication) K-Ar (biotite) 31.4 ± 0.9 m.y.
Tuff of Williams Ridge and Morey Peak. Rhyolitic welded tuff ($38^{\circ}43'12''N$, $116^{\circ}07'15''W$; Nye Co., NV). Analytical data: $K_2O = 8.94\%$, $^{*}Ar^{40}$ (avg.) = 4.169×10^{-10} mole/gm, $^{*}Ar^{40}/\Sigma Ar^{40} = 80\%$ and 52% . Collected by: E. N. Hinrichs, U. S. Geological Survey; dated by: Isotopes, Inc.
19. P. P. Orkild (written communication) K-Ar (biotite) 25.9 ± 1.8 m.y.
Tuff of Orange Lichen Creek. Vitrophyre ($38^{\circ}41'06''N$, $116^{\circ}10'00''W$; Nye Co., NV). Analytical data: $K_2O = 8.35\%$, $^{*}Ar^{40} = 3.228 \times 10^{-10}$ mole/gm, $^{*}Ar^{40}/\Sigma Ar^{40} = 38\%$. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

20. P. P. Orkild (written communication) K-Ar (biotite) 30.7±1.1 m.y.
(sanidine) 30.0±0.9 m.y.
- Tuff of Moofes Station Buttes. Vitrophyre (38°41'24"N, 116°10'18"W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.40%, Ar^{40} (avg.) = 3.858×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 62% and 36%; (sanidine) K₂O = 1.96%, Ar^{40} (avg.) = 5.354×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 76% and 58%. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
21. P. P. Orkild (written communication) K-Ar (biotite) 30.0±0.9 m.y.
(sanidine) 29.7±0.9 m.y.
- Tuff of Hot Creek Canyon. Vitrophyre (38°40'00"N, 116°05'30"W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.41%, Ar^{40} (avg.) = 3.776×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 63% and 61%; (sanidine) K₂O = 11.67%, Ar^{40} (avg.) = 5.179×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 80% and 82%. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
22. P. P. Orkild (written communication) K-Ar (whole rock) 10.2±0.9 m.y.
- Basalt (38°39'16"N, 116°04'20"W; Nye Co., NV). Analytical data: K₂O = 1.62%, Ar^{40} (avg.) = 0.2452×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 21% and 23%. Collected by: W. D. Quinlivan, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
23. P. P. Orkild (written communication) K-Ar (biotite) 30.6±0.9 m.y.
(sanidine) 30.0±0.9 m.y.
- Tuff of the Needles. Welded tuff (38°38'36"N, 116°06'00"W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.52%, Ar^{40} (avg.) = 3.891×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 57% and 55%; (sanidine) K₂O = 11.47%, Ar^{40} (avg.) = 5.104×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 90% and 82%. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
24. P. P. Orkild (written communication) K-Ar (biotite) 30.5±1.1 m.y.
- Tuff of Williams Ridge and Morey Peak. Tuff (38°35'25"N, 116°15'05"W; Nye Co., NV). Analytical data: K₂O = 8.08%, Ar^{40} (avg.) = 3.678×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 16% and 75%. Collected by: W. J. Carr, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
25. P. P. Orkild (written communication) K-Ar (biotite) 23.1±1.6 m.y.
- Tuff of Hot Creek Canyon. Basal vitrophyre of welded ash-flow tuff (38°38'N, 116°20'W; Nye Co., NV). Analytical data: K₂O = 8.37%, Ar^{40} (avg.) = 2.915×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 55% and 60%. Collected by: F. M. Byers, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
26. P. P. Orkild (written communication) K-Ar (biotite) 30.8±1.0 m.y.*
(biotite) 29.6±1.0 m.y.**
(sanidine) 29.0±1.1 m.y.*
(sanidine) 27.5±0.7 m.y.**
- Tuff of Hot Creek Canyon. Basal vitrophyre (38°39'N, 116°18'W; Nye Co., NV). Analytical data: (biotite*) K₂O = 7.46%, Ar^{40} = 3.718×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 86%; (biotite**) K₂O = 8.70%, Ar^{40} = 4.002×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 62%; (sanidine*) K₂O = 11.30%, Ar^{40} = 4.618×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 96%; (sanidine**) K₂O = 11.30%, Ar^{40} (avg.) = 4.906×10^{-10} mole/gm; $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 77% and 63%. Collected by: W. J. Carr, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey; and Geochron Laboratories, Inc. Comment: Biotite* and sanidine* analyzed by U. S. Geological Survey; biotite** and sanidine** analyzed by Geochron Laboratories, Inc.

27. P. P. Orkild (written communication) K-Ar (biotite) 28.0±1.8 m.y.
(sanidine) 14.3±0.7 m.y.
- Tuff of Hot Creek Canyon, bottom unit. Welded ash-flow tuff vitrophyre (38°38'N, 116°21'W; Nye Co., NV). Analytical data: (biotite) K₂O = 8.18%, Ar^{40} (avg.) = 3.428×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 68% and 79%; (sanidine) K₂O = 10.43%, Ar^{40} (avg.) = 2.227×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 51% and 59%. Collected by: F. M. Byers, U. S. Geological Survey; dated by: Geochron Laboratories, Inc. Comment: Sanidine age is incorrect in comparison with other radiometric ages of the same unit.
28. F. J. Kleinhampl (oral communication) K-Ar (biotite) 28.5±2.0 m.y.
- Tuff of Hot Creek Canyon. Basal vitrophyre of welded tuff (38°35'15"N, 116°22'12"W; Nye Co., NV). Analytical data: K₂O = 8.22%, Ar^{40} (avg.) = 3.503×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 66% and 78%. Collected by: F. J. Kleinhampl, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
29. Cook (1968) K-Ar (biotite) 27 m.y.
- Box Canyon Formation, upper ignimbrite unit. Dacite (approx. 38°33'N, 116°29'W; Nye Co., NV). Collected by: H. E. Cook; dated by: G. H. Curtis, and R. Fleck, Univ. of Calif. at Berkeley.
30. P. P. Orkild (written communication) K-Ar (biotite) 25.1±1.0 m.y.
(sanidine) 24.1±0.9 m.y.
- Tuff of Orange Lichen Creek. Rhyolitic welded tuff (38°22'05"N, 116°30'05"W; Nye Co., NV). Analytical data: (biotite) K₂O = 7.87%, Ar^{40} (avg.) = 2.952×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 48% and 45%; (sanidine) K₂O = 12.13%, Ar^{40} (avg.) = 4.353×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 71% and 85%. Collected by: W. D. Quinlivan, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
31. Cook (1968) K-Ar (biotite) 28.5 m.y.
- Rawhide Formation, lower ignimbrite member. Basal vitrophyre (approx. 38°21'N, 116°26'W; Nye Co., NV). Collected by: H. E. Cook; dated by: G. H. Curtis and R. Fleck, Univ. of Calif. at Berkeley.
32. P. P. Orkild (written communication) K-Ar (biotite) 20.4±1.2 m.y.
(sanidine) 22.5±0.9 m.y.
- Tuff of Orange Lichen Creek. Welded tuff (38°18'30"N, 116°36'W; Nye Co., NV). Analytical data: (biotite) K₂O = 7.24%, Ar^{40} (avg.) = 2.502×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 69% and 70%; (sanidine) K₂O = 11.79%, Ar^{40} (avg.) = 3.978×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 92% and 87%. Collected by: D. L. Hoover, U. S. Geological Survey; dated by: Geochron Laboratories, Inc. Comment: These ages appear to be young in comparison to other radiometric ages on the same tuff. Analyzed mineral concentrates are from a drill core.
33. P. P. Orkild (written communication) K-Ar (biotite) 28.5±1.3 m.y.*
(biotite) 26.4±1.0 m.y.**
(sanidine) 28.4±0.8 m.y.**
- Monotony Tuff. Rhyolitic welded tuff (38°15'30"N, 116°28'W; M & M Mine area; Nye Co., NV). Analytical data: (biotite*) K₂O = 8.61%, Ar^{40} (avg.) = 3.678×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 36% and 72%; (biotite**) K₂O = 8.83%, Ar^{40} = 3.460×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 89%; (sanidine**) K₂O = 12.10%, Ar^{40} = 5.102×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40}$ = 94%. Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.; and R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comment: Biotite* analyzed by Geochron Laboratories, Inc.; biotite** and sanidine** analyzed by U. S. Geological Survey.

Reveille Range

34. P. P. Orkild (written communication) K-Ar (whole rock) 5.7 ± 0.2 m.y.
 Basalt of Reveille Range. Basalt ($38^{\circ}07'N$, $116^{\circ}14'W$; Nye Co., NV). Analytical data: $K_2O = 1.465\%$, $^{40}Ar = 0.1236 \times 10^{-10}$ mole/gm, $^{40}Ar/^{39}Ar = 51\%$. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
35. P. P. Orkild (written communication) K-Ar (sanidine) 18.7 ± 0.8 m.y.
 Quartz latite intrusive ($38^{\circ}04'20''N$, $116^{\circ}09'30''W$; Nye Co., NV). Analytical data: $K_2O = 12.12\%$, ^{40}Ar (avg.) = 3.378×10^{-10} mole/gr, $^{40}Ar/\Sigma Ar^{40} = 69\%$ and 72% . Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
36. P. P. Orkild (written communication) K-Ar (biotite) 25.3 ± 1.1 m.y.
 (sanidine) 24.9 ± 0.6 m.y.
 Monotony Tuff (intracauldron). Tuff ($38^{\circ}02'10''N$, $116^{\circ}10'00''W$; Nye Co., NV). Analytical data: (biotite) $K_2O = 8.28\%$, $^{40}Ar = 3.114 \times 10^{-10}$ mole/gm, $^{40}Ar/\Sigma Ar^{40} = 85\%$; (sanidine) $K_2O = 11.72\%$, $^{40}Ar = 4.331 \times 10^{-10}$ mole/gm, $^{40}Ar/\Sigma Ar^{40} = 96\%$. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

Pancake Range

37. P. P. Orkild (written communication) K-Ar (nonhydrated glass) 25.8 ± 1.3 m.y.
 Rhyolite of Big Sand Springs Valley. Vitrophyre ($38^{\circ}35'N$, $115^{\circ}54'W$; Nye Co., NV). Analytical data: $K_2O = 4.83\%$, ^{40}Ar (avg.) = 1.876×10^{-10} mole/gm, $^{40}Ar/\Sigma Ar^{40} = 85\%$ and 84% . Collected by: P. P. Orkild, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
38. Ekren and others (1971) K-Ar (biotite) 25.4 ± 0.6 m.y.
 No. 25, Table 5 (sanidine) 23.8 ± 0.6 m.y.
 Marvin (1968)
 Shingle Pass Tuff. Rhyodacite welded ash-flow (approx. $38^{\circ}25'N$, $115^{\circ}52'W$; Nye Co., NV). Analytical data: (biotite) $K_2O = 8.58\%$, $^{40}Ar = 2.24 \times 10^{-10}$ mole/gm, $^{40}Ar/\Sigma Ar^{40} = 77\%$; (sanidine) $K_2O = 5.42\%$, $^{40}Ar = 1.92 \times 10^{-10}$ mole/gm, $^{40}Ar/\Sigma Ar^{40} = 85\%$. Collected by: F. J. Kleinhampl, U. S. Geological Survey; dated by: (biotite) R. F. Marvin and H. H. Mehnert, (sanidine) R. W. Kistler, U. S. Geological Survey. Comment: Longitude listed by Marvin (1968) is incorrect for this sample.
40. P. P. Orkild (written communication) K-Ar (biotite) 23.6 ± 1.0 m.y.
 (sanidine) 22.1 ± 0.8 m.y.
 Granite-weathering tuff. Rhyolitic welded tuff ($38^{\circ}16'23''N$, $115^{\circ}58'55''W$; Nye Co., NV). Analytical data: (biotite) $K_2O = 7.61\%$, ^{40}Ar (avg.) = 2.677×10^{-10} mole/gm, $^{40}Ar/\Sigma Ar^{40} = 55\%$, 48% , and 19% ; (sanidine) $K_2O = 10.75\%$, ^{40}Ar (avg.) = 3.553×10^{-10} mole/gm, $^{40}Ar/\Sigma Ar^{40} = 20\%$ and 21% . Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.
41. P. P. Orkild (written communication) K-Ar (biotite) 25.4 ± 1.3 m.y.
 Tuff of Buckskin Point. Tuff ($38^{\circ}20'N$, $116^{\circ}08'W$; Nye Co., NV). Analytical data: $K_2O = 8.46\%$, ^{40}Ar (avg.) = 3.203×10^{-10} mole/gm, $^{40}Ar/\Sigma Ar^{40} = 72\%$ and 74% . Collected by: G. L. Dixon, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

42. P. P. Orkild (written communication) K-Ar
 (biotite) 27.4 ± 0.9 m.y.*
 (biotite) 25.5 ± 1.0 m.y.**
 (sanidine) 21.8 ± 0.7 m.y.*
 (sanidine) 22.5 ± 0.6 m.y.**

Shingle Pass Tuff. Vitrophyre ($38^{\circ}21'N$, $116^{\circ}09'W$; Nye Co., NV). Analytical data: (biotite*) $K_2O = 7.54\%$, \bar{Ar}^{40} (avg.) = 3.097×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 63\%$ and 70% ; (biotite**) $K_2O = 7.83\%$, $\bar{Ar}^{40} = 2.973 \times 10^{-10}$ mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 87\%$; (sanidine*) $K_2O = 11.36\%$, \bar{Ar}^{40} (avg.) = 3.713×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 86\%$ and 90% ; (sanidine**) $K_2O = 11.72\%$, $\bar{Ar}^{40} = 3.916 \times 10^{-10}$ mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 97\%$. Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.; and R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comments: Biotite* and sanidine* analyzed by Geochron Laboratories, Inc.; biotite** and sanidine** analyzed by U. S. Geological Survey.

43. P. P. Orkild (written communication) K-Ar
 (biotite) 29.9 ± 1.2 m.y.*
 (biotite) 29.8 ± 1.0 m.y.**
 (sanidine) 27.0 ± 1.1 m.y.*
 (sanidine) 29.7 ± 0.7 m.y.**

Tuff of Palisade Mesa. Basal vitrophyre ($38^{\circ}26'24''N$, $116^{\circ}09'30''W$; Nye Co., NV). Analytical data: (biotite*) $K_2O = 8.44\%$, \bar{Ar}^{40} (avg.) = 3.756×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 74\%$ and 72% ; (biotite**) $K_2O = 8.22\%$, $\bar{Ar}^{40} = 3.649 \times 10^{-10}$ mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 87\%$; (sanidine*) $K_2O = 11.63\%$, \bar{Ar}^{40} (avg.) = 4.694×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 90\%$ and 92% ; (sanidine**) $K_2O = 11.48\%$, $\bar{Ar}^{40} = 5.066 \times 10^{-10}$ mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 96\%$. Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.; and R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comment: Biotite* and sanidine* analyzed by Geochron Laboratories, Inc.; biotite** and sanidine** analyzed by U. S. Geological Survey.

44. P. P. Orkild (written communication) K-Ar (biotite) 27.0 ± 0.8 m.y.

Monotony Tuff. Basal vitrophyre ($38^{\circ}27'00''N$, $116^{\circ}09'36''W$; Nye Co., NV). Analytical data: $K_2O = 8.85\%$, \bar{Ar}^{40} (avg.) = 3.550×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 87\%$ and 89% . Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Isotopes, Inc.

45. P. P. Orkild (written communication) K-Ar
 (biotite) 31.6 ± 0.9 m.y.
 (sanidine) 31.8 ± 1.4 m.y.

Tuff of Williams Ridge and Morey Peak. Welded ash-flow tuff ($38^{\circ}31'N$, $116^{\circ}08'W$; Nye Co., NV). Analytical data: (biotite) $K_2O = 8.30\%$, \bar{Ar}^{40} (avg.) = 3.918×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 77\%$ and 71% ; (sanidine) $K_2O = 12.29\%$, \bar{Ar}^{40} (avg.) = 5.855×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 68\%$ and 67% . Collected by: W. J. Carr, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

46. P. P. Orkild (written communication) K-Ar
 (biotite) 30.3 ± 0.9 m.y.
 (sanidine) 28.5 ± 0.9 m.y.

Tuff of Halligan Mesa. Welded tuff ($38^{\circ}31'24''N$, $116^{\circ}07'00''W$; Nye Co., NV). Analytical data: (biotite) $K_2O = 7.96\%$, \bar{Ar}^{40} (avg.) = 3.610×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 72\%$ and 70% ; (sanidine) $K_2O = 11.69\%$, \bar{Ar}^{40} (avg.) = 4.971×10^{-10} mole/gm, $\bar{Ar}^{40}/\Sigma Ar^{40} = 76\%$ and 90% . Collected by: E. B. Ekren, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

Kawich Range

47. Marvin and others (1970) K-Ar (biotite) 23.8 ± 1.1 m.y.
 No. 13, Tables 1, 2, and 8 (sanidine) 23.4 ± 0.7 m.y.
 Ekren and others (1971), No. 21, Table 5

Tuff of White Blotch Spring (?), highest unit. Welded tuff vitrophyre (38°00'N, 116°34'W; Nye Co., NV). Collected by: E. B. Ekren, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comment: Tuff is correlative with tuff of Kawich Range (Rogers and others, 1967).

48. Kistler (1968) K-Ar (biotite) 21.1±0.6 m.y.
 No. 26, Table 1 (sanidine) 21.9±0.4 m.y.
 Ekren and others (1971), No. 22, Table 5

Tuff of White Blotch Spring. Tuff (37°56'N, 116°25'W; Nye Co., NV). Collected by: H. R. Cornwall, U. S. Geological Survey; dated by: R. W. Kistler, U. S. Geological Survey. Comment: Tuff is correlative with tuff of Kawich Range (Rogers and others, 1967).

49. Kistler (1968) K-Ar (biotite) 17.8±0.5 m.y.
 No. 25, Table 1
 Ekren and others (1971), No. 16, Table 5

Tuff of Trailer Pass. Tuff (37°37'N, 116°19'30"W; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: Tuff is equivalent to Fraction Tuff (Marvin and others, 1970, Table 8).

50. Noble and others (1968) K-Ar (nonhydrated glass) 13.1±0.5 m.y.
 Marvin and others (1970), No. 5, Tables 1, 2, and 8
 Ekren and others (1971), No. 12, Table 5

Rhyolite of Saucer Mesa. Peralkaline rhyolite lava vitrophyre from lower part of older flow (37°24'N, 116°21'W; Nye Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: H. H. Mehnert, U. S. Geological Survey.

Pahute Mesa Area

51. Marvin and others (1970) K-Ar (biotite) 18.7±0.7 m.y.
 No. 11, Tables 1, 2, and 8 (biotite) 17.2±0.7 m.y.
 Ekren and others (1971), No. 18, Table 5

Rhyodacite lava vitrophyre (37°32'30"N, 116°32'00"W, Nye Co., NV). Collected by: R. E. Anderson and E. B. Ekren, U. S. Geological Survey; dated by: J. D. Obradovich, U. S. Geological Survey.

52. Marvin and others (1970) K-Ar (nonhydrated glass) 7.8±0.6 m.y.
 No. 1, Tables 1, 2, and 8 (nonhydrated glass) 9.5±0.7 m.y.
 Marvin and others (1970a) No. 2, Table 1

Thirsty Canyon Tuff, Gold Flat Member (lowermost part). Welded tuff vitrophyre (37°20'18"N, 116°39'42"W; Nye Co., NV). Collected by: D. C. Noble, U. S. Geological Survey; dated by: J. D. Obradovich, R. F. Marvin, and H. H. Mehnert, U. S. Geological Survey. Comment: The 9.5-m.y. age appears incorrect in comparison with ages of adjacent units in the stratigraphic sequence.

53. Kistler (1968) K-Ar (sanidine) 6.2±0.2 m.y.
 No. 1, Table 1
 Ekren and others (1971), No. 1, Table 5

Thirsty Canyon Tuff, Labyrinth Canyon Member. Tuff (37°18'N, 116°35'W; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

54. Kistler (1968) K-Ar (biotite) 11.4 ± 0.5 m.y.
 No. 7, Table 1
 Ekren and others (1971), No. 6, Table 5

Timber Mountain Tuff, Ammonia Tanks Member. Tuff ($37^{\circ}12'N$, $116^{\circ}28'30''W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

55. Kistler (1968) K-Ar (sanidine) 7.5 ± 0.2 m.y.
 No. 2, Table 1
 Ekren and others (1971), No. 2, Table 5

Thirsty Canyon Tuff, Spearhead Member. Tuff ($37^{\circ}08'N$, $116^{\circ}26'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: The latitude listed by Ekren and others (1971) is incorrect for this sample.

56. Kistler (1968) K-Ar (biotite) 10.8 ± 0.5 m.y.
 No. 11, Table 1 (biotite) 10.9 ± 0.5 m.y.
 (sanidine) 10.6 ± 0.3 m.y.
 (sanidine) 10.9 ± 0.4 m.y.

Timber Mountain Tuff, tuff of Cat Canyon (ring fracture tuff). Tuff ($37^{\circ}04'N$, $116^{\circ}21'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

57. Kistler (1968) K-Ar (biotite) 9.4 ± 2.0 m.y.
 No. 3, Table 1 (sanidine) 9.6 ± 0.3 m.y.

Tuff of caldera fill ($37^{\circ}04'N$, $116^{\circ}21'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: Tuff now known to correlate with tuff of Cut-off Road (Marvin and others, 1970, Table 8).

58. Kistler (1968) K-Ar (biotite) 11.7 ± 0.4 m.y.
 No. 13, Table 1 (sanidine) 11.1 ± 0.3 m.y.
 (sanidine) 11.4 ± 0.3 m.y.

Timber Mountain Tuff, tuff of Cat Canyon, lower part of lower cooling unit. Tuff ($37^{\circ}03'N$, $116^{\circ}26'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

59. Kistler (1968) K-Ar (sanidine) 11.1 ± 0.3 m.y.
 No. 12, Table 1

Timber Mountain Tuff, tuff of Cat Canyon, upper part of lower cooling unit. Tuff ($37^{\circ}04'N$, $116^{\circ}30'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

60. Kistler (1968) K-Ar (biotite) 11.2 ± 0.5 m.y.
 No. 6, Table 1
 Ekren and others (1971), No. 5, Table 5

Timber Mountain Tuff, Ammonia Tanks Member. Tuff ($37^{\circ}02'N$, $116^{\circ}35'30''W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

Bullfrog Hills

- 60a. H. R. Cornwall (oral communication) K-Ar (biotite) 12.5 ± 0.4 m.y.
 Quartz latite ash ¹ (37°00'N, 116°48'W; Nye Co., NV). Analytical data: K₂O = 7.66%, $\text{Ar}^{40} = 1.71 \times 10^{-10}$ mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 62\%$. Collected by: H. R. Cornwall, U. S. Geological Survey; dated by: R. W. Kistler, U. S. Geological Survey.
62. Kistler (1968) K-Ar (biotite) 12.4 ± 0.4 m.y.
 No. 17, Table 1
 Ekren and others (1971), No. 10, Table 5
 Paintbrush Tuff, Tiva Canyon Member. Tuff (36°54'30"N, 116°53'W; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.
63. H. R. Cornwall (written communication) K-Ar (sanidine) 19.4 ± 0.9 m.y.
 Rhyolitic welded tuff (36°54'37"N, 116°48'50"W; Nye Co., NV). Analytical data: K₂O = 6.45%, $\text{Ar}^{40} = 1.86 \times 10^{-10}$ mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 57\%$. Collected by: H. R. Cornwall, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
64. H. R. Cornwall (written communication) K-Ar (sanidine) 22.8 ± 1.3 m.y.
 Rhyolitic welded tuff (36°54'05"N, 116°48'10"W; Nye Co., NV). Analytical data: K₂O = 5.70%, $\text{Ar}^{40} = 1.93 \times 10^{-10}$ mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 40\%$. Collected by: H. R. Cornwall, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
65. Kistler (1968) K-Ar (biotite) 11.3 ± 0.4 m.y.
 No. 15, Table 1
 Rhyolite lava (37°57'N, 116°41'W; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: Rhyolite lava is similar to Timber Mountain Tuff, Rainier Mesa Member.

Yucca Mountains

66. Kistler (1968) K-Ar (biotite) 11.0 ± 0.4 m.y.
 No. 9, Table 1 (sanidine) 11.2 ± 0.3 m.y.
 Tuff of Transvaal. Tuff (36°59'N, 116°36'W; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: This tuff correlates with Timber Mountain Tuff, Ammonia Tanks Member (Marvin and others, 1970, Table 8).
67. Marvin and others (1970) K-Ar (K-feldspar) 12.6 ± 1.1 m.y.
 No. 4, Tables 1, 2, and 8 (K-feldspar) 11.3 ± 1.1 m.y.
 Paintbrush Tuff, Tiva Canyon Member. Basal vitrophyre (welded tuff) (36°58'00"N, 116°33'06"W; Nye Co., NV). Collected by: F. M. Byers, U. S. Geological Survey; dated by: Geochron Laboratories, Inc. Comment: The 11.3-m.y. age appears incorrect in comparison with other radiometric ages for the Paintbrush Tuff, Tiva Canyon Member.

68. Marvin and others (1970) K-Ar (biotite) 12.7 ± 0.6 m.y.
 No. 3, Tables 1, 2, and 8 (K-feldspar) 12.5 ± 0.6 m.y.

Tuff of Chocolate Mountain, upper unit. Welded tuff vitrophyre ($36^{\circ}56'06''N$, $116^{\circ}27'54''W$; Nye Co., NV). Collected by: F. M. Byers, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

69. Marvin and others (1970) K-Ar (biotite) 13.1 ± 0.4 m.y.
 Sample OB3a, No. 9, Tables 1, 2, and 8 (biotite) 12.9 ± 0.4 m.y.

Tuff of Crater Flat. Welded tuff vitrophyre ($36^{\circ}41'12''N$, $116^{\circ}32'12''W$; Nye Co., NV). Collected by: P. P. Orkild, U. S. Geological Survey; dated by: J. D. Obradovich, U. S. Geological Survey. Comment: Vitrophyre is 10 feet above sample No. 70.

70. Marvin and others (1970) K-Ar (biotite) 13.8 ± 0.4 m.y.
 Sample OB3, No. 9, Tables 1, 2, and 8 (biotite) 14.1 ± 0.4 m.y.

Tuff of Crater Flat. Welded tuff vitrophyre ($36^{\circ}41'12''N$, $116^{\circ}32'12''W$; Nye Co., NV). Collected by: P. P. Orkild, U. S. Geological Survey; dated by: J. D. Obradovich, U. S. Geological Survey. Comment: Vitrophyre is 10 feet below sample No. 69.

71. P. P. Orkild (written communication) K-Ar (whole rock) 2.0 ± 0.6 m.y.

Basalt flow ($36^{\circ}41'N$, $115^{\circ}30'30''W$; Nye Co., NV). Analytical data: $K_2O = 1.82\%$, ^{40}Ar (avg.) = 0.05504×10^{-10} mole/gm, $^{40}Ar/\Sigma Ar^{40} = 2\%$ and 3% . Collected by: K. A. Sargent, U. S. Geological Survey; dated by: Geochron Laboratories, Inc.

Shoshone Mountains

72. Kistler (1968) K-Ar (biotite) 13.2 ± 0.4 m.y.
 No. 18, Table 1
 Ekren and others (1971), No. 11, Table 5

Paintbrush Tuff, Topopah Spring Member. Tuff ($36^{\circ}54'30''N$, $116^{\circ}17'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

73. Kistler (1968) K-Ar (biotite) 15.0 ± 0.6 m.y.
 No. 24, Table 1
 Ekren and others (1971), No. 15, Table 5

Tuff ($36^{\circ}55'30''N$, $116^{\circ}16'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: Tuff is from drill core of Test Well No. 8, 4,000 feet below surface; tuff is correlated with Fraction Tuff (Marvin and others, 1970, Table 8).

74. Kistler (1968) K-Ar (biotite) 13.4 ± 0.4 m.y.
 No. 21, Table 1

Rhyolite of Calico Hills. Rhyolite ($36^{\circ}57'N$, $116^{\circ}15'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

75. Kistler (1968) K-Ar (sanidine) 10.4 ± 0.3 m.y.
 No. 14, Table 1

Timber Mountain Tuff, Rainier Mesa Member. Tuff ($36^{\circ}58'N$, $116^{\circ}14'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

76. Kistler (1968) K-Ar (sanidine) 10.5 ± 0.3 m.y.
No. 10, Table 1
- Timber Mountain Tuff, tuff of Cat Canyon, upper cooling unit. Tuff ($36^{\circ}58'N$, $116^{\circ}14'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: This tuff is an intracaldera facies and equivalent, in part, to Timber Mountain Tuff, Ammonia Tanks Member (Marvin and others, 1970, Table 8).
77. Kistler (1968) K-Ar (sanidine) 10.8 ± 0.3 m.y.
No. 5, Table 1 (sanidine) 10.8 ± 0.5 m.y.
Ekren and others (1971), No. 4, Table 5
- Timber Mountain Tuff, Ammonia Tanks Member. Tuff ($36^{\circ}59'N$, $116^{\circ}15'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.
78. Kistler (1968) K-Ar (biotite) 10.9 ± 0.4 m.y.
No. 4, Table 1
Ekren and others (1971), No. 3, Table 5
- Timber Mountain Tuff, Ammonia Tanks Member. Tuff ($36^{\circ}59'N$, $116^{\circ}15'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.
79. Kistler (1968) K-Ar (biotite) 12.4 ± 0.5 m.y.
No. 16, Table 1
Ekren and others (1971), No. 9, Table 5
- Paintbrush Tuff, Tiva Canyon Member. Tuff ($36^{\circ}58'36''N$, $116^{\circ}14'30''W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.
80. Kistler (1968) K-Ar (sanidine) 13.6 ± 0.4 m.y.
No. 22, Table 1
- Tuff of Redrock Valley. Tuff ($37^{\circ}01'N$, $116^{\circ}11'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: This tuff is equivalent to tuff 1 at Grouse Canyon, lower member, Indian Trail Formation (Orkild, 1963).
81. Marvin and others (1970) K-Ar (biotite) 13.3 ± 0.4 m.y.
Sample 011-101-2, No. 4a, Tables 1, 2, and 8 (K-feldspar) 12.8 ± 0.4 m.y.
- Paintbrush Tuff, Topopah Spring Member. Welded tuff vitrophyre ($36^{\circ}57'N$, $116^{\circ}07'W$; Nye Co., NV). Collected by: P. P. Orkild, U. S. Geological Survey; dated by: Isotopes, Inc.
82. Marvin and others (1970) K-Ar (biotite) 12.1 ± 0.4 m.y.
Sample 011-101-1, No. 4a, Tables 1, 2, and 8 (K-feldspar) 13.0 ± 0.3 m.y.
- Paintbrush Tuff, Topopah Spring Member. Welded tuff vitrophyre ($36^{\circ}57'N$, $116^{\circ}07'W$; Nye Co., NV). Collected by: P. P. Orkild, U. S. Geological Survey; dated by: Isotopes, Inc.
83. Kistler (1968) K-Ar (biotite) 12.9 ± 0.4 m.y.
No. 20, Table 1
- Wahmonie Formation. Basal ash fall ($36^{\circ}52'N$, $116^{\circ}07'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

84. Kistler (1968) K-Ar (biotite) 12.5 ± 0.4 m.y.
No. 19, Table 1

Wahmonie Formation. Rhyodacite lava ($36^{\circ}52'N$, $116^{\circ}07'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

Belted Range

85. Marvin and others (1970) K-Ar (sanidine) 15.7 ± 0.6 m.y.
No. 9a, Tables 1, 2, and 8

Tuff of Redrock Valley, Basal welded tuff vitrophyre ($37^{\circ}06'30''N$, $116^{\circ}10'24''W$; Nye Co., NV). Collected by: F. M. Byers, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

86. Marvin and others (1970) K-Ar (sanidine) 11.3 ± 0.3 m.y.
No. 2, Tables 1, 2, and 8
Ekren and others (1971), No. 8, Table 5

Timber Mountain Tuff, Rainier Mesa Member. Welded tuff vitrophyre ($37^{\circ}13'30''N$, $116^{\circ}15'30''W$; Nye Co., NV). Collected by: F. M. Byers, U. S. Geological Survey; dated by: J. D. Obradovich, U. S. Geological Survey.

87. Kistler (1968) K-Ar (biotite) 16.1 ± 0.4 m.y.
No. 23, Table 1

Biotite tuff ($37^{\circ}12'N$, $116^{\circ}08'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey. Comment: This tuff is equivalent to unit 1, Tilw, at White Rock Spring (Gibbons and others, 1963).

89. Noble and others (1968) K-Ar (nonhydrated glass) 13.8 ± 0.6 m.y.
Marvin and others (1970), No. 6, Tables 1, 2, and 8
Marvin and others (1970a), No. 9, Table 1
Ekren and others (1971), No. 13, Table 5

Belted Range Tuff, Grouse Canyon Member. Welded aphyric glass in lower ash flow ($37^{\circ}20'30''N$, $116^{\circ}01'00''W$; Nye Co., NV). Collected by: D. C. Noble; dated by: H. H. Mehnert, U. S. Geological Survey.

90. Noble and others (1968) K-Ar (sanidine) 14.8 ± 0.6 m.y.
Marvin and others (1970), No. 7, Tables 1, 2, and 8
Ekren and others (1971), No. 14, Table 5

Rhyolite of Kawich Valley. Rhyolite lava vitrophyre ($37^{\circ}21'12''N$, $116^{\circ}01'00''W$; Nye Co., NV). Collected by: D. C. Noble; dated by: H. H. Mehnert, U. S. Geological Survey.

91. Kistler (1968) K-Ar (biotite) 26.1 ± 0.7 m.y.
No. 28, Table 1
Ekren and others (1971), No. 27, Table 5

Monotony Tuff. Tuff ($37^{\circ}34'30''N$, $116^{\circ}06'W$; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

Quinn Canyon Range

92. Kistler (1968) K-Ar (biotite) 25.3 ± 0.7 m.y.
 No. 27, Table 1
 Ekren and others (1971), No. 24, Table 5

Shingle Pass Tuff. Tuff ($37^{\circ}38'N$, $115^{\circ}59'W$; Nye Co., NV). Collected by: H. R. Cornwall, U. S. Geological Survey; dated by: R. W. Kistler, U. S. Geological Survey. Comment: This tuff was called "tuff of Belted Peak" by Kistler (1968).

93. Marvin and others (1970) K-Ar (biotite) 25.2 ± 1.2 m.y.
 No. 14, Tables 1, 2, and 8 (sanidine) 24.4 ± 0.7 m.y.
 Ekren and others (1971), No. 20, Table 5

Tuff of White Blotch Spring, lowest unit. Welded tuff ($37^{\circ}45'N$, $116^{\circ}00'W$; Nye Co., NV). Collected by: D. C. Noble; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

94. Marvin (1968) K-Ar (biotite) 22.6 ± 0.7 m.y.

Rhyodacitic welded ash flow ($38^{\circ}09'N$, $115^{\circ}50'W$; Nye Co., NV). Analytical data: $K_2O = 8.21\%$, $Ar^{40} = 2.75 \times 10^{-10}$ mole/gm, $Ar^{40}/\Sigma Ar^{40} = 60\%$. Collected by: F. J. Kleinhampl, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

Grant Range

95. K-Ar (biotite) 34.0 ± 1.3 m.y.

Railroad Valley Rhyolite ($38^{\circ}55'N$, $115^{\circ}24'W$; White-Pine Co., NV). Analytical data: $K_2O = 8.55\%$, $Ar^{40} = 4.33 \times 10^{-10}$ mole/gm, $Ar^{40}/\Sigma Ar^{40} = 74\%$. Collected by: M. C. Blake, Jr., U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey.

96. Grommé and others (1972) (biotite) 30.7 ± 0.8 m.y.
 No. W9, Table 5 (sanidine) 30.3 ± 0.8 m.y.

Windous Butte Formation, upper member. Rhyolite welded tuff ($38^{\circ}55'48''N$, $115^{\circ}10'12''W$; White Pine Co., NV). Collected by: C. S. Grommé, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey. Comment: Sample collected near the type locality for the Windous Butte Formation.

97. Grommé and others (1972) K-Ar (biotite) 30.7 ± 0.8 m.y.
 No. W8, Table 5 (sanidine) 30.2 ± 0.8 m.y.

Windous Butte Formation, lower member. Rhyolite welded tuff ($38^{\circ}55'48''N$, $115^{\circ}10'12''W$; White Pine Co., NV). Collected by: C. S. Grommé, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey. Comment: Sample collected near the type locality for the Windous Butte Formation.

98. Firby (in press) K-Ar (biotite) 31.7 ± 1.2 m.y.

Currant Tuff. Tuff (approx. $38^{\circ}55'N$, $115^{\circ}10'W$; White Pine Co., NV). Analytical data: $K_2O = 8.42\%$, Ar^{40}

(avg.) = 3.991×10^{-10} mole/gm, $\frac{*Ar^{40}}{^{39}Ar^{40}} = 69\%$ and 71% . Collected by: J. R. Firby, Univ. of Nevada; dated by: Geochron Laboratories, Inc. Comment: Sample was collected near base of Currant Tuff, about 50 feet stratigraphically above marl and interbedded tuffaceous sandstone containing Chadronian land mammal stage (Oligocene) fossils—fossil locality UCMP 3426.

99. Armstrong (1970) K-Ar (biotite) 33.4 ± 0.7 m.y.
No. 150, Table 3

Railroad Valley Rhyolite. Rhyolite ($38^{\circ}41'35''N$, $115^{\circ}26'50''W$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
100. Grommé and others (1972) K-Ar (biotite) 34.9 ± 0.9 m.y.
No. S3, Table 5 (sanidine) 33.4 ± 0.8 m.y.

Stone Cabin Formation, upper member. Rhyolite welded tuff ($38^{\circ}40'12''N$, $115^{\circ}21'00''W$; Nye Co., NV). Collected by: C. S. Grommé, U. S. Geological Survey; dated by: E. H. McKee, U. S. Geological Survey. Comment: Sample was collected at type locality for the Stone Cabin Formation.
101. Armstrong (1970) K-Ar (biotite) 32.3 ± 0.7 m.y.
No. 76, Table 3

Calloway Well Formation. Silicic tuff ($38^{\circ}39'55''N$, $115^{\circ}21'45''W$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
102. Armstrong (1970) K-Ar (biotite) 30.2 ± 0.6 m.y.
No. 77, Table 3

Windous Butte Formation. Silicic tuff ($38^{\circ}39'55''N$, $115^{\circ}21'10''W$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
103. Armstrong (1970) K-Ar (sanidine) 32.4 ± 0.7 m.y.
No. 829, Table 3

Stone Cabin Formation. Silicic tuff ($38^{\circ}36'20''N$, $115^{\circ}16'55''W$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
104. Armstrong (1970) K-Ar (sanidine) 30.6 ± 0.6 m.y.
No. 826, Table 3

Windous Butte Formation. Silicic tuff ($38^{\circ}36'20''N$, $115^{\circ}16'58''W$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
105. Armstrong (1970) K-Ar (plagioclase) 26.5 ± 0.8 m.y.
No. 831, Table 3

Needles Range Formation, basal member. Tuff ($38^{\circ}35'54''N$, $115^{\circ}17'00''W$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
106. Armstrong (1970) K-Ar (biotite) 26.2 ± 0.5 m.y.
No. 81, Table 3

Needles Range Formation. Tuff ($38^{\circ}35'30''\text{N}$, $115^{\circ}21'05''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ. Comment: Tuff has been hydrothermally altered.

107. Armstrong (1970) K-Ar (biotite) 34.1 ± 0.7 m.y.
No. 79, Table 3

Calloway Well Formation. Silicic tuff ($38^{\circ}33'25''\text{N}$, $115^{\circ}22'40''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

108. Armstrong (1970) K-Ar (biotite) 27.2 ± 0.6 m.y.
No. 834, Table 3

Needles Range Formation, uppermost member. Tuff ($38^{\circ}19'00''\text{N}$, $115^{\circ}21'30''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

109. Armstrong (1970) K-Ar (biotite) 28.5 ± 0.6 m.y.
No. 834A, Table 3 (impure hornblende) 30.6 ± 0.9 m.y.

Needles Range Formation, basal member. Tuff ($38^{\circ}19'12''\text{N}$, $115^{\circ}21'45''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Seaman Range

110. Marvin and others (1970) K-Ar (biotite) 29.8 ± 1.4 m.y.
Sample NS-2-1, No. 18, Tables 1, 2, and 8

Needles Range(?) Formation, bottom unit. Welded quartz latite tuff ($38^{\circ}13'30''\text{N}$, $115^{\circ}14'30''\text{W}$; Nye Co., NV). Collected by: D. C. Noble; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

111. Marvin and others (1970) K-Ar (biotite) 30.8 ± 1.4 m.y.
Sample NS-2-4, No. 18, Tables 1, 2, and 8

Needles Range(?) Formation, top unit. Welded quartz latite tuff ($38^{\circ}13'30''\text{N}$, $115^{\circ}14'30''\text{W}$; Nye Co., NV). Collected by: D. C. Noble; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

Golden Gate Range

112. Armstrong (1970) K-Ar (biotite) 26.4 ± 0.5 m.y.
No. 72, Table 3

Latite welded tuff ($38^{\circ}04'00''\text{N}$, $115^{\circ}22'30''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

113. Armstrong (1970) K-Ar (whole rock) 20.1 ± 0.5 m.y.
No. 71Z, Table 3

Trachytic basalt ($38^{\circ}03'10''\text{N}$, $115^{\circ}24'30''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

114. Armstrong (1970) K-Ar (biotite) 21.3 ± 0.5 m.y.
No. 73, Table 3

Quichapa Group, Bauers Tuff. Tuff ($38^{\circ}03'15''\text{N}$, $115^{\circ}24'20''\text{W}$; Nye Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Groom Range

115. Marvin and others (1970) K-Ar (biotite) 27.4±0.8 m.y.
 No. 16, Tables 1, 2, and 8 (biotite) 27.8±0.8 m.y.
 Ekren and others (1971), No. 27, Table 5

Monotony Tuff. Welded quartz latite tuff (37°34'N, 115°40'W; Lincoln Co., NV). Collected by: D. C. Noble; dated by: J. D. Obradovich, U. S. Geological Survey.

116. Armstrong (1970) K-Ar (biotite) 18.6±0.5 m.y.
 No. 50, Table 3 (plagioclase) 18.1±1.0 m.y.
 (impure pyroxene) 16.5±2.0 m.y.

Andesite (37°22'10"N, 115°36'50"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Spotted Range Area

117. E. N. Hinrichs (oral communication) K-Ar (sanidine) 12.7±0.5 m.y.

Vitric tuff (36°56'30"N, 115°52'15"W; Lincoln Co., NV). Analytical data: K₂O = 9.02%, $\bar{A}r^{40} = 1.700 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 95\%$. Collected by: E. N. Hinrichs, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comment: Tuff contains fossil remains of land mammals.

- 117a. Kistler (1968) K-Ar (biotite) 12.1±0.5 m.y.
 No. 8, Table 1
 Ekren and others (1971), No. 7, Table 5

Timber Mountain Tuff, Ammonia Tanks Member. Tuff (36°54'30"N, 115°58'W; Nye Co., NV). Dated by: R. W. Kistler, U. S. Geological Survey.

118. Marvin and others (1970a) K-Ar (hydrated glass) 9.6±0.4 m.y.
 No. 8, Table 1

Paintbrush Tuff, Topopah Spring Member. Vitrophyre (36°53'00"N, 115°59'30"W; Nye Co., NV). Collected by: D. C. Noble; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comment: K-Ar mineral age of Paintbrush Tuff, Topopah Spring Member, is 13.3 m.y. (Marvin and others, 1970, No. 4a, Tables 1, 2, and 9).

119. Marvin and others (1970) K-Ar (biotite) 29.4±1.4 m.y.
 No. 19, Tables 1, 2, and 8

Horse Spring Formation. Bedded tuff (36°43'N, 115°57'W; Nye Co., NV). Collected by: E. B. Ekren, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

Spring Mountains

120. R. Fleck (written communication) K-Ar (biotite) 14.0±0.2 m.y.

Volcanics on Black Butte. (35°52'48"N, 115°52'18"W; Clark Co., NV). Analytical data: K₂O = 8.68%, $\bar{A}r^{40} = 1.804 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 82\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.

121. R. Fleck (written communication) K-Ar (biotite) 13.6 ± 0.2 m.y.
 Volcanics on Black Butte. ($35^{\circ}52'48''$ N, $115^{\circ}42'18''$ W, Clark Co., NV). Analytical data: $K_2O = 8.28\%$, $\bar{A}r^{40} = 1.671 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 74\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
122. R. Fleck (written communication) K-Ar (biotite) 13.2 ± 0.2 m.y.
 Volcanics at Sultan Mine. ($35^{\circ}46'12''$ N, $115^{\circ}30'24''$ W; Clark Co., NV). Analytical data: $K_2O = 7.93\%$, $\bar{A}r^{40} = 1.545 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 67\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
123. R. Fleck (written communication) K-Ar (biotite) 13.7 ± 0.2 m.y.
 Volcanics at Sultan Mine. ($35^{\circ}45'42''$ N, $115^{\circ}30'06''$ W; Clark Co., NV). Analytical data: $K_2O = 8.54\%$, $\bar{A}r^{40} = 1.732 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 76\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
124. R. Fleck (written communication) K-Ar (whole rock) 12.0 ± 0.4 m.y.
 Table Mountain Andesite. Andesite ($35^{\circ}48'42''$ N, $115^{\circ}28'24''$ W; Clark Co., NV). Analytical data: $K_2O = 4.78\%$, $\bar{A}r^{40} = 0.8491 \times 10^{-10}$ mole/gm, Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
- Las Vegas Range
125. R. Fleck (written communication) K-Ar (biotite) 13.6 ± 0.3 m.y.
 Horse Spring Formation (upper part). Tuff(?) ($36^{\circ}26'06''$ N, $115^{\circ}10'24''$ W; Clark Co., NV). Analytical data: $K_2O = 7.64\%$, $\bar{A}r^{40} = 1.535 \times 10^{-10}$ mole/gm, $\bar{A}r^{40}/\Sigma Ar^{40} = 50\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
- Egan Range
126. Armstrong (1970) K-Ar (biotite) 28.9 ± 0.6 m.y.
 No. 103C, Table 3
 Needles Range Formation, Wah Wah Springs Tuff Member. Tuff ($38^{\circ}32'35''$ N, $114^{\circ}56'00''$ W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
127. Armstrong (1970) K-Ar (biotite) 30.7 ± 0.6 m.y.
 No. 101E, Table 3
 Needles Range Formation, Wah Wah Springs Tuff Member. Tuff ($38^{\circ}21'20''$ N, $114^{\circ}55'40''$ W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
128. Marvin and others (1970) K-Ar (biotite) 30.9 ± 1.4 m.y.
 Sample TNR-1, No. 17, Tables 1, 2, and 8
 Needles Range(?) Formation, bottom unit. Welded quartz latite tuff ($38^{\circ}19'24''$ N, $114^{\circ}58'30''$ W; Lincoln Co., NV). Collected by: D. C. Noble; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

129. Marvin and others (1970) K-Ar (biotite) 28.3 ± 1.3 m.y.
Sample TNR-4-1, No. 17, Tables 1, 2, and 8

Needles Range (?) Formation, top unit. Welded quartz latite tuff ($38^{\circ}19'24''\text{N}$, $114^{\circ}58'30''\text{W}$; Lincoln Co., NV). Collected by: D. C. Noble; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

130. Armstrong (1970) K-Ar (biotite-hornblende mixture) 30.7 ± 0.6 m.y.
No. 102C, Table 3

Needles Range Formation, Minersville Tuff Member. Tuff ($38^{\circ}19'05''\text{N}$, $114^{\circ}58'25''\text{W}$; Lincoln Co., NV). Collected by: R. L. Armstrong, Yale Univ.

Snake Range

131. Marvin (1968) K-Ar (biotite) 31 ± 3 m.y.

Welded tuff (approx. $38^{\circ}45'\text{N}$, $114^{\circ}18'\text{W}$; White Pine Co., NV). Analytical data: $\text{K}_2\text{O} = 6.96\%$, $\bar{A}\text{r}^{40} = 3.20 \times 10^{-10}$ mole/gm, $\bar{A}\text{r}^{40}/\Sigma\text{Ar}^{40} = 62\%$. Collected by: D. E. Lee, U. S. Geological Survey; dated by: H. H. Thomas and R. F. Marvin, U. S. Geological Survey.

Fortification Range

132. Armstrong (1970) K-Ar (biotite) 33.3 ± 0.8 m.y.
No. 60, Table 3

Latite tuff ($38^{\circ}39'00''\text{N}$, $114^{\circ}28'20''\text{W}$; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Fairview Range

133. Armstrong (1970) K-Ar (impure biotite) 23.8 ± 0.5 m.y.
No. 70, Table 3

Quichapa Group, Harmony Hills Tuff. Tuff ($38^{\circ}04'30''\text{N}$, $114^{\circ}42'05''\text{W}$; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Pahroc Range

134. P. P. Orkild (written communication) K-Ar (biotite) 33.4 ± 1.2 m.y.
(hornblende) 28.7 ± 1.8 m.y.

Needles Range Formation, Wah Wah Springs Tuff Member. Vitrophyric welded tuff ($38^{\circ}01'30''\text{N}$, $114^{\circ}47'30''\text{W}$; Lincoln Co., NV). Analytical data: (biotite) $\text{K}_2\text{O} = 8.08\%$, $\bar{A}\text{r}^{40}$ (avg.) = 4.043×10^{-10} mole/gm, $\bar{A}\text{r}^{40}/\Sigma\text{Ar}^{40} = 57\%$ and 40% ; (hornblende) $\text{K}_2\text{O} = 0.86\%$, $\bar{A}\text{r}^{40} = 0.3671 \times 10^{-10}$ mole/gm, $\bar{A}\text{r}^{40}/\Sigma\text{Ar}^{40} = 74\%$. Collected by: R. E. Anderson, U. S. Geological Survey; dated by: (biotite) Geochron Laboratories, Inc. and (hornblende) R. F. Marvin and H. H. Mehnert, U. S. Geological Survey. Comment: Biotite age appears too old in comparison with ages of adjacent units in the stratigraphic sequence.

135. P. P. Orkild (written communication) K-Ar (sanidine) 33.0 ± 1.2 m.y.

Rhyolitic welded tuff with very smoky quartz ($37^{\circ}59'50''\text{N}$, $114^{\circ}47'15''\text{W}$; Lincoln Co., NV). Analytical data: $\text{K}_2\text{O} = 10.12\%$, $\bar{A}\text{r}^{40}$ (avg.) = 5.006×10^{-10} mole/gm, $\bar{A}\text{r}^{40}/\Sigma\text{Ar}^{40} = 84\%$ and 76% . Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Geochron Laboratories, Inc. Comment: Sanidine age appears too old in comparison with ages of adjacent units in the stratigraphic sequence.

136. Armstrong (1970) K-Ar (sanidine) 21.6±0.4 m.y.
No. 828, Table 3
Quichapa Group, Bauers Tuff. Tuff (37°50'20"N, 115°01'55"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
137. Armstrong (1970) K-Ar (biotite) 24.0±0.8 m.y.
No. 43, Table 3
Latite welded tuff (37°40'35"N, 114°59'35"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ. Comment: Tuff immediately underlies Leach Canyon Tuff.
138. Armstrong (1970) K-Ar (biotite) 23.3±0.5 m.y.
No. 42, Table 3
Quichapa Formation, Swett Tuff Member. Tuff (37°40'45"N, 114°59'40"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
139. Armstrong (1970) K-Ar (impure biotite) 19.8±0.4 m.y.
No. 41, Table 3
Quichapa Group, Harmony Hills Tuff. Tuff (37°40'50"N, 114°59'45"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
140. K-Ar (sanidine) 19.6±0.8 m.y.
Hiko Tuff. Tuff (37°32'N, 115°01'W; Lincoln Co., NV). Analytical data: K₂O = 10.81%, $\overset{*}{\text{Ar}}^{40} = 3.14 \times 10^{-10}$ mole/gm, $\overset{*}{\text{Ar}}^{40} / \Sigma \text{Ar}^{40} = 91\%$. Collected by: E. H. McKee; dated by: E. H. McKee, U. S. Geological Survey.
- Hiko Range
141. Armstrong (1970) K-Ar (sanidine) 13.3±0.5 m.y.
No. 45, Table 3
Kane Wash Tuff, basal unit. Silicic tuff (37°22'10"N, 115°05'10"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
142. Armstrong (1970) K-Ar (biotite-hornblende mixture) 17.6±0.6 m.y.
No. 44, Table 3 (plagioclase) 17.7±1.0 m.y.
Hiko Tuff. Tuff (37°22'10"N, 115°04'30"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
- Cedar Range Area
143. Armstrong (1970) K-Ar (biotite) 23.5±0.5 m.y.
No. 764, Table 3 (plagioclase) 22.6±1.7 m.y.
Quichapa Formation, Swett Tuff Member. Tuff (37°51'35"N, 114°19'45"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

144. Armstrong (1970) K-Ar (impure biotite) 17.9±0.4 m.y.
 No. 36B, Table 3
 Hiko Tuff. Tuff (37°51'40"N, 114°19'25"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

145. Armstrong (1970) K-Ar (biotite) 29.1±0.6 m.y.
 No. 63, Table 3
 Needles Range Formation, Wah Wah Spring Tuff Member. Tuff (37°50'00"N, 114°21'30"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

146. K-Ar (sanidine) 25.4±1.0 m.y.
 Welded tuff (37°27'N, 114°18'W; Lincoln Co., NV). Analytical data: K₂O = 4.75%, $\overset{*}{\text{Ar}}^{40} = 1.79 \times 10^{-10}$ mole/gm, $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 82\%$. Collected by: E. H. McKee; dated by: E. H. McKee, U. S. Geological Survey.

Clover Mountains

147. K-Ar (sanidine) 15.1±0.6 m.y.
 Ox Valley Tuff. Tuff (37°23'N, 114°13'W; Lincoln Co., NV). Analytical data: K₂O = 6.52%, $\overset{*}{\text{Ar}}^{40} = 1.46 \times 10^{-10}$ mole/gm, $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 72\%$. Collected by: E. H. McKee; dated by: E. H. McKee, U. S. Geological Survey.

Delamar Mountains

148. Armstrong (1970) K-Ar (sanidine) 13.0±0.6 m.y.
 Kane Wash Tuff. Silicic tuff (37°25'30"N, 114°33'20"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

149. Noble (1968) K-Ar (sanidine) 14.0±0.6 m.y.
 Marvin and others (1970), No. 8, Tables 1, 2, and 8
 Kane Wash Tuff, uppermost cooling unit. Peralkaline welded tuff vitrophyre (37°12'N, 114°57'W; Lincoln Co., NV). Collected by: D. C. Noble; dated by: H. H. Mehnert, U. S. Geological Survey.

Meadow Valley Mountains

150. Armstrong (1970) K-Ar (sanidine) 12.5±0.3 m.y.
 No. 203F, Table 3
 Kane Wash Formation, highest unit. Silicic tuff (37°16'35"N, 114°28'10"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

151. Armstrong (1970) K-Ar (whole rock) 8.5±0.3 m.y.
 No. 203I, Table 3
 Basaltic andesite (37°15'50"N, 114°27'40"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Mormon Mountains

152. Armstrong (1970) K-Ar (impure biotite) 20.4±0.4 m.y.
No. 35, Table 3 (plagioclase) 20.9±1.0 m.y.
- Quichapa Group, Harmony Hills Tuff. Tuff (37°51'40"N, 114°19'35"W; Lincoln Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

Muddy Mountains

153. Anderson and others (1972) K-Ar (biotite) 19.6±0.8 m.y.
No. 2, Table 1
- Horse Spring Formation. Tuff (36°38'30"N, 114°31'40"W; Clark Co., NV). Dated by: P. E. Damon, Univ. of Arizona.
154. Armstrong (1970) K-Ar (impure biotite) 21.3±0.4 m.y.
No. 32, Table 3
Anderson and others (1972), No. 1, Table 1
- Horse Spring Formation. Tuff (36°38'20"N, 114°31'30"W; Clark Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
155. R. Fleck (written communication) K-Ar (biotite) 13.0±0.2 m.y.
- Horse Spring Formation, upper part. Tuff (?) (36°33'54"N, 114°35'06"W; Clark Co., NV). Analytical data: K₂O = 7.66%, $\overset{*}{\text{Ar}}^{40} = 1.471 \times 10^{-10}$ mole/gm, $\overset{*}{\text{Ar}}^{40}/\overset{\gamma}{\text{Ar}}^{40} = 75\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
156. Anderson and others (1972) K-Ar (hornblende) 9.6±3.2 m.y.
No. 14, Table 1
- Lava (?) (36°30'N, 114°36'W; Clark Co., NV). Collected by: C. R. Longwell, Stanford Univ.; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
157. Anderson and others (1972) K-Ar (biotite) 15.3±0.7 m.y.
No. 3, Table 1
- Horse Spring Formation. Tuff (36°30'N, 114°36'W; Clark Co., NV). Collected by: C. R. Longwell, Stanford Univ.; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
158. R. Fleck (written communication) K-Ar (biotite) 13.1±0.2 m.y.
- Horse Spring Formation (upper part). Tuff (?) (36°29'N, 114°36'W; Clark Co., NV). Analytical data: K₂O = 6.39%, $\overset{*}{\text{Ar}}^{40} = 1.239 \times 10^{-10}$ mole/gm, $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 78\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
159. Anderson and others (1972) K-Ar (biotite) 15.1±0.3 m.y.
No. 5, Table 1
- Horse Spring Formation. Tuff (?) (36°14'48"N, 114°46'12"W; Clark Co., NV). Analytical data: K₂O = 8.80%, $\overset{*}{\text{Ar}}^{40} = 1.961 \times 10^{-10}$ mole/gm, $\overset{*}{\text{Ar}}^{40}/\Sigma\text{Ar}^{40} = 70\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.

160. Anderson and others (1972) K-Ar (biotite) 15.0 ± 0.3 m.y.
No. 4, Table 1

Horse Spring Formation. Tuff (?) ($36^{\circ}13'06''\text{N}$, $114^{\circ}48'06''\text{W}$; Clark Co., NV). Analytical data: $\text{K}_2\text{O} = 8.79\%$, $^{40}\text{Ar}^* = .955 \times 10^{-10}$ mole/gm, $^{40}\text{Ar}^*/\Sigma\text{Ar}^{40} = 66\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.

161. Anderson and others (1972) K-Ar (whole rock) 11.1 ± 0.5 m.y.
No. 24, Table 1

Muddy Creek Formation, Fortification Basalt Member. Basalt lava ($36^{\circ}09'55''\text{N}$, $114^{\circ}46'\text{W}$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. L. Armstrong, Yale Univ.

162. Anderson and others (1972) K-Ar (whole rock) 13.2 ± 0.5 m.y.
No. 6, Table 1

Horse Spring Formation. Basalt lava ($36^{\circ}09'\text{N}$, $114^{\circ}46'\text{W}$; Clark Co., NV). Dated by: P. E. Damon, Univ. of Arizona.

Black Mountains

163. Anderson and others K-Ar (whole rock) 12.7 ± 0.8 m.y.
No. 27, Table 1

Mount Davis Volcanics. Andesite lava ($36^{\circ}16'45''\text{N}$, $114^{\circ}25'50''\text{W}$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. L. Armstrong, Yale Univ.

164. Armstrong (1970) K-Ar (whole rock) 11.3 ± 0.3 m.y.
No. 977, Table 3
Anderson and others (1972), No. 22, Table 1

Muddy Creek Formation, Fortification Basalt Member. Basalt lava ($36^{\circ}10'10''\text{N}$, $114^{\circ}41'20''\text{W}$; Clark Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.

River Mountains Area

165. Anderson and others (1972) K-Ar (whole rock) 17.2 ± 3 m.y.
Nos. 12 and 13, Table 1 (whole rock) 15.6 ± 3 m.y.

Thumb Formation. Andesite lava ($36^{\circ}07'27''\text{N}$, $114^{\circ}56'38''\text{W}$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. L. Armstrong, Yale Univ.

166. Anderson and others (1972) K-Ar (biotite) 13.4 ± 0.7 m.y.
Nos. 8 and 9, Table 1 (hornblende) 11.7 ± 2.0 m.y.

Thumb Formation. Rhyodacite ($36^{\circ}07'50''\text{N}$, $114^{\circ}56'25''\text{W}$; Clark Co., NV). Collected by: C. R. Longwell, Stanford Univ.; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

167. K-Ar (whole rock) 10.0 ± 0.5 m.y.

Dacite ($36^{\circ}07'17''\text{N}$, $114^{\circ}56'47''\text{W}$; Clark Co., NV). Analytical data: $\text{K}_2\text{O} = 5.83\%$, $^{40}\text{Ar}^* = 0.858 \times 10^{-10}$ mole/gm, $^{40}\text{Ar}^*/\Sigma\text{Ar}^{40} = 12\%$. Collected by: C. R. Longwell, Stanford Univ.; dated by: E. H. McKee, U. S. Geological Survey.

168. Anderson and others (1972) K-Ar (whole rock) 11.8 ± 0.7 m.y.
No. 11, Table 1
Thumb Formation. Mafic alkalic rock ($36^{\circ}07'15''N$, $114^{\circ}58'35''W$; Clark Co., NV). Dated by: P. E. Damon, Univ. of Arizona.
169. Armstrong (1970) K-Ar (whole rock) 11.8 ± 1.0 m.y.
No. 33, Table 3
Anderson and others (1972), No. 10, Table 1
Thumb Formation. Basalt ($36^{\circ}07'15''N$, $114^{\circ}58'35''W$; Clark Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
170. Anderson and others (1972) K-Ar (whole rock) 10.9 ± 1.1 m.y.
No. 7, Table 1
Thumb Formation. Mafic alkalic rock ($36^{\circ}06'20''N$, $114^{\circ}57'22''W$; Clark Co., NV). Dated by: P. E. Damon, Univ. of Arizona.
171. Anderson and others (1972) K-Ar (whole rock) 11.8 ± 0.5 m.y.
No. 25, Table 1
Mount Davis Volcanics. Basaltic andesite lava ($36^{\circ}04'47''N$, $114^{\circ}53'47''W$; Clark Co., NV). Collected by: C. R. Longwell, Stanford Univ.; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
172. R. Fleck (written communication) K-Ar (whole rock) 12.2 ± 0.4 m.y.
Mount Davis Volcanics. ($36^{\circ}05'12''N$, $114^{\circ}51'18''W$; Clark Co., NV). Analytical data: $K_2O = 2.45\%$, $\overset{*}{Ar}^{40} = 0.4466 \times 10^{-10}$ mole/gm, $\overset{*}{Ar}^{40}/\Sigma Ar^{40} = 60\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
173. R. Fleck (written communication) K-Ar (biotite) 12.5 ± 0.2 m.y.
Patsy Mine Volcanics. ($36^{\circ}05'18''N$, $114^{\circ}51'24''W$; Clark Co., NV). Analytical data: $K_2O = 6.21\%$, $\overset{*}{Ar}^{40} = 1.148 \times 10^{-10}$ mole/gm, $\overset{*}{Ar}^{40}/\Sigma Ar^{40} = 71\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.
174. Anderson and others (1972) K-Ar (biotite) 13.2 ± 0.3 m.y.
No. 30, Table 1
Mount Davis Volcanics. Silicic lava ($36^{\circ}02'30''N$, $114^{\circ}50'W$; Clark Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
175. Anderson and others (1972) K-Ar (biotite) 13.2 ± 0.4 m.y.
No. 29, Table 1
Mount Davis Volcanics. Silicic lava ($36^{\circ}01'43''N$, $114^{\circ}51'40''W$; Clark Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
176. R. Fleck (written communication) K-Ar (biotite) 13.9 ± 0.2 m.y.
Patsy Mine Volcanics. ($36^{\circ}01'24''N$, $114^{\circ}54'36''W$; Clark Co., NV). Analytical data: $K_2O = 8.00\%$, $\overset{*}{Ar}^{40} =$

1.641×10^{-10} mole/gm, $\text{Ar}^{40}/\Sigma\text{Ar}^{40} = 57\%$. Collected by: R. Fleck; dated by: R. Fleck, U. S. Geological Survey.

Eldorado Mountains Area

177. Anderson and others (1972) K-Ar (biotite) 15.8 ± 0.2 m.y.
Nos. 41 and 42, Table 1 (hornblende) 18.6 ± 0.3 m.y.
Patsy Mine Volcanics. Basal vitrophyre of dacite lava ($35^{\circ}48'N$, $114^{\circ}52'50''W$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Isotopes, Inc.
178. Anderson and others (1972) K-Ar (biotite) 14.5 ± 0.6 m.y.
Nos. 34 and 35, Table 1 (sanidine) 14.4 ± 0.5 m.y.
Tuff of Bridge Spring. Basal vitrophyre ($35^{\circ}47'22''N$, $114^{\circ}52'53''W$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
179. Anderson and others (1972) K-Ar (whole rock) 13.8 ± 0.2 m.y.
No. 28, Table 1
Mount Davis Volcanics. Basalt lava ($35^{\circ}46'47''N$, $114^{\circ}48'38''W$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: Isotopes, Inc.
180. Anderson and others (1972) K-Ar (biotite) 15.5 ± 0.7 m.y.
Nos. 39 and 40, Table 1 (sanidine) 14.5 ± 0.6 m.y.
Patsy Mine Volcanics. Basal vitrophyre of rhyolite lava ($35^{\circ}45'15''N$, $114^{\circ}51'40''W$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
181. Anderson and others (1972) K-Ar (biotite) 15.3 ± 0.6 m.y.
No. 36, Table 1
Patsy Mine Volcanics. Basal vitrophyre of rhyodacite lava ($35^{\circ}45'N$, $114^{\circ}50'40''W$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.
182. Armstrong (1970) K-Ar (biotite) 14.5 ± 0.3 m.y.
No. 26, Table 3
Anderson and others (1972), No. 32, Table 1
Mount Davis Volcanics. Dacite porphyry dike ($35^{\circ}44'20''N$, $114^{\circ}49'30''W$; Clark Co., NV). Collected by: R. L. Armstrong; dated by: R. L. Armstrong, Yale Univ.
183. Anderson and others (1972) K-Ar (biotite) 15.8 ± 0.6 m.y.
Nos. 37 and 38, Table 1 (sanidine) 16.1 ± 0.6 m.y.
Patsy Mine Volcanics. Basal vitrophyre of rhyolite lava ($35^{\circ}37'N$, $114^{\circ}52'13''W$; Clark Co., NV). Collected by: R. E. Anderson, U. S. Geological Survey; dated by: R. F. Marvin and H. H. Mehnert, U. S. Geological Survey.

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