Previous section
Volume contents

Isotopic Ages of Igneous Intrusions in Southeastern Utah

By Kim R. Sullivan[1]

CONTENTS

TABLE

Previously determined ages for the Abajo, Henry, and La Sal Mountains in southeastern Utah (table 1) lack consistency and reflect the problems associated with K-Ar age determination on certain materials (such as hornblende, pyroxene, whole rocks, or altered mafic minerals). To provide a more consistent geochronology of these laccolithic centers, samples were collected from multiple intrusive bodies in each range. Zircon and sphene were separated, prepared, and analyzed according to standard fission-track techniques (Naeser, 1978). The resulting ages (table 2) show that these laccolithic centers were emplaced between about 30 and 20 Ma, making them contemporaneous with the Reno-Marysvale and San Juan volcanic zones to the west and east. Ranges of zircon ages for these intrusions are as follows: 22.6±2.2 to 28.6±3.4 Ma (Abajo Mountains); 20.0±1.9 to 29.2±2.3 Ma (Henry Mountains); 28.7±2.7 Ma (La Sal Mountains, one sample). These data suggest the existence of an essentially continuous, intracontinental magmatic zone extending from Reno to the San Juan Mountains during the Oligocene and early Miocene. The length of this zone (more than 1,000 km) and its orientation perpendicular to the trend of the subduction zone along the western coast of North America are additional constraints on the subduction models generally used to explain mid-Cenozoic igneous activity in the western United States.

[1] Department of Geology, Brigham Young University, Provo, Utah 84602.

Table 1. Previous age determinations of Utah laccolithic centers

[All K–Ar ages corrected for new age constants (Dalrymple, 1979). Do., ditto (same as above)]

Laccolithic center	Lithology	Material dated	Method	Age (Ma)	Reference
Abajo Mountains	Altered hornblende-diorite porphyry.	Altered mafic rock (chlorite).	K–Ar	28.1	Armstrong (1969).
		Whole rock minus heavy fraction.	K–Ar	28.9	Do.
Henry Mountains	Hornblende-monzodiorite porphyry.	Hornblende (17 percent rock).	K–Ar	[1] 44.8	Do.
		Whole rock minus heavy fraction.	K–Ar	49.2	Do.
La Sal Mountains	Hornblende-diorite porphyry.	Pyroxene-hornblende (5 percent rock).	K–Ar	24.1	Do.
	Soda syenite porphyry ---	Aegerine augite --------	K–Ar	26.1±2.6	Stern and others (1965).
		Zircon ------------------	U–Pb[2]	32 ±2	Do.
	Monzonite porphyry -----	Aegerine augite --------	K–Ar	23.1±3.3	Do.
		Zircon ------------------	U–Pb[2]	32 ±2	Do.
	Diorite porphyry ----------	Hornblende ------------	K–Ar	[3] 56.2±1.5	Do.
		Zircon ------------------	U–Pb[2]	494 ±20	Do.

[1] Armstrong notes the possibility of xenolithic contamination in hornblende diorites from other intrusive centers on the Colorado Plateau but does not suggest the same explanation for this older age (Armstrong, 1969, p. 2082).

[2] Pb^{206}/U^{238} ages reported here. Pb^{207}/U^{235} and Pb^{208}/U^{232} ages were also obtained but were not concordant for any sample.

[3] Stern and others (1965, p. 1503) interpret this age as "due to incomplete degassing of Precambrian hornblende and the presence of Precambrian zircon xenocrysts."

Table 2. New fission-track age determinations for Colorado Plateau laccoliths

[All samples from diorite porphyry except as noted. No. = number; tr = tracks; n = neutrons. Fission-track constants (Naeser and others, 1981): $\lambda_d = 1.55\times10^{-10}\ yr^{-1}$; $\lambda_f=7.03\times10^{-10}\ yr^{-1}$; $U^{235}/U^{238}=0.00725$]

Sample number	Field number	North latitude	West longitude	Mineral	Age ± 2σ (Ma)	Fossil-track density		Induced-track density		Neutron fluence		No. of grains
						tr/cm^2 ×10^6	(No. of tr)	tr/cm^2 ×10^6	(No. of tr)	n/cm^2 ×10^{15}	(No. of n)	
A1	MONT–1	37°48'11"	109°27'09"	Zircon	28.1±2.1	5.82	(2049)	5.02	(3534)	0.8114	(3204)	6
				Sphene	26.8±3.7	0.438	(290)	1.56	(2068)	3.202	(2484)	8
A2	MONT–2	37°50'42"	109°29'58"	Zircon	28.6±3.4	2.84	(671)	2.41	(1138)	0.8114	(3204)	7
				Sphene	32.3±4.6	0.906	(288)	2.68	(1706)	3.202	(2484)	8
A3	MONT–3	37°51'08"	109°27'09"	Zircon	22.6±2.2	2.59	(892)	2.77	(1914)	0.8114	(3204)	9
A4	MONT–4	37°51'08"	109°28'33"	Zircon	24.7±2.2	5.55	(1155)	5.44	(2264)	0.8114	(3204)	4
A5	LIN–1	37°49'34"	109°30'12"	Zircon	24.2±2.4	5.62	(966)	5.63	(1938)	0.8114	(3204)	7
				Sphene	26.9±3.8	0.623	(273)	2.22	(1942)	3.202	(2484)	6
H1	ELLN–1	38°03'55"	110°47'22"	Zircon	20.0±1.9	3.87	(979)	4.70	(2376)	0.8114	(3204)	9
H2	PENL–1	37°59'43"	110°48'05"	Zircon	23.9±2.1	3.38	(1276)	3.44	(2592)	0.8114	(3204)	6
				Sphene	26.4±2.5	1.07	(673)	3.88	(4880)	3.202	(2484)	9
H3	HIL–1	37°57'11"	110°34'36"	Zircon	29.2±2.3	1.37	(1790)	1.14	(2978)	0.8114	(3204)	22
H4	HIL–2	37°55'06"	110°36'00"	Zircon	21.2±2.4	3.99	(655)	4.56	(1496)	0.8114	(3204)	4
				Sphene	25.6±3.3	0.394	(332)	1.47	(2480)	3.202	(2484)	10
H5	BULL–1	38°08'34"	110°43'31"	Zircon	28.6±2.4	5.32	(1356)	5.23	(1334)	0.9620	(3555)	5
[1] L1	CSTV–2	38°32'36"	109°16'24"	Zircon	28.7±2.7	8.90	(1122)	7.52	(1896)	0.8114	(3204)	7
				Sphene	30.3±3.2	0.831	(567)	2.63	(3582)	3.202	(2484)	10
[2] L2	LAS–1	38°28'57"	109°17'05"	Sphene	28.5±3.8	0.583	(322)	1.96	(2160)	3.202	(2484)	6

[1] Biotite from this sample also yielded a K–Ar date of 28.21±1.16 Ma, based on determinations of 0.51–0.52% Na_2O, 6.30–6.32% K_2O, 2.5826 moles/g ^{40}Ar (49.1% of total Ar), and the following decay constants: $\lambda_\varepsilon=0.581\times10^{-10}\ yr^{-1}$; $\lambda_\beta=4.962\times10^{-10}\ yr^{-1}$; $^{40}K/K=1.167\times10^{-4}$. Age obtained by Harald Mehnert, U.S. Geological Survey, Denver, Colo.

[2] Sample from monzonite porphyry.

REFERENCES CITED

Armstrong, R.L., 1969, K-Ar dating of laccolithic centers of the Colorado Plateau and vicinity: Geological Society of America Bulletin, v. 80, p. 2081–2086.

Dalrymple, G.B., 1979, Critical tables for conversion of K-Ar ages from old to new constants: Geology, v. 7, p. 558–560.

Naeser, C.W., 1978, Fission track dating: U.S. Geological Survey Open-File Report 76–190, 87 p.

Naeser, C.W., Zimmerman, R.A., and Cebula, G.T., 1981, Fission track dating of apatite and zircon—An interlaboratory comparison: Nuclear Tracks, v. 5, p. 65–72.

Stern, T.W., Newell, M.F., Kistler, R.W., and Shawe, D.R., 1965, Zircon uranium-lead ages and mineral potassium-argon ages of La Sal Mountains rocks: Journal of Geophysical Research, v. 70, p. 1503–1507.

Next section ⟶