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The eight potassium-argon dates on samples from the northern Pine Forest Mountains of Humboldt County, Nevada and the Pueblo Mountains of Harney County, Oregon that are reported here will be incorporated in a Master of Science thesis in Geology now in preparation. Bryant (1969), Burnam (1971), and Row (1971) have completed Master of Science theses previously as part of a systematic study of this region. Samples for dating were collected in December 1971 by Dr. H. E. Enlows (Oregon State University Geology Department) and the author. Donald J. Parker (Oregon State University Geology Department) conducted the analyses at Yale University.

The K-Ar data were obtained using standard analytical techniques as described by Armstrong (1970). Argon was determined by isotope dilution, potassium by atomic absorption spectrophotometry. The dates are computed using the following constants: $K^{40} = 0.0119$ atom percent; $K\lambda_\beta = 4.72 \times 10^{-10} yr^{-1}$, $K\lambda_\epsilon = 0.584 \times 10^{-10} yr^{-1}$. Analyses of standards indicate that calibrations are accurate within 2%. Uncertainties reported are for analytical error only and represent one standard deviation, or the standard error for averaged dates. The geochronometry laboratory of Yale University is supported by NSF Grant GA 26025.

GEOLOGIC DISCUSSION

The north-south trending Pine Forest and Pueblo Mountains are located in the northwest portion of the Basin and Range Structural Province. The low-grade regionally metamorphosed geosynclinal basement rocks have been intruded by gabbros, quartz diorites, granodiorites, quartz monzonites, leucogranodiorites and aplites, some displaying contact aureoles and crosscutting features. These rocks are partially covered by late Tertiary igneous rocks. The block faulting and uplift producing the present terrain began in Oligocene time and continues today.

The granitic rocks of northwestern Nevada are considered by Smith and others (1971) to be a link between the Sierra Nevada and Idaho batholiths. The basis for this conclusion is the similarity in petrology, chemistry, and ages of the intrusive rocks in these three areas.

Petrologically and chemically the granitic rocks of northwestern Nevada are divided into three broad categories by Smith and others (1971): 1. quartz diorites (175 m.y.), 2. leucogranodiorites to quartz monzonites (85-105 m.y.), and 3. granodiorites (85-105 m.y.). Similar granitic rocks which occur in southwestern Oregon may be petrographically and chemically related to the three broad categories above.

The dates for the granitic rocks from Oregon are 91.3±1.3 m.y. for the porphyritic quartz monzonite (sample no. 3) and 92.4±1.3 m.y. for the diorite porphyry (no. 2). These dates are somewhat less than the two dates for the Pine Forest quartz diorites (no. 2, 101±2.0 m.y.) and (no. 3, 107±2.1 m.y.). A date for a Pine Forest leucogranodiorite (no. 1) of 93.6±1.5 m.y. is similar to the Pueblo Mountain dates. Smith and others (1971) obtained similar results for the southern Pine Forest Duffer Peak pluton, 96.2±3.5 m.y., (nos. 1 & 2 are the same as samples 12 and 11 respectively, of Smith and others [1971]).

The dates of 108±1.5 m.y. and 100±2.0 m.y. for the regional metamorphics (nos. 1 & 5, respectively) of the Pueblo Mountains are very similar to the dates for the Pine Forest granitic intrusive rocks, and only slightly older than the dates for the granitic plutons in the Pueblo Mountains. None of these dates are necessarily the times of emplacement of the granitic rocks or of the regional metamorphism as they may be set by cooling consequent upon

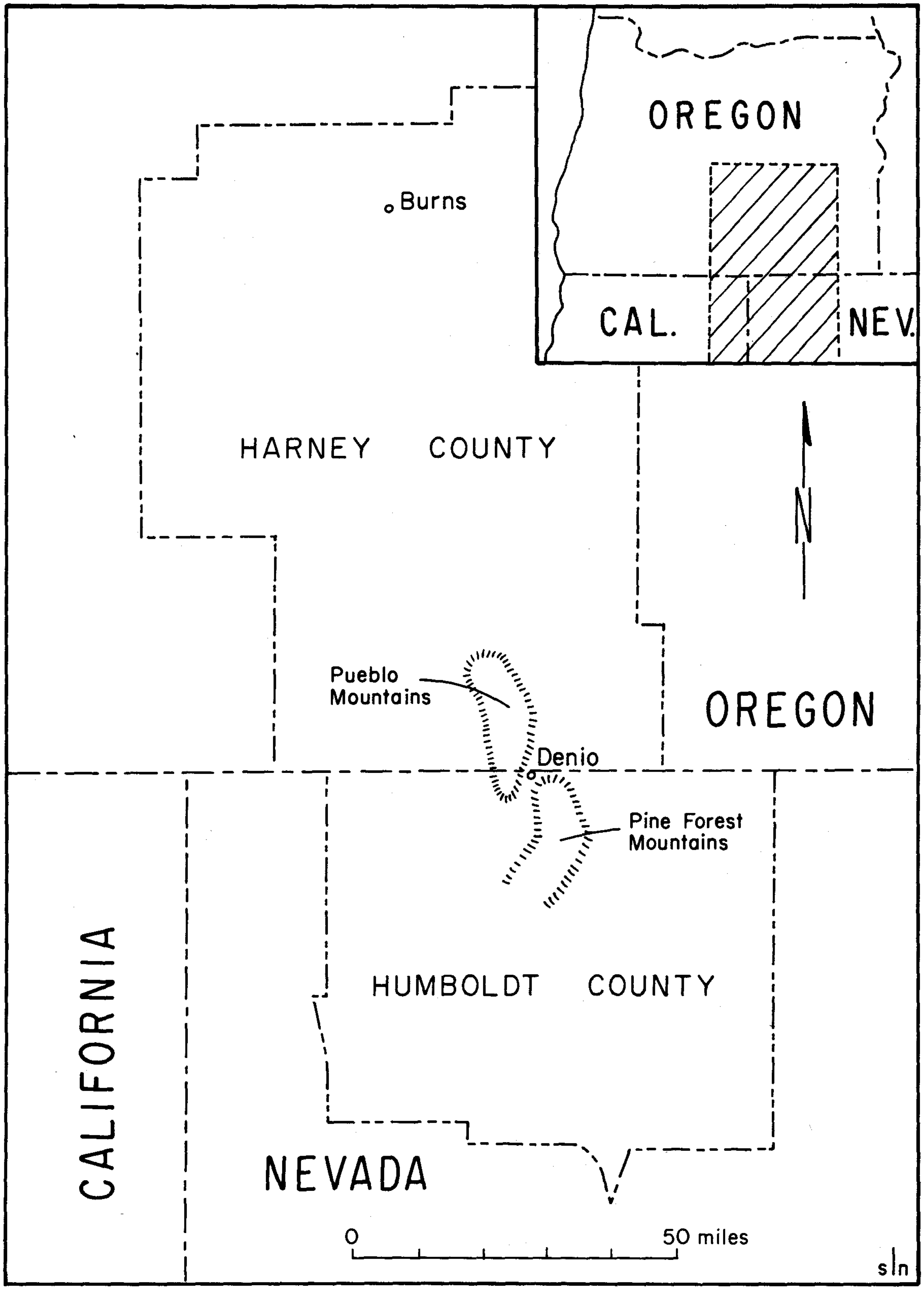

Figure 1. Index map showing the location of Pine Forest and Pueblo Mountains of northwestern Nevada and southern Oregon.

later uplift and erosion. Nevertheless, they provide an upper limit on the age of plutonic events and are consistent with the interpretation that the sierra-type batholiths can be followed northward into Oregon.

SAMPLE DESCRIPTIONS

(A. Pueblo Mountains)

1. YU-P-1 K-Ar (plagioclase) 108±1.5 m.y.

Regionally metamorphosed andesite porphyry (Sec. 8, T40S, R35E; 42°06′30″N, 118°37′18″W; approx. 11.1 mi SE of Fields, Harney Co., OR). Andesine phenocrysts 1-15 mm in length are almost totally altered to white mica and calcite and are rimmed by perthite. The finer grained matrix makes up approximately 65 percent of the rock and consists of quartz, plagioclase (albite), chlorite, sphene, epidote replacing mafics, and calcite. This rock has been subjected to low-grade regional metamorphism, the quartz-albite-muscovite subfacies of the greenschist facies. Analytical data: K = 3.61, 3.60, 3.64%; $\overset{*}{Ar}{}^{40}$ = 15.90 x 10^{-6} cc/gm (92% ΣAr^{40}), 16.11 x 10^{-6} cc/gm (82% ΣAr^{40}).

2. YU-P-2 K-Ar (whole rock) 92.4±1.3 m.y.

Strawberry Butte. Diorite porphyry (Sec. 36, T47N, R28E; 41°0′30″N, 118°42′5″W; approx. 4.5 mi SW of Denio, Humboldt Co., NV) with andesine phenocrysts 2 to 6 mm in length. The xenomorphic granular groundmass is plagioclase (andesine), green biotite, epidote, and quartz. The crystals average 1 mm in length. The andesine phenocrysts are corroded and altered to epidote, sericite kaolin and calcite. Biotite contains inclusions of euhedral to anhedral magnetite and epidote. Analytical data: K = 3.29, 3.26%; $\overset{*}{Ar}{}^{40}$ = 12.22 x 10^{-6} cc/gm (70% ΣAr^{40}), 12.55 x 10^{-6} cc/gm (33% ΣAr^{40}).

3. YU-P-3 K-Ar (biotite) 91.3±1.3 m.y.

Porphyritic quartz monzonite (Sec. 8, T41S, R35E; 42°1′30″N, 118°38′15″W; approximately 2.7 mi N of Denio, Humboldt Co., NV) with a hypidiomorphic granular texture. Phenocrysts of plagioclase (albite and oligoclase), microcline, and hornblende are 6 mm in length. The groundmass crystals, plagioclase, microcline and quartz, average 2 mm in length. Accessory minerals include sphene, magnetite and apatite. Hydrothermal alteration has affected this rock with the introduction of biotite, epidote, and sericite. Analytical data: K = 6.33, 6.35%; $\overset{*}{Ar}{}^{40}$ = 23.62 x 10^{-6} cc/gm (89% ΣAr^{40}), 23.75 x 10^{-6} cc/gm (88% ΣAr^{40}).

4. YU-P-156 K-Ar (microcline microperthite) 59.5±1.2 m.y.

Aplite (Sec. 5, T40S, R35E; 42°7′30″N, 118°37′45″W; approx. 9.9 mi SE of Fields, Harney Co., OR) intruding metaquartz diorite and a metabasic volcanic rock that have been subjected to greenschist metamorphism as has no. 1 (above). The aplite is fine grained (less than 1 mm) xenomorphic granular. The essential minerals are quartz and microperthitic orthoclase with accessory plagioclase feldspar (andesine), hornblende, tourmaline, apatite and chalcopyrite. There is no visible alteration of the feldspar and a noticeable lack of mafic minerals. Analytical data: K = 8.72, 8.63%; $\overset{*}{Ar}{}^{40}$ = 20.94 x 10^{-6} cc/gm (84% ΣAr^{40}). Comment: The low age probably is due to considerable post-emplacement loss of radiogenic Ar from K-feldspar, a familiar phenomenon.

5. YU-P-156-1 K-Ar (whole rock) 100±2.0 m.y.

Metaquartz diorite (Sec. 5, T40S, R35E; 42°7′30″N, 118°37′45″W; approx. 9.9 mi SE of Fields, Harney Co., OR) subjected to low-grade greenschist metamorphism as have nos. 1 & 4 (above). The essential minerals are plagioclase, hornblende, and potassium feldspar. Hornblende altering to chlorite occurs after the original mafics. Plagioclase is altered to epidote, calcite, and white mica. Potassium feldspar is typically myrmekitic with quartz and altered to clay minerals. Accessory minerals include granular sphene, apatite and sphene. The rock is coarse grained averaging 7 mm, hypidiomorphic granular. Analytical data: K = 3.63%; $\overset{*}{Ar}{}^{40} = 14.82 \times 10^{-6}$ cc/gm (80% Σ Ar^{40}).

(B. Pine Forest Mountains)

YU-PF-1 K-Ar (biotite) 93.6±1.5 m.y.

Porphyritic leucogranodiorite (Sec. 20, T46N, R30E; 41°50′42″N, 118°39′6″W; approx. 10 mi SW of Denio, Humboldt Co., NV) with plagioclase (andesine), microcline, quartz, biotite, and occasionally hornblende as essential minerals. Microcline is the dominant phenocryst mineral reaching lengths of 10 cm, with myrmekitic reaction rims and embayed by quartz and plagioclase. Microcline, quartz and plagioclase have undulatory extinction. The feldspars are altered to sericite and kaolin. Accessory minerals are magnetite, zircon, apatite, epidote and sphene. The groundmass crystals, ranging in size from .1 to 4 mm, are all of the above minerals. The rock has a hypidiomorphic texture. Analytical data: K = 8.15, 8.18%; $\overset{*}{Ar}{}^{40} = 32.45 \times 10^{-6}$ cc/gm (85% Σ Ar^{40}), 32.54×10^{-6} cc/gm (85% Σ Ar^{40}).

7. YU-PF-2 K-Ar (biotite) 101±2.0 m.y.

Quartz diorite of Black Mountain (Sec. 21, T47N, R30E; 41°56′12″N, 118°38′5″W; approx. 3.7 mi S of Denio, Humboldt, Co., NV) with porphyritic to granular texture. Plagioclase (andesine) and microcline occur as phenocrysts with undulatory extinction or as equigranular grains with the other essential minerals quartz, hornblende, and biotite. Plagioclase phenocrysts, less than 12 mm in length, are bent and broken as a result of strain. Reaction rims of myrmekite occur on the plagioclase at the contacts with microcline. Kaolin and sericite are the main alteration products of the feldspars. Accessory minerals are magnetite, apatite, sphene and zircon. When porphyritic the groundmass crystals range in size from .1 to 5 mm. Analytical data: K = 7.50, 7.52%; $\overset{*}{Ar}{}^{40} = 30.97 \times 10^{-6}$ cc/gm (85% Σ Ar^{40}).

8. YU-PF-3 K-Ar (biotite) 107±2.1 m.y.

Quartz diorite (Sec. 18, T46N, R30E; 41°51′27″N, 118°40′14″W; approx. 9.4 mi SW of Denio, Humboldt Co., NV) with hypidiomorphic, porphyritic to granular texture. Essential minerals are plagioclase (calcic andesine), quartz, orthoclase, augite, hornblende, and biotite. Orthoclase and plagioclase are the common phenocrysts ranging in size from 3 to 20 mm and altered to sericite, kaolin, epidote and calcite. Myrmekitic intergrowths are also present where the plagioclase contacts the orthoclase. Augite is mantled by hornblende due to deuteric alteration. Zircon, magnetite, and apatite are the accessory minerals and occur in the groundmass with the above minerals when the rock is porphyritic. The anhedral to subhedral groundmass crystals range in size from .1 to 2 mm in the porphyritic rocks. Analytical data: K = 7.56, 7.52%; $\overset{*}{Ar}{}^{40} = 33.28 \times 10^{-6}$ cc/gm (88% Σ Ar^{40}).

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