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Rb-Sr ISOCHRON AGES OF FOUR PRECAMBRIAN IGNEOUS ROCK UNITS FROM SOUTH-CENTRAL NEW MEXICO

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We report Rb-Sr isochron ages for four Precambrian rock units from south-central New Mexico as part of a continuing study of the Precambrian basement rocks of New Mexico. The rock units included in this study are: the Sevillita metarhyolite, the Priest quartz monzonite, the Los Pinos granite and the Sepultura granite. The reader is referred to White (1978) for a reference map of the Precambrian igneous rocks of New Mexico and to Bolton (1976) for detailed maps. The Rb-Sr isochron ages reported here should be considered as reconnaissance in nature as work is in progress by several groups.

Rb and Sr concentrations were determined by replicate x-ray fluorescence spectrometry at the New Mexico Bureau of Mines and Mineral Resources in Socorro, New Mexico. The isotopic composition of Sr was determined at the University of New Mexico in Albuquerque, New Mexico. The $^{87}Rb/^{86}Sr$ ratios are precise to ± 2% (one sigma) and the $^{87}Sr/^{86}Sr$ ratios precise to ± 0.03% (one sigma). All $^{87}Sr/^{86}Sr$ ratios were normalized to $^{86}Sr/^{88}Sr$ = 0.1194; and seven replicate analyses of Eimer and Amend $SrCO_3$ yielded $^{87}Sr/^{86}Sr$ = 0.7080 ± 0.0001. A decay constant for ^{87}Rb of $1.42 \times 10^{-11} y^{-1}$ was used for age calculations. The least squares treatment of York (1969) was used for isochron calculation.

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ISOTOPIC RESULTS

Results for our investigation are shown below. The data are given in Tables 1–4 and shown graphically as Figures 1–4.

Sevillita Metarhyolite

This unit consists of intercalated siliceous metavolcanics and metasediments (quartzite and arkose). The Sevillita metarhyolite is the uppermost of four pre-granitic plutons, metamorphic units recognized in the southern Manzano and Los Pinos Mountains (Stark, 1956; Beers, 1976). Only metarhyolites were used in this study. Their average modal composition consists of 15–25% K-feldspar, 10–20% plagioclase (predominantly albite), ~ 50% quartz, 1–5% biotite, with minor magnetite, apatite, zircon. Much of the feldspar has been altered to white mica, quartz, and epidote.

Priest Quartz Monzonite

According to Stark (1956), the Priest quartz monzonite can be characterized as a coarse-grained, biotite-quartz-feldspar phanerite containing large phenocrysts of light-pink microcline. It is clearly intrusive into the surrounding metamorphic rocks with chilled margins, xinoliths of metamorphic rocks, late stage aplites and pegmatities, and granitic rocks cross cutting the metamorphics all noted at the edges of the pluton.

Los Pinos Granite

This granite is porphyritic with predominant plagioclase (An_{34}) and lesser K-feldspar and quartz phenocrysts set in a groundmass of abundant K-feldspar and quartz plus myrmekitic intergrowths of quartz-plagioclase. Rapakivi textures are noted in places (Beers, 1976). Bolton (1976) reports an average modal analysis of 44% quartz, 38% K-feldspar, 12% plagioclase, 4% biotite, 1.5% magnetite, and 0.5% sericite.

Sepultura Granite

This porphyritic granite is macroscopically similar to the Los Pinos granite and contains phenocrysts of microcline, lesser amounts of plagioclase (An_{32}), and quartz set in a groundmass of anhedral quartz and K-feldspar with minor euhedral plagioclase (Bolton, 1976). The average modal analysis yields 43% K-feldspar, 36% quartz, 18% plagioclase, 2% biotite, 1% magnetite, and < 1% sericite. The sericite is evenly distributed throughout the groundmass. No rapakivi textures were noted in the Sepultura outcrops (Bolton, 1976).

COMMENT

Field evidence (see Bolton, 1976; for discussion) indicates that the granitic rocks (Priest, Los Pinos, Sepultura) are intrusive into the metavolcanic-metasedimentary rocks of the southern Manzano and Los Pinos Mountains. The data presented here support but do not unequivocally confirm this hypothesis. A different pre-emplacement history for the Sepultura granite from the Los Pinos and Priest granites is indicated by the very high initial $^{87}Sr/^{86}Sr$ ratios for the Sepultura. It is not possible at this time to state whether this high initial ratio reflects crustal contamination, long magma-residence time with radiogenic

^{87}Sr redistribution, or other processes. Within the stated limits of errors for the isochrons, the three granitic plutons fall in the 1350–1600 m.y. period of igneous plutonism recognized in New Mexico, although the data suggest a slightly younger crystallization of the Sepultura granite relative to the Priest quartz monzonite and Los Pinos granite.

REFERENCES

Beers, C. A. (1976) Geology of the Precambrian rocks of the southern Los Pinos Mountains, Socorro County, New Mexico: New Mex. Inst. Min. Tech. MS thesis.

Bolton, W. R. (1976) Precambrian geochronology of the Sevillita metarhyolite and the Los Pinos, Sepultura and Priest plutons of the southern Sandia uplift, central New Mexico: New Mex. Inst. Min.Tech. MS thesis.

Stark, J. T. (1956) Geology of the south Manzano Mountains, New Mexico: N. M. Bur. Mines & Mineral Resources Bull. 34.

White, D. L. (1978) Rb-Sr isochron ages of some Precambrian plutons in south-central New Mexico: Isochron/West, no. 21, p. 8–14.

York, D. (1969) Least squares fitting of a straight line with correlated errors: Earth Plan. Sci. Lett., v. 5, p. 320–326.

Table 1. Data for the Sevillita Metavolcanics.

Sample	Rb (ppm)	Sr (ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Latitude	Longitude
NP–36	135	136	2.90	0.7707	34°24′	106°33′
NP–46	142	67.7	6.11	0.8436	34°23′	106°33′
NP–47	154	53.1	8.48	0.9029	34°23′	106°33′
NP–52	44.5	51.6	2.50	0.7563	34°23′	106°33′
NP–63	14.4	192	0.22	0.7110	34°23′	106°33′

Age = 1559 m.y. ± 52 m.y.
$(^{87}Sr/^{86}Sr)_o$ = 0.7060 ±0.0007
Correlation Coefficient = 0.99

Table 2. Data for the Priest Quartz Monzonite.

Sample	Rb (ppm)	Sr (ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Latitude	Longitude
MAN–38	186	372	1.45	0.7324	34°30′	106°30′
MAN–41	130	328	1.15	0.7310	34°30′	106°29′
MAN–44	164	250	1.91	0.7449	34°29′	106°29′
MAN–46	166	322	1.50	0.7366	34°29′	106°29′
MAN–60	142	275	1.495	0.7373	34°32′	106°28′
MAN–G	155	329	1.36	0.7315	*	*

Age = 1569 m.y. ± 314 m.y.
$(^{87}Sr/^{86}Sr)_o$ = 0.7029 ± 0.0064
Correlation Coefficient = 0.94
*MAN–G = composite sample from 14 locations

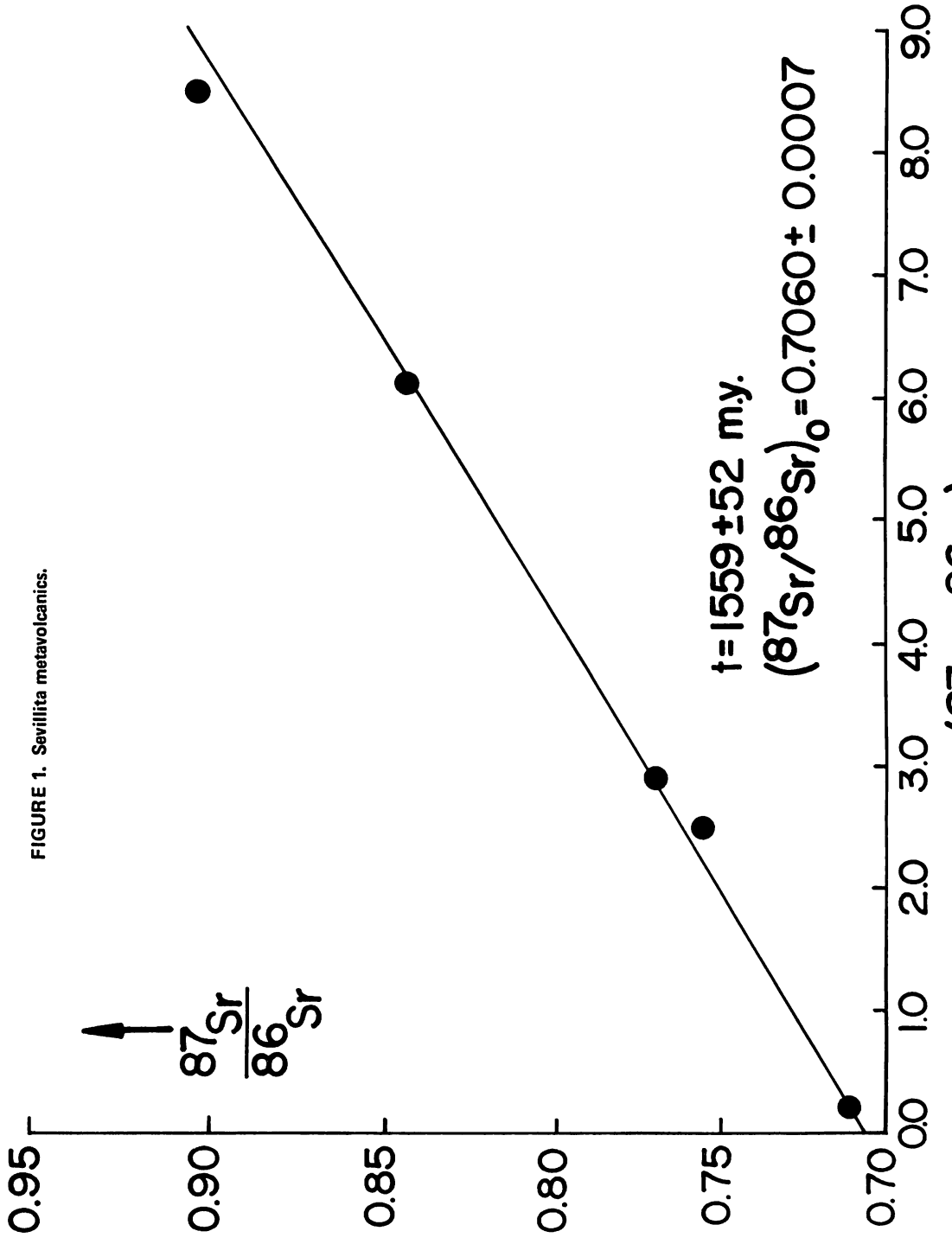

FIGURE 1. Sevillita metavolcanics.

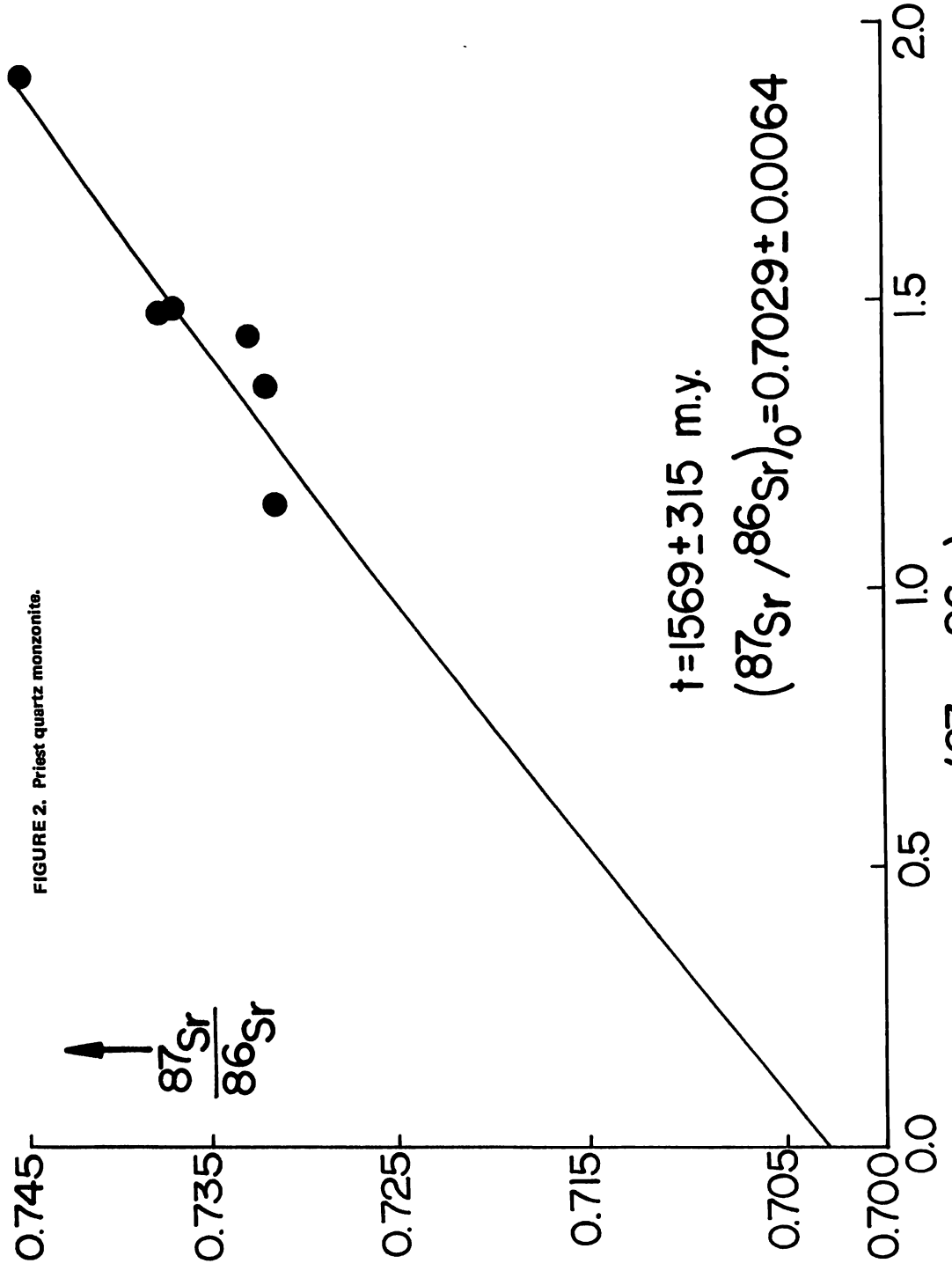

FIGURE 2. Priest quartz monzonite.

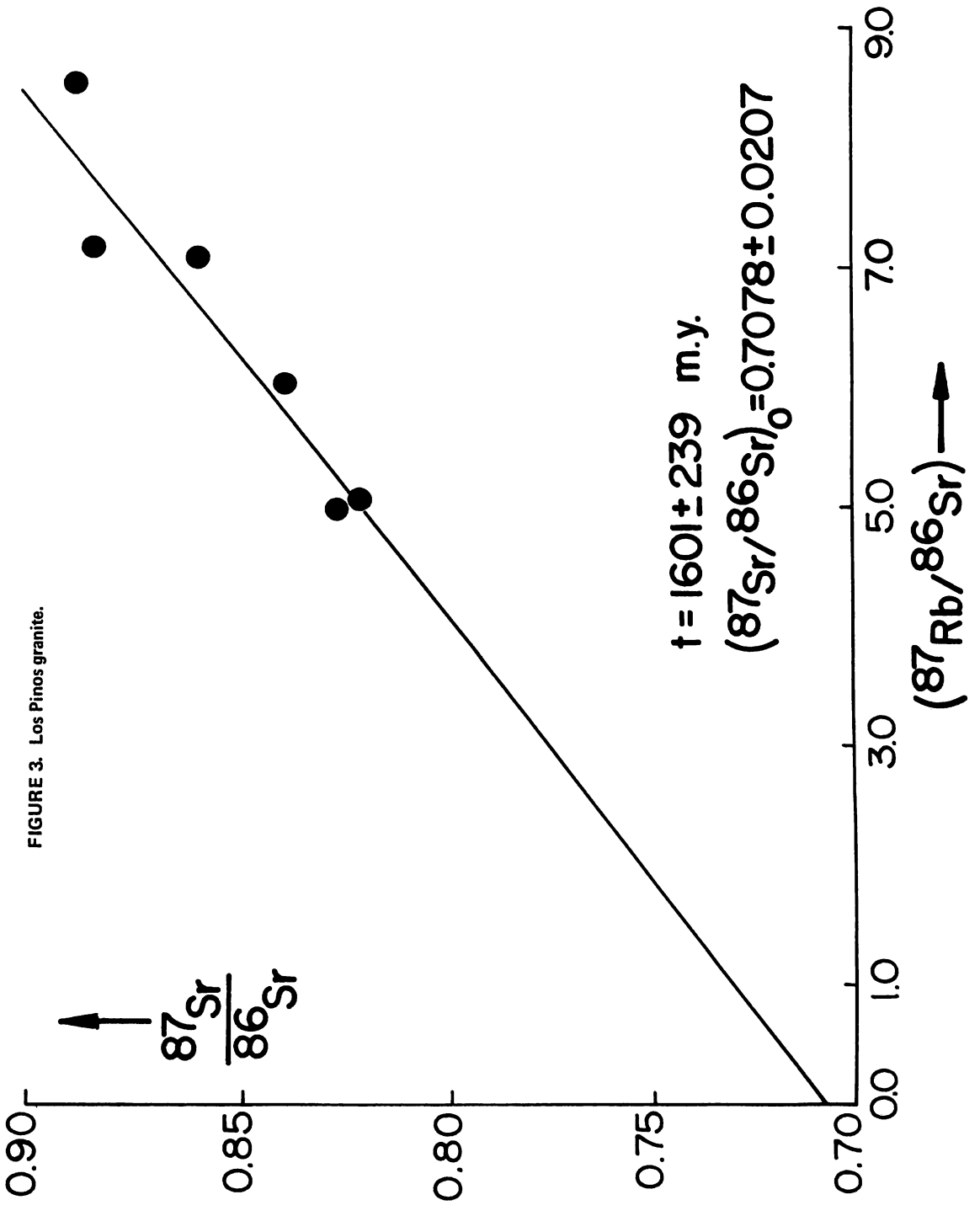

FIGURE 3. Los Pinos granite.

Table 3. Data for the Los Pinos Granite.

Sample	Rb (ppm)	Sr (ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Latitude	Longitude
N–2	152	42.4	8.52	0.8879	34°21′	106°35′
N–3	105	61.1	5.05	0.8220	34°22.5′	106°34′
N–4	155	52.3	4.98	0.8271	34°22.5′	106°34′
NP–4	113	55.1	6.01	0.8398	34°21′	106°34′
NP–8	138	57.4	7.07	0.8600	34°22′	106°34′
NP–9	158	64.8	7.15	0.8841	34°22′	106°34′

Age = 1601 m.y. ± 239 m.y.
$(^{87}Sr/^{86}Sr)_o$ = 0.7078 ± 0.0205
Correlation Coefficient = 0.95

Table 4. Data for the Sepultura Granite.

Sample	Rb (ppm)	Sr (ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Latitude	Longitude
N–6	248	17.5	44.3	1.5586	34°21′	106°36′
N–9	148	30.3	14.5	1.0613	34°20′	106°37′
NP–12	237	13.0	58.9	1.8967	34°21′	106°36′
NP–14	173	30.6	16.9	1.0588	34°20′	106°37′
NP–16	192	10.5	59.3	1.9175	34°20′	106°36′
NP–19	212	32.8	19.4	1.0794	34°20′	106°37′

Age = 1350 m.y. ± 104 m.y.
$(^{87}Sr/^{86}Sr)_o$ = 0.7488 ± 0.0333
Correlation Coefficient = 0.99

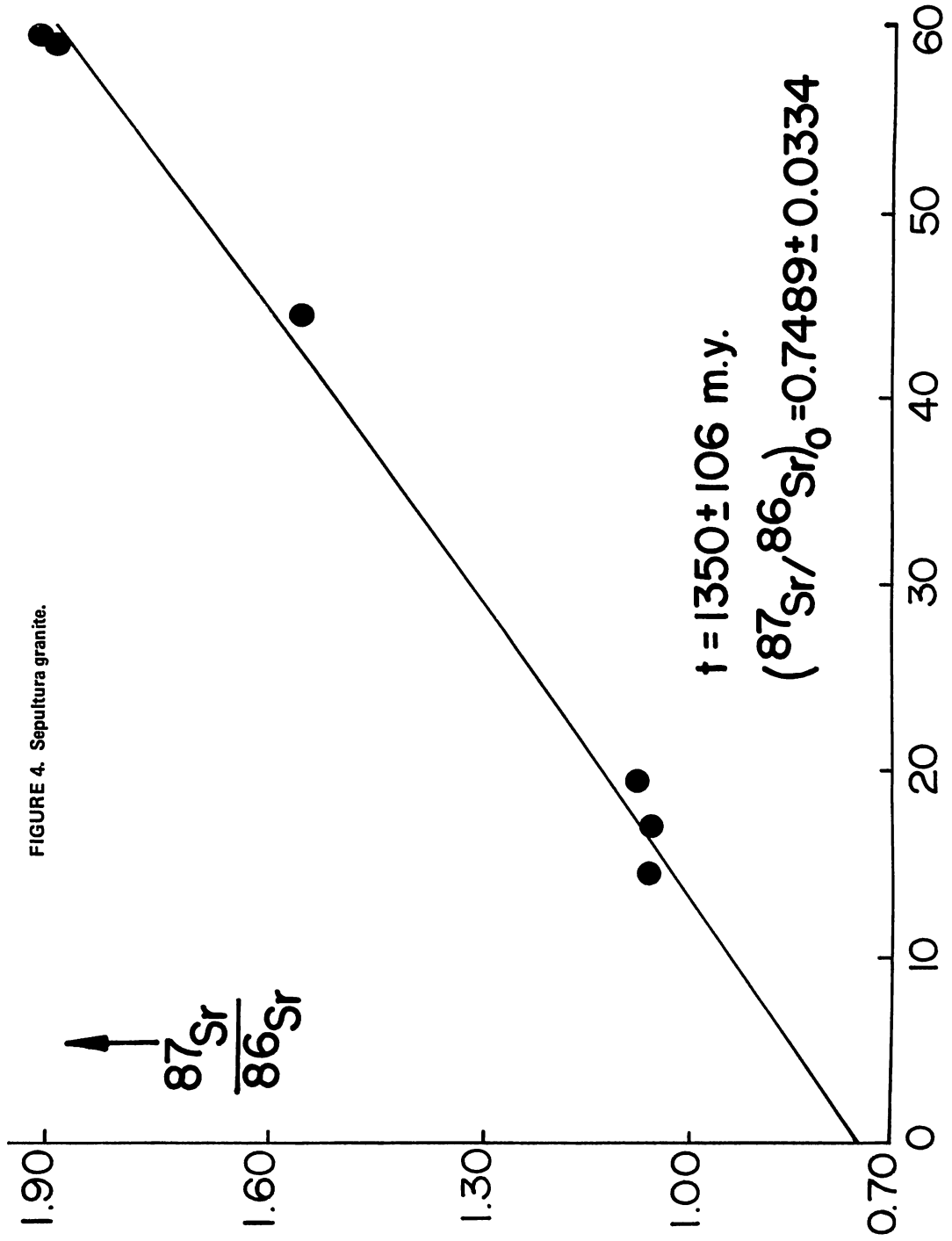

FIGURE 4. Sepultura granite.