Summary of radiometric ages of Tertiary volcanic and selected plutonic rocks in Nevada. Part V: northeastern Nevada

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Isochron/West, Bulletin of Isotopic Geochronology, v. 16, pp. 15-28

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Isochron/West was published at irregular intervals from 1971 to 1996. The journal was patterned after the journal *Radiocarbon* and covered isotopic age-dating (except carbon-14) on rocks and minerals from the Western Hemisphere. Initially, the geographic scope of papers was restricted to the western half of the United States, but was later expanded. The journal was sponsored and staffed by the New Mexico Bureau of Mines *(now Geology)* & Mineral Resources and the Nevada Bureau of Mines & Geology.

ISOCHRON/WEST
A Bulletin of Isotopic Geochronology

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SUMMARY OF RADIOMETRIC AGES OF TERTIARY VOLCANIC AND SELECTED PLUTONIC ROCKS IN NEVADA. PART V: NORTHEASTERN NEVADA[1]

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A total of 68 ages are tabulated; sample localities are shown on the map (fig. 1) and longitude and latitude is presented in the sample description section. All ages are by the K-Ar method except for one Rb-Sr. Twenty-seven ages are in published papers; 41 are unpublished. Analytical data are included in the sample-description section for each of the unpublished ages, and if possible, a comment on the significance of the age is added. Analytical techniques used for the age determinations are basically those described by Dalrymple and Lanphere (1969) and are used in the following laboratories: the U. S. Geological Survey, Menlo Park, Calif., and Denver, Colo.; the University of California at Berkeley; Yale University, New Haven, Conn.; and Geochron Laboratories, Inc., Cambridge, Mass.

The region, in the northeastern part of Nevada, covered by this report includes most of Elko County and the east half of White Pine County, an area of about 50,000 sq km (fig. 1). It lies between long. 114° and 117°W. and lat. 39° and 42°N. The southwestern part of the region outlined (between long. 115° and 117°W. and lat. 39° and 41°N.) is included in Part I of the summary (McKee and others, 1971). Two samples (nos. 42 and 43) are from westernmost Utah about 2 km from the Nevada state line at the approximate latitude of Wells, Nev.; one sample (no. 66) is from about 5 km south of the 39° parallel in the Snake Range of White Pine County.

Most of the rocks dated are silicic volcanic types or small intrusive bodies related to the volcanic rocks. A few basalt flows or dikes were dated. The dates include nine coarse-grained plutonic bodies and two samples of vein adularia, one from the Tuscarora mining district, the other from the Midas mining district.

GEOLOGIC DISCUSSION

Plotted on a histogram the ages of Tertiary igneous rocks from northeastern Nevada clearly show two periods of volcanic activity (fig. 2). The older started somewhat before 40 m.y. ago, reached a peak about 35 m.y., and tapered off about 30 m.y. ago. Rocks in this age group include only silicic rocks ranging from andesites to rhyolites, but almost all are highly potassic calc-alkalic types: The younger period of volcanism, which is probably not adequately sampled relative to the actual volume of rocks of this age, is between 17 and 8 m.y. old. This group of rocks is mostly basaltic but includes some calc-alkalic types.

The terms calc-alkalic and basaltic here refer to igneous products of two fundamentally different tectonic regimes. Calc-alkalic rocks have higher Ca, Mg, Sr and Al than do basaltic rocks of similar SiO_2 content, which reflects the degree of depletion during crystallization. The alkali feldspar in calc-alkalic rocks is rich in K ($>Or_{50}$) and in basaltic rocks rich in Na ($<Or_{50}$). Hornblende and biotite are common mafic accessories in silicic calc-alkalic rocks, and ferroaugite and fayalite in silicic basaltic types.

The general distribution of the older group of calc-alkalic rocks in Nevada is shown in figure 3, and the overall distribution of similar rocks of about the same age in the northern part of the Basin and Range Province is shown in figure 4. These rocks define a broad zone extending from the northwestern part of the Basin and Range Province in Oregon to the east-central part of the province in Utah. Calc-alkalic rocks with ages between about 30 and 20 m.y. define a parallel and partly overlapping northwest-trending belt across the province that is southwest of the older belt (fig. 4; see in addition, Armstrong and others, 1969; Noble, 1972).

Rocks in the younger age group (17 to 8 m.y.) in northeastern Nevada are part of the widespread basaltic volcanism that occurred at many places in the Great Basin less than 20 m.y. ago (see fig. 5) and are related to Basin and Range tectonism.

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[1] Part I, Central Nevada, published in Isochron/West, no. 2, pages 21-42, 1971
Part II, Western Nevada, published in Isochron/West, no. 4, pages 7-28, 1972
Part III, Eastern Nevada, published in Isochron/West, no. 6, pages 1-30, 1973
Part IV, Northwestern Nevada, published in Isochron/West, no. 10, pages 1-6, 1974

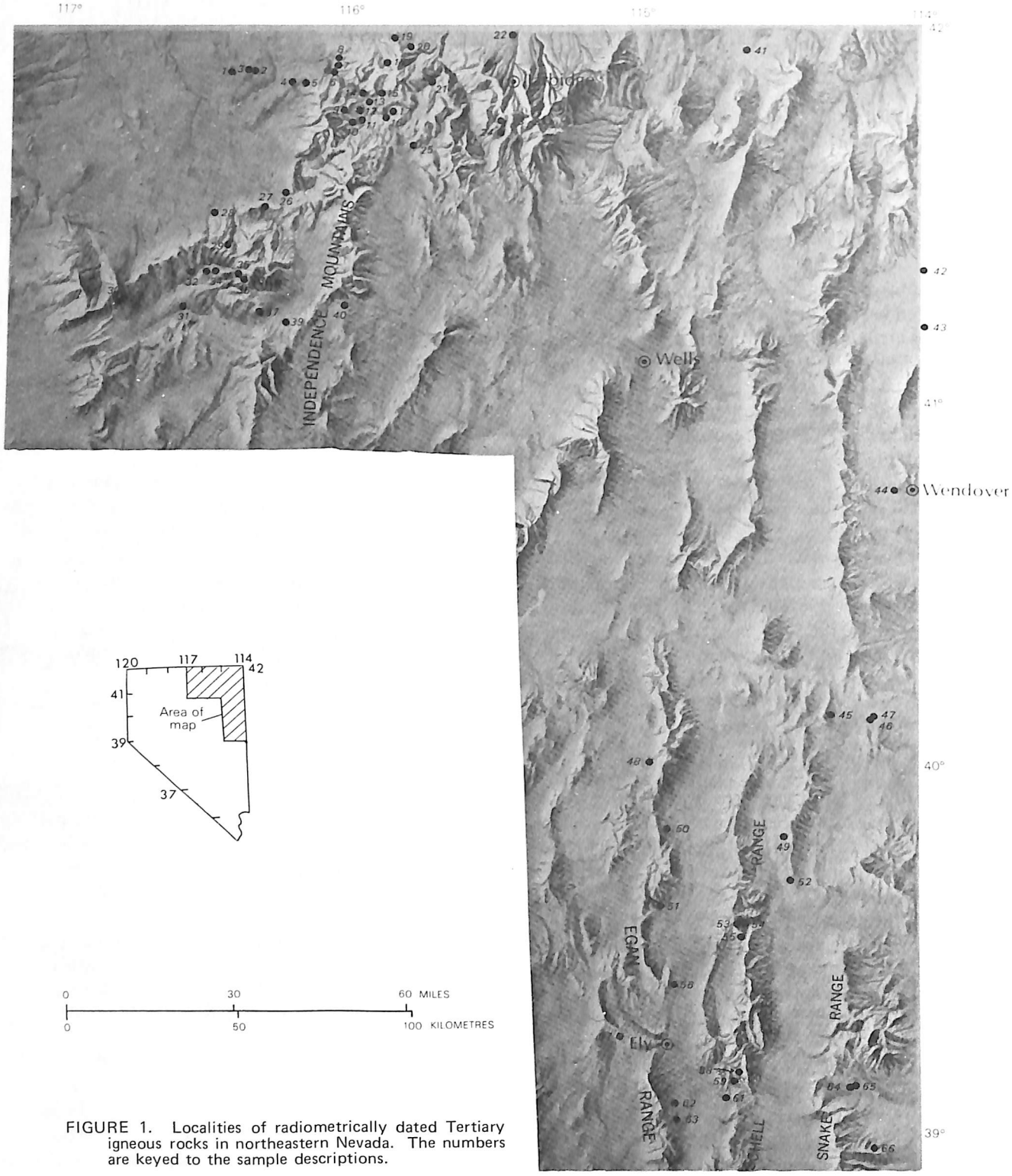

FIGURE 1. Localities of radiometrically dated Tertiary igneous rocks in northeastern Nevada. The numbers are keyed to the sample descriptions.

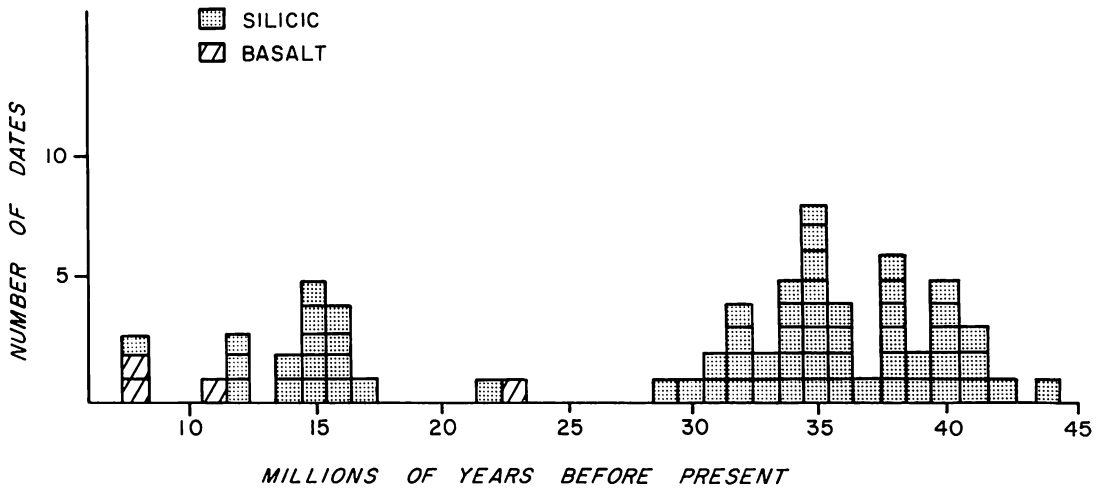

FIGURE 2. Histogram of K-Ar ages of Tertiary igneous rocks in northeastern Nevada.

SAMPLE DESCRIPTIONS

Nos. in fig. 1

1. Unpublished K-Ar (biotite) 13.8±0.8 m.y.
Circle Creek Rhyolite (approx. 116°25′W, 41°53′30″N; sec. 18, T. 46 N., R. 50 E.; Elko Co., NV). Analytical data: K_2O = 9.01%, $*Ar^{40}$ = 1.841 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 91%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC130; dated by: R. F. Marvin, U. S. Geol. Survey.

2. Coats, R. R., 1968 K-Ar (sanidine) 11.6±0.5 m.y.
Circle Creek Rhyolite. Multiple-source dome (SW¼ sec. 9, T. 46 N., R. 50 E.; 116°22′36″W, 41°54′N; Elko Co., NV); collected by: R. R. Coats, U. S. Geol. Survey, sample 61NC119; dated by: J. D. Obradovich, U. S. Geol. Survey. Comment: Location is not given in Coats, 1968 (Schilling, 1965).

3. Mark, R. K., Lee-Hu, C., Bowman, H. R., Asaro, F., McKee, E. H., Coats, R. R., 1975 K-Ar (basalt) 10.6±1.0 m.y.
Feeder dike to olivine basalt flow (41°54′00″N, 116°23′15″W; Elko Co., NV); collected by: R. R. Coats, U. S. Geol. Survey, sample 61NC18; dated by: E. H. McKee, U. S. Geol. Survey.

4. Unpublished K-Ar (sanidine) 39.6±2.0 m.y.
Perlitic biotite rhyodacite vitrophyre (116°11′50″W, 41°51′36″N; Elko Co., NV). Analytical data: K_2O = 11.03%, $*Ar^{40}$ = 6.520 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 62%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC55; dated by: U. S. Geol. Survey.

5. Unpublished K-Ar (plagioclase) 15.6±0.7 m.y.
Dacitic welded tuff (41°52′N, 116°10′W; Elko Co., NV). Analytical data: K_2O = 1.87%, 1.90%, $*Ar^{40}$ = 0.4343 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 80%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC182; dated by: R. F. Marvin, U. S. Geol. Survey.

6. Unpublished K-Ar (plagioclase) 16.0±0.7 m.y.
Dacitic tuff (41°53′N, 116°04′W; Elko Co., NV). Analytical data: K_2O = 2.75%, 2.90%, $*Ar^{40}$ = 0.6685 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 92%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC181; dated by: R. F. Marvin, U. S. Geol. Survey.

7. Unpublished K-Ar (biotite) 33.4±3.3 m.y.
Rhyolitic dome (116°03′W, 41°54′20″N; Elko Co., NV). Analytical data: K_2O = 5.69%, $*Ar^{40}$ = 2.831 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 18%; collected by: R. R. Coats, U. S. Geol. Survey, sample 59NC143; dated by: U. S. Geol. Survey.

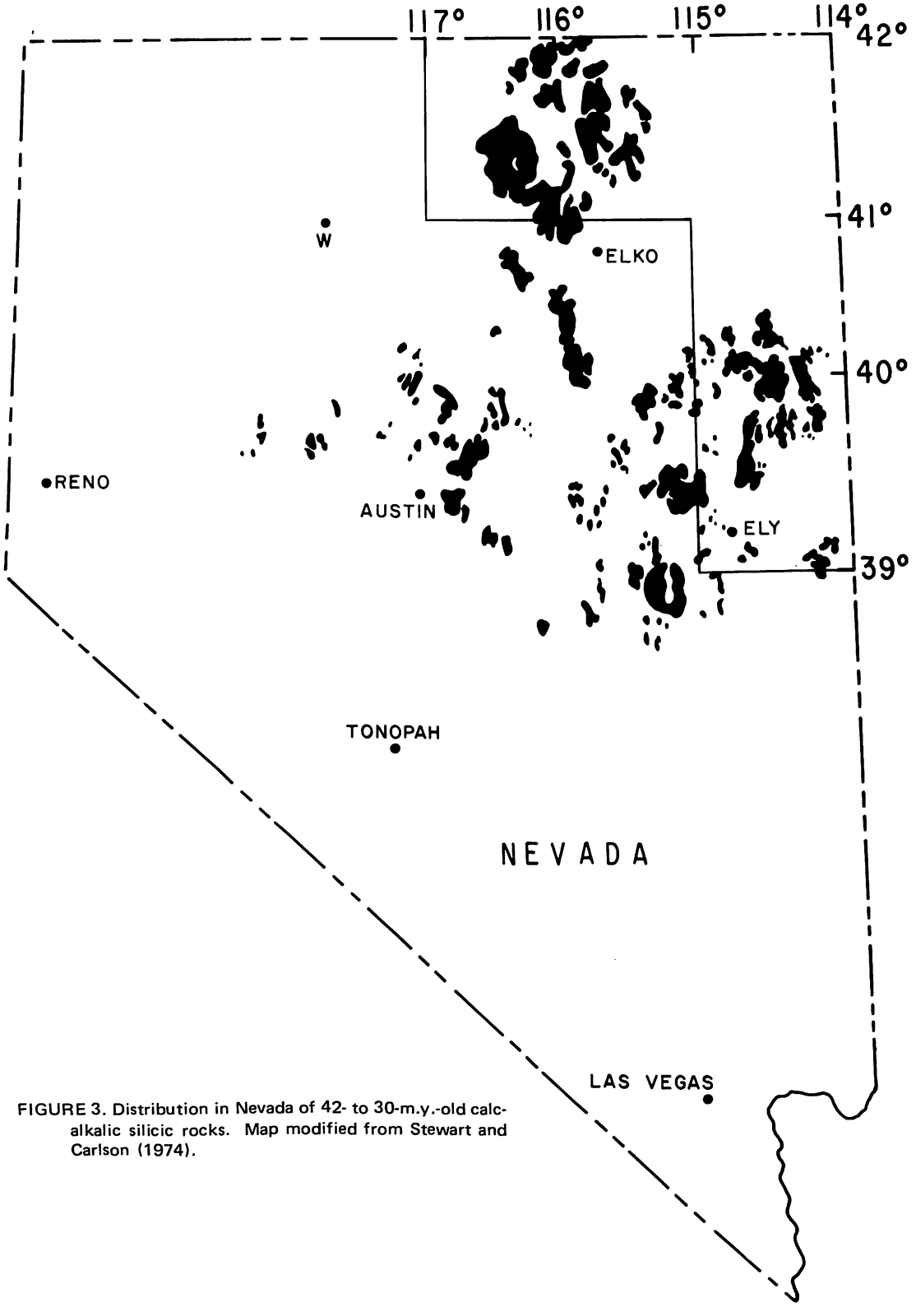

FIGURE 3. Distribution in Nevada of 42- to 30-m.y.-old calc-alkalic silicic rocks. Map modified from Stewart and Carlson (1974).

8. Coats, R. R., and Stephens, E. L., 1968 K-Ar (sanidine) 12.1±0.8 m.y.
Coats, R. R., 1968
Cougar Point Welded Tuff (116°02′15″W, 41°54′22″N; Elko Co., NV); collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC51; dated by: J. F. Obradovich, U. S. Geol. Survey. Comment: Schilling (1965) sample 235.

9. Unpublished K-Ar (biotite) 39.6±2.0 m.y.
Rhyolitic pumiceous welded tuff (116°01′W, 41°47′10″N; Elko Co., NV). Analytical data: $K_2O = 8.61\%$, $*Ar^{40} = 5.090 \times 10^{-10}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 80\%$; collected by: R. R. Coats, U. S. Geol. Survey, sample 60NC81; dated by: U. S. Geol. Survey.

10. Unpublished K-Ar (plagioclase) 16.2±0.7 m.y.
Dacitic welded tuff (sec. 2, T. 44 N., R. 53 E.; approx. 41° 44′N, 116° 00′W; Elko Co., NV). Analytical data: $K_2O = 2.93\%, 2.99\%$, $*Ar^{40} = 0.7101 \times 10^{-10}$ moles/gm, $*Ar^{40}/\Sigma Ar^{40} = 78\%$; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC183; dated by: R. F. Marvin, U. S. Geol. Survey.

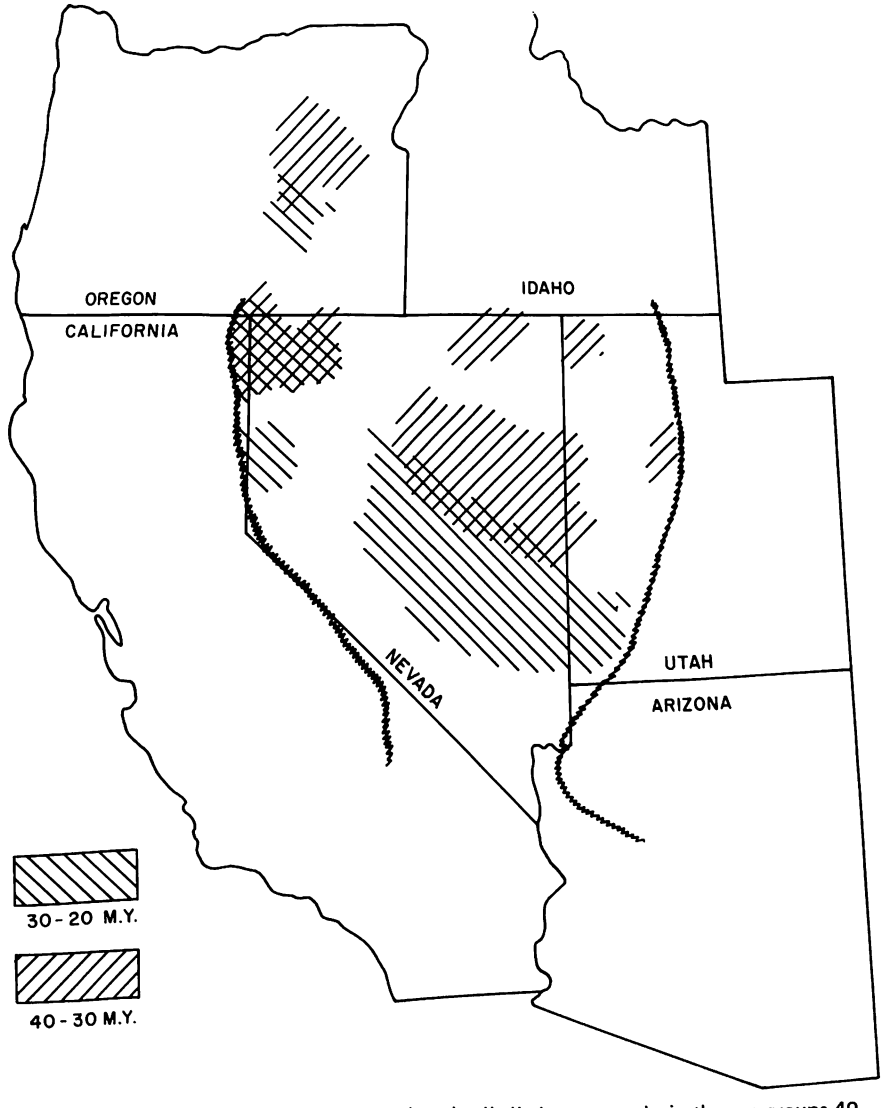

FIGURE 4. Distribution of predominantly calc-alkalic igneous rocks in the age groups 40 to 30 m.y. and 30 to 20 m.y. in the northern part of the Basin and Range province.

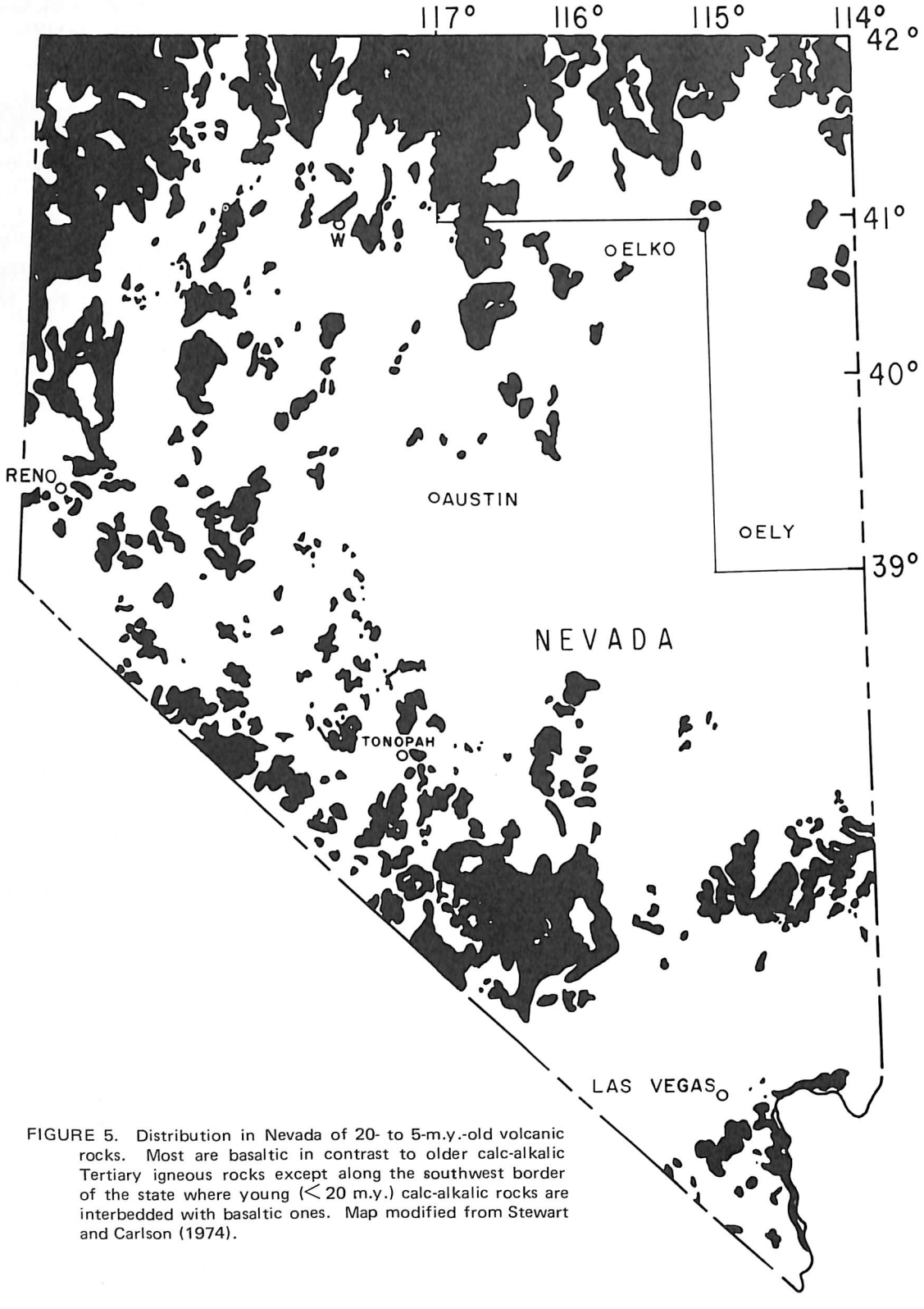

FIGURE 5. Distribution in Nevada of 20- to 5-m.y.-old volcanic rocks. Most are basaltic in contrast to older calc-alkalic Tertiary igneous rocks except along the southwest border of the state where young (< 20 m.y.) calc-alkalic rocks are interbedded with basaltic ones. Map modified from Stewart and Carlson (1974).

11. Unpublished K-Ar (plagioclase) 15.0±0.7 m.y.
Dacitic welded tuff (sec. 2, T. 44 N., R. 53 E.; approx. 41°44′N, 116°00′W; Elko Co., NV). Analytical data: K_2O = 3.62%, 3.70%, $*Ar^{40}$ = 0.8135 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 81%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC184; dated by: R. F. Marvin, U. S. Geol. Survey.

12. Unpublished K-Ar (biotite) 40.0±1.2 m.y.
Pumiceous biotite rhyolite ignimbrite (41°47′N, 115°58′W; Elko Co., NV). Analytical data: K_2O = 8.0%, $*Ar^{40}$ = 4.7832 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 80.1%; collected by: R. R. Coats, U. S. Geol. Survey, sample 65NC69, dated by: E. H. McKee, U. S. Geol. Survey. Comment: Oldest Tertiary rock in the area.

13. Unpublished K-Ar (biotite) 42.4±1.5 m.y.
Rhyodacite welded tuff (115°56′18″W, 41°48′25″N; Elko Co., NV). Analytical data: K_2O = 8.41%, 8.43%, $*Ar^{40}$ = 5.330 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 65.0%; collected by: R. R. Coats, U. S. Geol. Survey, sample 65NC54; dated by: E. H. McKee, U. S. Geol. Survey.

14. Unpublished K-Ar (biotite) 14.0±1.1 m.y.
Biotite welded tuff (altered) (approx. 115°58′W, 41°50′N; Elko Co., NV). Analytical data: K_2O = 4.84%, $*Ar^{40}$ = 1.005 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 22%; collected by: R. R. Coats, U. S. Geol. Survey, sample 59NC89; dated by: U. S. Geol. Survey. Comment: R. R. Coats (oral commun., 1974) says the age is very questionable, probably too young. This is due to alteration of the biotite.

15. Unpublished K-Ar (sanidine) 30.1±1 m.y.
Tuffs of Harris Gulch. Biotite, sanidine rhyolite pumice (115°53′W, 41°50′N; Elko Co., NV). Analytical data: K_2O = 10.58%, 10.53%, $*Ar^{40}$ = 4.730 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 87%; collected by: R. R. Coats, U. S. Geol. Survey, sample 66NC81; dated by: J. C. Von Essen, U. S. Geol. Survey.

16. Unpublished K-Ar (plagioclase) 22.9±3 m.y.
Basaltic lapilli tuff equivalent to Seventy Six Basalt (approx. 115°49′W, 41°46′30″N; Rough Mountain; Elko Co., NV). Analytical data: K_2O = 0.240%, 0.237%, $*Ar^{40}$ = 8.129 x 10^{-12} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 11%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC46; dated by: J. C. Von Essen, U. S. Geol. Survey.

17. Unpublished K-Ar (sanidine) 14.6±0.9 m.y.
Rhyolite perlitic vitrophyre (115°49′30″W, 41°47′N; Elko Co., NV). Analytical data: K_2O = 10.98%, $*Ar^{40}$ = 2.369 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 50%; collected by: R. R. Coats, U. S. Geol. Survey, sample 62NC111; dated by: U. S. Geol. Survey.

18. Unpublished K-Ar (plagioclase) 15.5±0.7 m.y.
Dacitic welded tuff (41°55′N, 115°52′W; Elko Co., NV). Analytical data: K_2O = 2.97%, 2.96%, $*Ar^{40}$ = 0.6813 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 88%; collected by: R. R. Coats, U. S. Geol. Survey, sample 64NC73; dated by: R. F. Marvin, U. S. Geol. Survey.

19. Unpublished K-Ar (biotite) 43.5±2.2 m.y.
Hornblende, biotite rhyodacite welded tuff (115°50′30″W, 41°51′N; Elko Co., NV). Analytical data: K_2O = 7.75%, $*Ar^{40}$ = 5.051 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 70%; collected by: R. R. Coats, U. S. Geol. Survey, sample 63NC77; dated by: U. S. Geol. Survey.

20. Unpublished K-Ar (biotite) 38.0±1.1 m.y.
Hornblende biotite dacite ignimbrite (41°57′N, 115°48′W; Elko Co., NV). Analytical data: K_2O = 8.75%, $*Ar^{40}$ = 4.963 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 81%; collected by: R. R. Coats, U. S. Geol. Survey, sample 66NC109; dated by: E. H. McKee, U. S. Geol. Survey.

21. Coats, R. R., 1964 K-Ar (sanidine) 16.8±0.5 m.y.
Schilling, J. H., 1965
Jarbidge Rhyolite, includes flows, tuffs, and welded tuffs of rhyolitic composition, sanidine (41°51′10″N, 115°42′27″W; Elko Co., NV); collected by: D. I. Axelrod; dated by: Geochron Laboratories. Comment: Schilling (1965), sample 92; location by written communication from Axelrod to Coats.

22. Mark, R. K., Lee-Hu, C., Bowman, H. R., Asaro, F., McKee, E. H., Coats, R. R., 1975 K-Ar (basalt) 7.9±0.5 m.y.
Olivine basalt, 9 m thick flow, top vesicular; uppermost of three flows. Cliff on west side of Jarbidge River, south of the Nevada-Idaho stateline (41° 59′48″N, 115° 25′24″W; Elko Co., NV); collected by: R. R. Coats, U. S. Geol. Survey, sample 54NC93; dated by: E. H. McKee, U. S. Geol. Survey.

23. Axelrod, D. I., 1964 K-Ar (biotite) 39±1 m.y.
Schilling, J. H., 1965 (sanidine) 40±1 m.y.
Dead Horse Tuff, biotite-hornblende rhyolite lapilli tuff (sec. 30, T. 45 N., R. 58 E.; 41° 46′N, 115° 28′W (approx.); Elko Co., NV); collected by: D. I. Axelrod (1961); dated by: Geochron Labs (1962). Comment: Axelrod (1964) does not give location or data; Schilling (1965) samples 94A and 94B.

23a. Coats, R. R., 1964 K-Ar (biotite) 39.9 m.y.
Schilling, J. H., 1965
Dead Horse Tuff; crystal-vitric rhyolite tuff (41°46′N, 115°28′W; Elko Co., NV); collected by: D. I. Axelrod (1961); dated by: Geochron Labs (1962). Comment: Schilling (1965) sample 95 and Coats (1964) do not give location or data. Approximate location is from Schilling (1965) map.

24. Unpublished K-Ar (biotite) 41.8±1.5 m.y.
Rhyodacite vitrophyric welded tuff (115°26′30″W; 41°43′25″N; Elko Co., NV). Analytical data: K_2O = 7.81%, 7.99%, $*Ar^{40}$ = 4.935 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 56.2%; collected by: R. R. Coats, U. S. Geol. Survey, sample 57NC90; dated by: E. H. McKee, U. S. Geol. Survey.

25. Evernden, J. F., Savage, D. E., Curtis, G. H., and James, G. T., 1964 K-Ar (sanidine) 15.4 m.y.
Schilling, J. H., 1965
Jarbidge rhyolite, basal phase sanidine (sec. 4, T. 43 N., R. 55 E., 41° 41′01″N, 115° 47′00″W; Elko Co., NV); collected by: R. R. Coats, U. S. Geol. Survey; dated by: California Univ. Berkeley (UC KA-1380). Comment: Basal phase of Jarbidge rhyolite containing epithermal gold-silver veins; Schilling (1965) sample 91.

26. Axelrod, D. I., 1964 K-Ar (biotite) 35.2±1 m.y.
Schilling, J. H., 1965
Chicken Creek Tuff of Evernden and James (1964), biotite rhyolite ash about 600 feet above Bull Run flora biotite rhyolite ash (sec. 11, T. 42 N., R. 51 E.; 41°33′N, 116°12′W, approx.; Elko Co., NV); collected by: D. I. Axelrod (1961); dated by: Geochron Labs (1962). Comment: Schilling (1965), sample 93. Axelrod (1964) mentions this date but does not give location.

27. Unpublished K-Ar (sanidine) 15.3±0.5 m.y.
Biotite, sanidine welded tuff (Cornucopia mining district; approx. 116°17′30″W, 41°33′N; Elko Co., NV). Analytical data: K_2O = 6.78%, 6.79%, $*Ar^{40}$ = 1.546 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 44%; collected by: R. R. Coats, U. S. Geol. Survey, sample 66NC20; dated by: J. C. Von Essen, U. S. Geol. Survey.

28. Unpublished K-Ar (biotite) 33.9±1.0 m.y.
Dike of biotite pheno-rhyodacite (41°29′N, 116°28′W; Elko Co., NV). Analytical data: K_2O = 8.72%, $*Ar^{40}$ = 4.408 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 82%; collected by: R. R. Coats, U. S. Geol. Survey, sample 70NC106; dated by: E. H. McKee, U. S. Geol. Survey.

29. Unpublished K-Ar (biotite) 37.8±1.1 m.y.
Dike of biotite rhyolite felsophyre (41°24′N, 116°27′W; Elko Co., NV). Analytical data: K_2O = 8.39%, $*Ar^{40}$ = 4.727 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 72%; collected by: R. R. Coats, U. S. Geol. Survey, sample 70NC101; dated by: E. H. McKee, U. S. Geol. Survey.

30. Unpublished K-Ar (adularia) 15.0±0.4 m.y.
Mineralized vein adularia in altered rhyolite (Sheep Creek Range; Midas mining district; 41° 15′N, 116° 48′W; Elko Co., NV). Analytical data: K_2O = 15.36%, $*Ar^{40}$ = 3.41 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 95%; collected by: D. R. Shawe, U. S. Geol. Survey, sample DRS-9-67; dated by: R. F. Marvin, U. S. Geol. Survey.

31. Unpublished K-Ar (sanidine) 32.1±1.1 m.y.
Rhyodacite (approx. 116°33′W, 41°14′N; Elko Co., NV). Analytical data: K_2O = 12.16%, $*Ar^{40}$ = 5.822 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 66.7%; collected by: R. R. Coats, U. S. Geol. Survey, sample 66NC148; dated by: E. H. McKee, U. S. Geol. Survey.

32. Unpublished K-Ar (biotite) 39.3±1.2 m.y.
Biotite dacite ignimbrite (41°19′N, 116°33′W; Elko Co., NV). Analytical data: K_2O = 7.91%, $*Ar^{40}$ = 4.636 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 78.3%; collected by: R. R. Coats, U. S. Geol. Survey, sample 71NC291; dated by: E. H. McKee, U. S. Geol. Survey.

33. Unpublished K-Ar (biotite) 37.9±1.0 m.y.
Biotite rhyodacite welded tuff (41°20′N, 116°29′W; Elko Co., NV). Analytical data: K_2O = 8.20%, $*Ar^{40}$ = 4.638 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 89.7%; collected by: R. R. Coats, U. S. Geol. Survey, sample 70NC96; dated by: E. H. McKee, U. S. Geol. Survey.

34. Unpublished K-Ar (biotite) 33.6±1.6 m.y.
Rhyolite pumice in mudflow (116°27′18″W, 41°20′N; Elko Co., NV). Analytical data: K_2O = 6.63%, 6.66%, $*Ar^{40}$ = 3.326 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 30.0%; collected by: R. R. Coats, U. S. Geol. Survey, sample 68NC114; dated by: E. H. McKee, U. S. Geol. Survey.

35. Unpublished K-Ar (biotite) 35.4±1.1 m.y.
Rhyodacite (116°23′25″W, 41°19′20″N; Elko Co., NV). Analytical data: K_2O = 8.80%, 8.80%, $*Ar^{40}$ = 4.646 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 66.7%; collected by: R. R. Coats, U. S. Geol. Survey, sample 68NC159; dated by: E. H. McKee, U. S. Geol. Survey.

36. Coats, R. R., and McKee, E. H., 1972 K-Ar (biotite) 38.4±1.5 m.y.
Granodiorite of Mount Neva (116°21′40″W, 41°19′20″N; Elko Co., NV). Collected by: R. R. Coats, U. S. Geol. Survey; dated by: E. H. McKee, U. S. Geol. Survey.

37. Unpublished K-Ar (biotite) 41.0±1.2 m.y.
Biotite rhyodacite pumice (116°17′30″W, 41°14′10″N; Elko Co., NV). Analytical data: K_2O = 8.38%, 8.37%, $*Ar^{40}$ = 5.139 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 66.7%; collected by: R. R. Coats, U. S. Geol. Survey, sample 67NC23; dated by: E. H. McKee, U. S. Geol. Survey.

38. Unpublished K-Ar (adularia) 38.4±1.1 m.y.
Mineralized vein (Modoc vein, Tuscarora district; 41°18′55″N, 116°13′25″W; Elko Co., NV). Analytical data: K_2O = 14.87%, 14.77%, $*Ar^{40}$ = 8.496 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 75%; collected by: R. R. Coats, U. S. Geol. Survey, sample 67NC13; dated by: E. H. McKee, U. S. Geol. Survey.

39. Unpublished K-Ar (whole rock) 35.4±1.0 m.y.
Olivine-hypersthene basaltic andesite (116°15′W, 41°14′N; Elko Co., NV). Analytical data: K_2O = 3.05%, $*Ar^{40}$ = 1.610 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 90%; collected by: R. R. Coats, U. S. Geol. Survey, sample 70NC28; dated by: E. H. McKee, U. S. Geol. Survey.

40. Unpublished K-Ar (biotite) 40.7±1.2 m.y.
Biotite hornblende rhyodacite ignimbrite (41°16′N, 115°58′W; Elko Co., NV). Analytical data: K_2O = 8.63%, $*Ar^{40}$ = 5.238 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 84.8%; collected by: R. R. Coats, U. S. Geol. Survey, sample 69NC41; dated by: E. H. McKee, U. S. Geol. Survey.

41. Mark, R. K., Lee-Hu, C., Bowman, H. R., Asaro, F., McKee, E. H., and Coats, R. R., 1975 K-Ar (whole rock basalt) 8.2±0.6 m.y.
Olivine basalt flow forming rimrock (on a hill on S side of Shoshone Creek, S side of Shoshone Creek, about 6.5 km SE of Jackpot, Elko Co., NV; 41°57′00″N, 114°35′54″W). Collected by: Roger Hope, U. S. Geol. Survey; dated by: E. H. McKee, U. S. Geol. Survey.

42. Blue, D. M., 1960 K-Ar (sanidine) 8.4±0.2 m.y.
Armstrong, R. L., 1970
Quartz latite vitrophyre (41°20′10″N, 114°1′35″W; N end Pilot Range, UT); dated by: R. L. Armstrong, Yale Univ. Comment: Armstrong (1970), sample 139.

43. Coats, R. R., Marvin, R. F., and Stern, T. W., 1965 K-Ar (biotite) 31±1.55 m.y.
Biotite granodiorite (W side Patterson Pass, Pilot Range; SE¼ sec. 33, T. 6 N., R. 19 W.; Box Elder County, UT; 41°13′N, 114°01′W); collected by: R. R. Coats, U. S. Geol. Survey, sample 63NC106; dated by: R. F. Marvin, U. S. Geol. Survey. Comment: Pb-α dated 30±10 m.y. from same rock.

44. Schaeffer, F. E., and Anderson, W. L., 1960 K-Ar (sanidine) 11.6±0.4 m.y.
Armstrong, R. L., 1970
Tridymite rhyolite (40°44′50″N, 114°5′45″W; Elko Co., NV); dated by: R. L. Armstrong, Yale Univ. Comment: Armstrong (1970) sample 90.

45. Schilling, J. H., 1965 K-Ar (biotite) 33.4±0.7 m.y.
Armstrong, R. L., 1966 and 1970
Kingsley stock. Medium-grained hornblende-biotite adamellite. Biotite (3% cl) 10% hornblende (40°7′40″N, 114°20′45″W; Elko Co., NV); dated by: R. L. Armstrong, Yale Univ. Comment: In Armstrong (1970) revised the 1966 date: location is in 1966 paper, Schilling (1965), sample 68.

46. Unpublished K-Ar (biotite) 36.3±1.1 m.y.
Quartz latite (40°07′N, 114°13′W; Elko Co., NV). Analytical data: K_2O = 8.83%, 8.91%, $*Ar^{40}$ = 4.797 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 75%; collected by: R. K. Hose, U. S. Geol. Survey, sample H-64-132; dated by: M. A. Lanphere, U. S. Geol. Survey.

47. Unpublished K-Ar (biotite) 38.7±1.5 m.y.
Rhyolite (40°07′N, 114°12′30″W; Elko Co., NV). Analytical data: K_2O = 8.59%, 8.90%, $*Ar^{40}$ = 5.050 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 86%; collected by: R. K. Hose, U. S. Geol. Survey, sample H-64-49; dated by: M. A. Lanphere, U. S. Geol. Survey.

48. Unpublished K-Ar (biotite) 34.6±1.4 m.y.
Rhyolite vitrophyre flow (114°58′W, 40°00′33″N; White Pine Co., NV). Analytical data: K_2O = 3.38%, 3.38%, $*Ar^{40}$ = 4.318 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 62.4%; collected by: M. C. Blake, Jr., U. S. Geol. Survey, sample B66-210; dated by: E. H. McKee, U. S. Geol. Survey.

49. Unpublished K-Ar (sanidine) 34.8±1.0 m.y.
(biotite) 32.7±1.0 m.y.
Rhyolite (39°51′N, 114°27′W; White Pine Co., NV). Analytical data: (sanidine) K_2O = 10.18%, 10.18%, $*Ar^{40}$ = 5.286 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 88%; (biotite) K_2O = 7.67%, 7.78%, $*Ar^{40}$ = 3.767 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 72%; collected by: M. C. Blake, Jr., U. S. Geol. Survey, sample CB-64-43; dated by: M. A. Lanphere, U. S. Geol. Survey.

50. Schilling, J. H., 1965 K-Ar (biotite) 32.1±0.6 m.y.
Armstrong, R. L., 1966, 1970
Dike in Cherry Creek stock. Fine-grained porphyritic leucoadamellite (sec. 31, T. 23 N., R. 63 E.; 39°49′20″N, 114°53′55″W; White Pine Co., NV); dated by: R. L. Armstrong, Yale Univ. Comment: In 1970, Armstrong revised the 1966 date. Location is in 1966 paper, Schilling (1965) sample 70.

51. Schilling, J. H., 1965 K-Ar (biotite) 36.2±0.7 m.y.
Armstrong, R. L., 1966 and 1970
Coarse- to medium-grained biotite granite porphyry (sec. 9, T. 20 N., R. 63 E.; 39°37′15″N, 114°53′50″W; White Pine Co., NV); dated by: R. L. Armstrong, Yale Univ. Comment: In 1970, Armstrong revised the 1966 date. Location is in 1966 paper, Schilling (1965) sample 71.

52. Unpublished K-Ar (plagioclase) 33.9±1.3 m.y.
(biotite) 35.2±1.0 m.y.
Quartz latite (39°41′N, 114°27′W; White Pine Co., NV). Analytical data: (plagioclase) K_2O = 0.459%, 0.464%, $*Ar^{40}$ = 0.2315 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 49%; (biotite) K_2O = 7.42%, 7.44%, $*Ar^{40}$ = 3.898 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 89%; collected by: R. K. Hose, U. S. Geol. Survey, sample H-64-148; dated by: M. A. Lanphere, U. S. Geol. Survey.

53. Unpublished K-Ar (biotite) 34.2±1.3 m.y.
"Eutaxite" of Kalamazoo Creek. Rhyolite welded tuff (114°37′W, 39°34′N; White Pine Co., NV). Analytical data: K_2O = 7.37%, 7.44%, 7.54%, $*Ar^{40}$ = 3.801 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 78.7%; collected by: M. C. Blake, Jr., U. S. Geol. Survey, sample B67-68; dated by: E. H. McKee, U. S. Geol. Survey.

54. Armstrong, R. L., 1970 K-Ar (biotite) 35.1±0.7 m.y.
Hornblende biotite andesite vitric welded tuff (114°37′00″W, 39°33′40″N; White Pine Co., NV). Comment: Sample contains mostly biotite, 20% hornblende and 3% chlorite, Armstrong (1970) sample 191F.

55. Young, J. C., 1960 K-Ar (biotite) 31.8±0.7 m.y.
Armstrong, R. L., 1970
Biotite dacite crystal welded tuff (39°32′00″N, 114°37′40″W; White Pine Co., NV); collected by: R. L. Armstrong, Yale Univ.; dated by: R. L. Armstrong. Comment: Sample contains 85% biotite and 15% hornblende, Armstrong (1970) sample 194.

56. Schilling, J. H., 1965 K-Ar (biotite) 33.6±0.7 m.y.
Armstrong, R. L., 1966 and 1970
Medium- to coarse-grained biotite adamellite Heuser Peak pluton (39°24′10″N, 114°51′50″W; White Pine Co., NV); dated by: R. L. Armstrong, Yale Univ. Comment: In 1970 Armstrong revised the 1966 date. Location is in 1966 paper, Schilling (1965) sample 72.

57. McDowell, F. W., and Kulp, J. L., 1967 K-Ar (biotite) 37±1 m.y.
Rhyolite (intrusive) Liberty Pit at Ruth near Ely (approx. 115°00′W, 39°15′30″N; White Pine Co., NV); collected by: H. L. Bauer; dated by: Lamont Labs. sample L-969. Comment: Location shown on map from Bauer and others (1960).

58. Unpublished K-Ar (biotite) 36±4 m.y.
Dacite vitrophyre (39°09′50″N, 114°37′54″W; White Pine Co., NV). Analytical data: K_2O = 5.45%, $*Ar^{40}$ = 0.0118 ppm = 2.95 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 86%; collected by: Harald Drewes, U. S. Geol. Survey, sample 59D320; dated by: H. H. Thomas and R. F. Marvin, U. S. Geol. Survey.

59. Drewes, Harald, 1967 K-Ar (biotite) 34.8±0.7 m.y.
Armstrong, R. L., 1970
Biotite latite vitric crystal welded tuff (39°09′40″N, 114°38′20″W; White Pine Co., NV); dated by: R. L. Armstrong, Yale Univ. Comment: Armstrong (1970) sample 149.

60. No entry.

61. Drewes, Harald, 1967 K-Ar (biotite) 38±4 m.y.
Quartz latite vitrophyre (39°06′20″N, 114°41′50″W; White Pine Co., NV). Analytical data: K_2O = 9.08%, $*Ar^{40}$ = 0.0207 ppm = 5.175 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 85%; collected by: Harald Drewes, U. S. Geol. Survey, sample 60D414; dated by: H. H. Thomas and R. F. Marvin, U. S. Geol. Survey.

62. Unpublished K-Ar (biotite) 35.1±1.3 m.y.
Quartz monzonite of the Ward intrusive (114°53′W, 39°04′48″N; White Pine Co., NV). Analytical data: Unavailable; dated by: Geochron Lab., Inc. Comment: James (1971).

63. Unpublished K-Ar (sanidine) 32.0±1.1 m.y.
Rhyolite welded tuff (tuff of charcoal ovens) (39°02′N, 114°51′W; White Pine Co., NV). Analytical data: K_2O = 12.60%; $*Ar^{40}$ = 6.02 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 85.3%; collected by: M. C. Blake, Jr., U. S. Geol. Survey, sample B69-54; dated by: E. H. McKee, U. S. Geol. Survey.

64. Unpublished K-Ar (biotite) 21.9±0.8 m.y.
Rhyolitic airfall tuff, basal unit (near Lehman Cave, 114°13′30″W, 39°06′N; White Pine Co., NV). Analytical data: K_2O = 9.02%, 9.01%, 8.88%, $*Ar^{40}$ = 2.913 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 61.9%; collected by: M. C. Blake, Jr., U. S. Geol. Survey, sample B67-52; dated by: E. H. McKee, U. S. Geol. Survey.

65. Schilling, J. H., 1965 K-Ar (hornblende, biotite) 28.5±0.8 m.y.
Armstrong, R. L., 1970
Highly welded crystal-vitric tuff (39°06′15″N, 114°13′00″W; White Pine Co., NV); collected by: R. L. Armstrong, Yale Univ.; dated by: R. L. Armstrong. Comment: Armstrong (1970) sample 183B; Schilling (1965) sample 29.

66A. Lee and others, 1970 K-Ar (muscovite) 31±2 m.y.
Aplite (Snake Range, 38°57′55″N; 114°12′10″W; White Pine Co., NV). Analytical data: K_2O = 10.10%, $*Ar^{40}$ = 4.65 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 82%; collected by: Donald E. Lee, U. S. Geol. Survey, sample no. 121-MW-60; dated by: H. H. Thomas and R. F. Marvin, U. S. Geol. Survey.

66B. Lee and others, 1970 K-Ar (muscovite) 34±1 m.y.
Aplite (Snake Range, 38°59′30″N, 114°12′30″W; White Pine Co., NV). Analytical data: K_2O = 10.06%, $*Ar^{40}$ = 5.096 x 10^{-10} moles/gm, $*Ar^{40}/\Sigma Ar^{40}$ = 82%; collected by: Donald E. Lee, U. S. Geol. Survey, sample no. 119-MW-60; dated by: R. F. Marvin, U. S. Geol. Survey.

66C. Lee and others, 1970 Rb-Sr (muscovite) 28±3 m.y.
Aplite (Snake Range, 39°00′30″N, 114°13′30″W; White Pine Co., NV). Analytical data: Rb = 529 ppm, Sr = 8.88 ppm, Rb^{87}/Sr^{86} = 0.7821, $*Sr^{87}/\Sigma Sr^{87}$ = 8.7%, initial Sr^{87}/Sr^{86} assumed to be 0.714; collected by: Donald E. Lee, U. S. Geol. Survey; dated by: Z. E. Peterman, U. S. Geol. Survey.

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