MASTER

TOPICAL REPORT

**SUMMARY OF POTASSIUM/ARGON
AGE DATING -- 1980**

by

S. H. Evans, Jr. and F. H. Brown

Work performed under Contract No.

DE-AC07-80ID12079

Department of Geology and Geophysics

**University of Utah
Salt Lake City, Utah (USA)**

November 1980

Prepared for

DEPARTMENT OF ENERGY

Division of Geothermal Energy

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

TOPICAL REPORT

Summary of Potassium/Argon
Age Dating -- 1980

by

Stanley H. Evans, Jr.

and

F. H. Brown

November 1980

9/15

NOTICE

This report was prepared to document work sponsored by the United States Government. Neither the United States nor its agent, the United States Department of Energy, nor any Federal employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

NOTICE

Reference to a company or product name does not imply approval or recommendation of the product by the University of Utah Research Institute or the U.S. Department of Energy to the exclusion of others that may be suitable.

TABLE OF CONTENTS

	<u>PAGE</u>
ABSTRACT	1
INTRODUCTION	2
EXPERIMENTAL METHOD	2
RESULTS	3
Mineral Mountains, Utah	3
Cove Creek Domes/Twin Peaks Area, Utah	11
Beowawe, Nevada	15
Dating in Support of the State Coupled Program	17
CONCLUSIONS	21
ACKNOWLEDGEMENTS	22
REFERENCES	23

ABSTRACT

During FY80 a significant improvement in efficiency of the K-Ar laboratory was brought about by completion of a second extraction line. Two extractions can now be done routinely each day and the ^{38}Ar spike ratios of the new table will permit dating of much younger samples than previously.

Extensive K-Ar dating of samples from the Mineral Mountains shows intervals of silicic volcanism at 0.5, 0.8 and 7.5 m.y. K-Ar dating of plutonic units does not present a consistent picture, however. Plutonic events 35-40 m.y., 29 m.y. and 19-21 m.y. ago are suggested but interpretation must be considered preliminary. Joint programs with the U.S. Geological Survey now underway to study the Rb-Sr and U-Pb systematics of the Mineral Mountains pluton should aid in unravelling its history.

Dating of basalts from the Cove Creek Domes/Twin Peaks area, Utah, has aided in delineating the timing of basaltic volcanism. This adds to the already extensive data on the chronology of volcanic activity in the area.

Dating of samples from the Beowawe Known Geothermal Resources Area, Nevada have confirmed earlier dates indicating major volcanism took place 38 m.y. ago and 17-16 m.y. ago.

The State Coupled Program to assess geothermal potential of areas such as the Cascades has brought about an influx of samples from Oregon, Washington and Montana. Twenty-six samples were dated in support of the program this year.

INTRODUCTION

The purpose of this report is to record new Potassium-Argon age dates produced in our laboratory since the last dating summary (Evans, 1980). The period covered is from 1 January 1980 to 30 September 1980. During this period fifty-six new dates have been obtained. In addition, about thirty-six calibration extractions were completed, particularly in connection with construction of the second extraction line. The second extraction line was finished in late summer and has been calibrated to sufficient accuracy that it is now being used for routine extractions.

EXPERIMENTAL METHOD

No change in analytical procedures recorded in the previous summary (Evans, 1980) have been instituted. It should be noted, however, that the operating temperatures recorded for the copper-copper oxide and titanium furnaces are 450°C and 850°C, respectively, and not the reverse as indicated erroneously in Evans (1980).

Construction of a second extraction line has greatly improved operating efficiency in the laboratory. Two extractions are now routinely done during one working day. This has enabled the extraction phase of the dating procedure to keep pace with the mineral separation phase. A second benefit gained from construction of the additional extraction line was the utilization of ultrapure Argon 38 gas in the spike reservoir. The spike reservoir on the old table was filled with argon which was less than 95% Argon 38; this resulted in spike ratios of $^{40}\text{Ar}/^{38}\text{Ar} = 0.0521$ and $^{36}\text{Ar}/^{38}\text{Ar} = 0.0308$. In contrast, spike ratios for the new table have been determined to be $^{40}\text{Ar}/^{38}\text{Ar} = 0.0014$ and $^{36}\text{Ar}/^{38}\text{Ar} = 4.49 \times 10^{-5}$. This reduction of ^{40}Ar and ^{36}Ar

contamination of the spike on the new table will allow dating of younger samples with significantly improved accuracy.

The precision and accuracy of our analytical results is an on going concern in the Potassium-Argon laboratory. Periodically, samples of known age have been dated in order to establish the "accuracy" by the degree of agreement with the results of other laboratories. Two samples used in this way are U.S.G.S. standard biotite LP-6 and U.S.G.S. standard muscovite P-207. Data on LP-6 are recorded in U.S.G.S. Information Sheet No. 6 (March, 1972) and data on P-207 are recorded in Dalrymple and Lanphere (1969). These standards have been used both to calibrate spikes (in conjunction with an air pipette) and later as cross checks on dating. Other known samples have been dated and compared with results of the Potassium-Argon laboratory of the University of California at Berkeley. Our dates lie within 1.5 percent of dates detailed by other laboratories.

Repeated extraction of the same samples, thought to be homogeneous, shows that the precision of argon determinations is of the order 0.5% of the total moles of radiogenic Argon 40 extracted from typical samples. Precision of potassium analyses using the metaborate procedure given in Evans (1980) is 0.5% of the amount present.

RESULTS

Mineral Mountains, Utah

Much of the effort in the K-Ar laboratory during the last nine months has been in obtaining dates for extrusive and intrusive igneous rocks in the Mineral Mountains. Attempts were made to carefully document the timing of the silicic volcanics previously dated at 0.8 to 0.5 m.y. (Lipman et al., 1978).

The precision of the dates obtained in our laboratory was unsatisfactory, in part due to the extractions being run on the older table. With completion of the new table with the improved ^{38}Ar spike system, these volcanic rocks will be run again.

Compiled in Tables 1 and 2 are new dates for units of the Mineral Mountain pluton obtained this year. These dates were a product of a joint program with staff at the Earth Science Laboratory, University of Utah Research Institute and the author to determine age relations of the pluton. Previous detailed geologic mapping by Sibbett and Nielson (1980) provides a relative sequence of intrusion for most phases delineated by their mapping. Figure 1 presents a summary map of the Mineral Mountains pluton. The ages of Quaternary volcanism are well established as spanning a period from 0.8 to 0.5 m.y. ago (Lipman et al., University of Utah work, unpub.). A small volume of silicic volcanics exposed in Ranch and Corral canyons (Unit Trf, Figure 1) was erupted 7.5 m.y. ago.

The absolute ages of intrusive phases were unknown when mapping was begun. Units from Tpr to hgn (Table 3) were dated at least once in an effort to establish the absolute chronology of plutonism in the Mineral Mountains. Table 3 presents a complete tabulation of 36 dates obtained thus far. Ages of units from Evans (1980) as well as Tables 2 and 3 are recorded. From the data in Table 3 it is obvious that the K-Ar systematics of plutonic phases are highly disturbed. Resetting of biotite is particularly extensive and has resulted from reheating by diking (units Tpr and Trd) and possibly by tectonic events associated with uplift of the Mineral Mountains as well. Sample UT/MM 79-5 is from a rhyolite dike on the western margin of the pluton. This dike

Table 1. Samples from the Mineral Mountains, Utah

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (X10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
MR79-1	Tbg	Biotite	0.40065	7.21	13.082	62	10.4 ± 0.5
MR79-1	Tbg	Hornblende	2.00450	0.77	1.588	69	11.8 ± 0.6
MR79-2	Tdb	Biotite	0.60170	7.36	19.596	57	15.3 ± 0.6
MR79-2	Tdb	Hornblende	2.48700	0.61	2.338	58	21.8 ± 0.9
MR79-10	hgn	Biotite	0.56814	7.49	13.448	72	10.3 ± 0.6
MR79-10	hgn	Hornblende	2.50659	0.75	5.284	39	40.3 ± 1.4
MR79-15	Tpr	Biotite	0.50312	6.94	14.237	36	11.8 ± 0.4
MR79-16	Tgr	Biotite	0.60920	7.75	17.463	43	12.9 ± 0.5
MR79-17	Tg	Biotite	0.54777	7.48	14.368	74	11.0 ± 0.5
MR79-18	Ti	Biotite	0.76066	7.67	17.405	56	10.8 ± 0.4
MR79-19	Tg	Biotite	0.50824	7.77	25.641	60	18.9 ± 0.8
LM-2	Mafic Dike	Hornblende	1.00062	1.72	5.177	47	17.3 ± 0.6
MR79-9	Trf	Biotite	0.40854	6.92	1.482	72	7.39 ± 0.39

Constants Used

$$\lambda_B = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_E = 0.581 \times 10^{-10}/\text{yr.}$$

$$K^{40}/K_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

Table 2. Samples Dated from the Mineral Mountains, Utah
for Earth Science Laboratory

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (X10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
UT/MM79-150	hd	Biotite	0.52549	7.89	18.362	27	13.4 ± 0.5
UT/MM79-151	hd	Biotite	0.60145	7.77	26.392	34	19.5 ± 0.7
UT/MM79-151	hd	Hornblende	2.53078	0.67	4.503	59	38.4 ± 1.6
UT/MM79-152	Tpr	Whole Rock	1.23059	4.34	7.271	74	9.63 ± 0.55
UT/MM79-153	hd	Biotite	0.50100	7.40	17.473	57	13.6 ± 0.6
UT/MM79-153	hd	Hornblende	2.50158	0.79	3.744	33	27.2 ± 0.9
UT/MM79-154	Tqm	Biotite	0.61965	7.00	14.777	49	12.1 ± 0.5
UT/MM79-155	Td	Biotite	0.60285	7.79	22.763	44	16.8 ± 0.6
UT/MM79-155	Td	Hornblende	2.54013	0.87	5.338	39	35.0 ± 1.2
UT/MM79-157	Tg	Biotite	0.50862	5.80	14.730	67	14.6 ± 0.7

Constants Used:

$$\lambda_{\beta} = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_{\epsilon} = 0.581 \times 10^{-10}/\text{yr.}$$

$$K^{40}/K_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

Figure 1. Generalized geologic map of the Mineral Mountains pluton taken from Sibbett and Nielson (1980).

GEOLOGIC UNITS

Quaternary	Qal	— Alluvium
	Qb	— Basalt
	Qrd	— Rhyolite Domes
	Qra	— Rhyolite Ash
	Qrf	— Rhyolite Flows
Tertiary	Trf	— Rhyolite Flows and Domes
	Tpr	— Porphyritic Rhyolite Dikes
	Trd	— Rhyolite Dikes
	Tmd	— Microdiorite Dikes
	Tgr	— Granite Dikes
	Tg	— Granite
	Ts	— Syenite
	Tbg	— Biotite Granite
	Ti	— Porphyritic Quartz Monzonite
	Tqm	— Quartz Monzonite
Age Uncertain	Tdb	— Diorite Breccia
	Td	— Diorite
	hd	— Hornblende Granodiorite
	gd	— Biotite Granodiorite
	hgn	— Hornblende Gneiss
P	P	— Paleozoic Sediments and Metamorphics
	Pcbg	— Pre-Cambrian Banded Gneiss

Table 3. Tabulation of K/Ar Ages for Units in the Mineral Mountains Pluton

Unit	Sample Number	Mineral	Age (m.y.)
Tpr	MR79-15	Biotite	11.8 $\pm$ 0.4
	UT/MM79-152	Whole Rock	9.63 $\pm$ 0.55
Trd	UT/MM79-5	Whole Rock	9.06 $\pm$ 0.34
Tmd	UT/MM79-3	Biotite	12.4 $\pm$ 0.5
		Hornblende	18.8 $\pm$ 0.7
Tgr	UT/MM79-1	Biotite	11.9 $\pm$ 0.4
	MR79-16	Biotite	12.9 $\pm$ 0.5
Tg	MR79-17	Biotite	11.0 $\pm$ 0.5
	UT/MM79-157	Biotite	14.6 $\pm$ 0.7
	GR-II	Biotite	15.2 $\pm$ 0.6
	MR79-19	Biotite	18.9 $\pm$ 0.8
Tbg	MR79-1	Biotite	10.4 $\pm$ 0.5
		Hornblende	11.8 $\pm$ 0.6
Ti	MR79-18	Biotite	10.8 $\pm$ 0.4
Tqm	UT/MM79-154	Biotite	12.1 $\pm$ 0.5
	GC-8	Biotite	14.7 $\pm$ 0.6
	GC-10B	Biotite	16.6 $\pm$ 0.6
	GC-2	Biotite	20.8 $\pm$ 0.4
Tdb	MR79-2	Biotite	15.3 $\pm$ 0.6
		Hornblende	21.8 $\pm$ 0.9
Td	UT/MM79-155	Biotite	16.8 $\pm$ 0.6
		Hornblende	35.0 $\pm$ 1.2
hd	UT/MM79-150	Biotite	13.4 $\pm$ 0.5
	UT/MM79-153	Biotite	13.6 $\pm$ 0.6
	UT/MM79-151	Hornblende	27.2 $\pm$ 0.9
		Biotite	19.5 $\pm$ 0.7
gd	UT/MM79-7	Hornblende	38.4 $\pm$ 1.6
		Biotite	9.80 $\pm$ 0.42
	UT/MM79-8	Hornblende	29.2 $\pm$ 1.1
		Biotite	10.4 $\pm$ 0.4
hgn	UT/MM79-170	Hornblende	21.8 $\pm$ 0.8
		Biotite	9.85 $\pm$ 0.37
	MR79-10	Hornblende	29.4 $\pm$ 1.0
		Biotite	10.3 $\pm$ 0.6
PEbg	UT/MM79-10	Hornblende	40.3 $\pm$ 1.4
		Biotite	9.85 $\pm$ 0.37

has been brecciated and yields a whole-rock age of 9 m.y. This age coincides with two preliminary fission track ages on zircons from other dikes. It is tentatively suggested that this thermal event 9 m.y. ago corresponds to a major episode of uplift in the Mineral Mountains which resulted in brecciation of units and partial to complete resetting of many of the mineral ages. In order to document this tectonic event an extensive program of fission track dating is now underway. This program will include a sampling traverse over the crest of the range which should provide information on differential uplift rates within the Mineral Mountains.

Some information regarding the ages of plutonism in the Mineral Mountains may tentatively be gleaned from the dates recorded in Table 3. The hornblende ages of units hd and Td are nearly concordant and may represent the time of initiation of intrusion. The 40 m.y. date on unit hgn is probably from a xenolith of unit hd within hgn. Samples MR79-10 and UT/MM79-151 are identical petrographically. Units hgn and hd are extremely similar in the field and difficult to distinguish from one another.

Another interval of plutonic activity may be recorded by the 29 m.y. hornblende dates on samples UT/MM78-170 and UT/MM79-7. This age has been confirmed by a Rb/Sr date of a sample equivalent to UT/MM78-170 by Carl Hedge of the U.S. Geological Survey (Personal comm. 1979). It is suggested then that the first intervals of plutonism took place 35 to 40 m.y. and 29 m.y. ago and were dioritic in composition.

The major interval of plutonism involved emplacement of intermediate composition intrusives such as quartz monzonite Tqm and Ti. This major interval was culminated by intrusion of the large silicic units Tbg, Ts and

Tg. The timing of this plutonism is almost completely obscured, however. The oldest of the biotite ages are 19 to 21 m.y. and may represent the age of intrusion of these late silicic units. This age is roughly concordant with that of extensive silicic volcanism in the Marysvale volcanic field immediately to the east where the eruption of the Joe Lott Tuff and formation of the Mount Belknap Caldera took place approximately 18 m.y. ago (Steven et al., 1979).

In order to help unravel the complex intrusive history of plutonism in the Mineral Mountains, a cooperative program is underway with personnel of the U.S. Geological Survey to study the U/Pb systematics of the Mineral Mountains pluton as well as the Rb/Sr systematics. This information hopefully will result in arriving at a consistent model for magmatism in the Mineral Mountains.

Cove Creek Domes/Twin Peaks Area, Utah

Study of this interesting and complex area continues as part of a program to study the regional geologic setting of the Roosevelt Hot Springs KGRA. The Twin Peaks area is about 25 km north of the Roosevelt Hot Springs KGRA and represents an area of extensive bimodal volcanism active around 2.5 million years ago. Previous dating of silicic units was reported in Evans et al., 1980, and the details of the petrology are published in Crecraft et al., 1980. Three new dates on basalts associated with the silicic volcanism are recorded in Table 4. Figure 2, taken from Evans et al. (1980), shows the location of the newly dated samples as well as previously reported dates of silicic units. Samples CC79-4 would appear to be a northeastward tongue of Black Rock basalt as its age of 1.32 ± 0.09 m.y. overlaps with the date of 0.97 ± 0.25 m.y.

Table 4. Samples from Cove Creek Domes/Twin Peaks, Utah

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (x10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
CC79-4	Black Rock Basalt	Whole Rock	5.03275	1.058	0.242	80	1.32 ± 0.09
CC79-8L	Early Dome Basalt	Whole Rock	5.15022	0.847	0.372	93	2.53 ± 0.52
CC79-9U	Early Dome Basalt	Whole Rock	5.02432	0.822	0.374	90	2.62 ± 0.35

Constants Used:

$$\lambda_{\beta} = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_{\text{E}} = 0.581 \times 10^{-10}/\text{yr.}$$

$$\text{K}^{40}/\text{K}_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

Figure 2. Generalized geologic map of the Twin Peaks area showing the location of newly dated samples. (New dates in boxes)

reported for the Black Rock basalt in Hoover (1974). Samples CC79-8L and CC79-8U are from two basalt flows on the western flank of a structural dome whose N-S axis is approximately coincident with the outcrop of unit T1 on Figure 2. These two basalt flows are concordant with one another and appear to have been erupted contemporarily, a conclusion supported by their overlapping radiometric ages. A problem yet to be resolved is the age of doming in this area. The two basalt samples clearly indicate doming was post 2.5 to 2.6 m.y. Basalts were erupted from two vents along the axis of the dome and flowed down its eroded east flank; they are clearly post-dome in age. These outcrops were sampled this last field season and will be dated shortly. Acquisition of ages for the post-dome basalts will indicate if they post-date the youngest exposed silicic rocks dated at 2.35 m.y. (Evans et al., 1980). If they do, then doming is possibly due to injection of basaltic magma into shallow levels of the crust with subsequent arching of overlying rocks and, finally, eruption of post-dome basalts. However, the presence of a large mafic body under the dome is not reflected in gravity data. If the basalts do not post-date silicic activity, doming may be a result of resurgent silicic activity 2.35 m.y. ago. Resolution of the cause of doming will have important consequences regarding any geothermal potential for this area.

Beowawe, Nevada

Four new dates from the Beowawe KGRA in north-central Nevada are recorded in Table 5. These new dates as well as four previous ones are included in the report by Struhsacker (1980). This report is a detailed account of the geology of the Beowawe area and should be consulted for further information.

Table 5. Samples Dated from Beowawe, Nevada for Earth Science Laboratory

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (X10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
NV/BW 79-84	-	Biotite	0.40630	6.64	44.934	18	38.6 ± 1.3
NV/BW 79-112	-	Whole Rock	2.13457	0.83	2.390	68	16.5 ± 0.8
NV/BW 79-180	-	Plagioclase	2.08253	0.89	2.499	51	16.1 ± 0.6
NV/BW 79-154	-	Sanidine	0.52108	6.54	18.290	32	16.1 ± 0.5

Constants Used:

$$\lambda_{\beta} = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_{\alpha} = 0.581 \times 10^{-10}/\text{yr.}$$

$$K^{40}/K_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

Dating in Support of the State Coupled Program

A number of dates were obtained for state agencies as part of the State Coupled program of the Department of Energy administered by the Earth Science Laboratory Division of the University of Utah Research Institute. One date was obtained for the Montana Geological Survey and is tabulated in Table 6. This is from an area north of Yellowstone National Park presently being evaluated for geothermal potential. Seven dates were determined for the state of Washington and are recorded in Table 7. Eighteen new dates on units from the Cascades are recorded in Table 8. These dates are part of the extensive study of the Cascades presently underway at the Oregon Department of Geology and Mineral Industries. Surprisingly little is known of the volcanic stratigraphy of the Cascades and the geochronologic work underway there will be a major contribution to the geologic knowledge of the Cascade Range.

Table 6. Sample Dated for Montana Geological Survey

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (X10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
MT-80-1	-	Whole Rock	2.12833	0.838	0.973	83	6.68 ± 0.54

Constants Used:

$$\lambda_{\beta} = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_{\epsilon} = 0.581 \times 10^{-10}/\text{yr.}$$

$$K^{40}/K_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

Table 7. Samples Dated for Washington State Coupled Team

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (x10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
PLC-2, 3		Whole Rock	5.00113	0.57	0.174	93	1.78 ± 0.35
PLC-4, 5		Whole Rock	2.52630	1.52	0.280	92	1.06 ± 0.18
McN-q		Biotite	0.81368	6.71	3.989	74	3.42 ± 0.19
HM-SP-1		Whole Rock	5.01978	0.78	0.208	88	1.53 ± 0.18
RM-5		Whole Rock	2.51230	1.31	0.179	92	0.79 ± 0.13
SFCCF		Whole Rock	4.82114	0.93	0.105	89	0.65 ± 0.08
DH-2		Whole Rock	5.13920	0.57	0.378	83	3.80 ± 0.31

Constants Used:

$$\lambda_{\beta} = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_{\epsilon} = 0.581 \times 10^{-10}/\text{yr.}$$

$$K^{40}/K_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

Table 8. Samples Dated for Oregon Department of Geology and Mineral Industries

Sample No.	Unit	Material Dated	Weight (gms).	%K	Moles/gm Ar ⁴⁰ (X10 ¹¹)	%Ar ⁴⁰ atm	Age (m.y.)
CT-17	-	Whole Rock	7.31954	0.44	0.458	71	6.05 ± 0.31
CT-22	-	Whole Rock	4.68341	0.64	0.217	90	1.97 ± 0.27
CT-32	-	Whole Rock	6.59840	1.00	0.185	80	1.07 ± 0.08
CT-41	-	Whole Rock	5.09256	2.17	1.524	59	4.04 ± 0.17
CT-51	-	Whole Rock	8.01601	0.63	0.111	90	1.02 ± 0.14
CT-52	-	Whole Rock	8.10805	0.86	0.239	82	1.62 ± 0.14
CT-59	-	Whole Rock	5.42872	1.25	2.566	34	11.8 ± 0.4
CT-68	-	Whole Rock	8.02548	0.78	0.639	58	4.74 ± 0.19
CT-8	-	Whole Rock	2.08904	1.29	5.756	22	25.5 ± 0.8
CT-62	-	Whole Rock	2.81221	1.06	0.293	89	1.59 ± 0.21
CT-64	-	Whole Rock	3.00691	0.90	1.533	66	9.83 ± 0.46
SH-12	-	Whole Rock	3.53915	0.27	0.134	90	2.91 ± 0.38
OM-5	-	Plagioclase	5.03912	0.34	1.264	66	21.3 ± 1.0
OM-49	-	Whole Rock	3.07859	0.76	2.282	53	17.3 ± 0.7
OM-520	-	Plagioclase	5.00452	0.51	1.667	67	18.7 ± 0.9
BF-5	-	Whole Rock	3.05013	0.76	1.223	56	9.31 ± 0.44
Bullard-1	-	Whole Rock	0.74802	3.36	14.448	29	24.6 ± 0.9
Bullard-2	-	Plagioclase	4.27471	0.52	2.449	37	27.2 ± 0.9

Constants Used:

$$\lambda_{\beta} = 4.962 \times 10^{-10}/\text{yr.}$$

$$\lambda_{\epsilon} = 0.581 \times 10^{-10}/\text{yr.}$$

$$K^{40}/K_{\text{Tot.}} = 1.167 \times 10^{-4} \text{ Mole/Mole}$$

CONCLUSIONS

During the report period, a marked increase in efficiency for our laboratory has resulted from the construction and calibration of a second extraction line. The much greater purity of the spike for this table will enable us to date young samples with increased accuracy and precision.

During the present period the backlog of samples for dating was overcome so turn-around time now is strictly dependent on sample preparation. Whole-rock samples can be processed in less than one month. Samples requiring the separation of minerals involve longer times, depending on the difficulty of obtaining pure separates.

With the arrival of the K-Ar laboratory to a fully operational status, it is expected that dating of samples for various Department of Energy programs administered by Earth Science Laboratory will provide much valuable new data for geologists involved in geothermal exploration and evaluation programs. This contribution of data will be particularly important in areas such as the Cascades where very little is known of the volcanic stratigraphy. Other studies underway in North-central Nevada are equally likely to benefit from the age dating programs presently underway.

ACKNOWLEDGEMENTS

Without the able assistance of Margo Jennison, Mary Beth Sienkewicz, Beatrice Griffey and Heidi Shlosar, the dating reported on herein would not have been possible. Funding for research in the Potassium/Argon Laboratory was by Department of Energy Contract No. DE-AC07-80ID12079 to the University of Utah. This report was substantially improved by the reviews of Dr. W. P. Nash of the University of Utah and Dr. D. L. Nielson of the Earth Science Laboratory Division/University of Utah Research Institute.

REFERENCES

- Anonymous, 1972, United States Dept. of the Interior, Geological Survey
Memorandum: LP-6 Bio. 40-60u; Information Sheet No. 6, March, 1972.
- Creecraft, H. R., Nash, W. P. and Evans, S. H. Jr., 1980, Petrology, Geochronology and chemical evolution of the Twin Peaks rhyolite domes, Utah: DOE/DGE Topical Report 12079-4, University of Utah, 200 p.
- Dalrymple, G. B. and Lanphere, M. A., 1969, Potassium-argon dating: W. H. Freeman and Company, San Francisco, 250 p.
- Evans, S. H., Jr., 1980, Summary of potassium/argon age dating -- 1979: DOE/DGE Topical Report 28392-41, University of Utah, 23 p.
- Evans, S. H., Jr., Creecraft, H. R. and Nash, W. P., 1980, K/Ar ages of silicic volcanism in the Twin Peaks/Cove Creek Dome area, southwestern Utah: Isochron/West, no. 28, p. 21-24.
- Hoover, J. D., 1974, Periodic Quaternary volcanism in the Black Rock Desert, Utah: Brigham Young Univ. Geol. Studies, v. 21, p. 2-72.
- Lipman, P. W., Rowley, P. D., Mehnert, H., Evans, S. H., Jr., Nash, W. P. and Brown, F. H., 1978, Pleistocene rhyolite of the Mineral Mountains Utah: geothermal and archeological significance: Jour. Res. U.S. Geol. Survey, v. 6, no. 1, p. 133-147.
- Sibbett, B. S. and Nielson, D. L., 1980, Geology of the Central Mineral Mountains, Beaver County, Utah: DOE/DGE Report ESL-33, Earth Science Laboratory, University of Utah Research Institute, 42 p.
- Steven, T. A., Cunningham, C. G., Naeser, C. W. and Mehnert, H., 1979, Revised stratigraphy and radiometric ages of volcanic rocks and mineral deposits in the Marysvale area, west-central Utah: U.S. Geol. Survey Bull. 1469, 40 p.
- Struhsacker, E. M., 1980, The geology of the Beowawe geothermal system, Eureka and Lander Counties, Nevada: DOE/DGE Report ESL-37, Earth Science Laboratory, University of Utah Research Institute, 78 p.