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Rb-Sr ISOCHRON AGE OF EVAPORITE MINERALS FROM THE SALADO FORMATION (LATE PERMIAN), SOUTHEASTERN NEW MEXICO

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The bedded evaporites of southeastern New Mexico have been extensively studied in conjunction with potash deposit exploration, and, more recently, for consideration for a Waste Isolation Pilot Plant (WIPP) for radioactive waste disposal. An important facet of the latter study is the chemical and isotopic integrity of the evaporite minerals. Experience elsewhere with evaporite minerals (see discussion in Brookins and others, 1980) suggests post-formational, open-system conditions resulting in anomalously young ages for both halide and sulfate minerals by the K-Ar and Rb-Sr methods. Many of these young dates elsewhere (i.e. Federal Republic of Germany) have been attributed to metamorphic events or, alternately, to both episodic and/or continuous loss of radiogenic ^{40}Ar and ^{87}Sr by unspecified, though subtle, events. Tremba (1969) and Bodine (1978) have suggested episodic and continuous recrystallization events for the southeastern New Mexico evaporites.

It is the purpose of this report to present our Rb-Sr isochron findings for 41 samples including sylvite-halite rich mixtures, polyhalite-rich samples, and anhydrites. The locations are given in Table 1, the data in Table 2, and the mineralogy in Table 3. Figure 1 shows the isochron. Sample procedures are given in Register (1979). The decay constant of $1.42 \times 10^{-11} y^{-1}$ was used, and the York (1969) method for isochron construction was employed.

COMMENT

The Rb-Sr isochron age of 214 ± 15 m.y. agrees well with the K-Ar dates of 198–216 m.y. ($\overline{X}$ = 210 m.y.) for primary polyhalites (Brookins and others, 1980). These dates, however, are possibly post-Late Permian which may reflect either final potash ore formation in the Triassic or post-sedimentation, diagenetic-epigenetic events lasting into the Triassic. The isochron date and the polyhalite dates do not support post-200 m.y. continuous or episodic loss of ^{87}Sr or ^{40}Ar throughout the evaporite sequence except in the immediate vicinity of a 34 m.y. lamprophyre dike (Brookins, in press). Five data (samples AEC-8, 1636.6–1637.1; DV-3A; DV-4D; DV-5C; MC-3A; Table 2) have been omitted from the construction of Figure 1 as the data clearly fall well off the isochron. Four of these data are from mine wall samples. If these five samples were to be included in the isochron construction, the age changes to 199 ± 20 m.y. (Register, 1979).

Table 1. Sample Locations.

ERDA-9	Drill Hole	32°22'10"N., 103°47'30"W.
ERDA-6	Drill Hole	32°26'20"N., 103°44'56"W.
AEC-8	Drill Hole	32°24'20"N., 103°44'55"W.
MCC	Mississippi Chem. Corp.Mine	32°30'14"N., 103°54'41"W.
DV	Duval Corp. Mine	32°21'19"N., 103°52'56"W.

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Table 2. Rb-Sr data for evaporite mineral samples from the Salado Formation.

Sample Number	Rb (ppm)	Sr (ppm)	$^{87}Sr/^{86}Sr$	Rb/Sr	$^{87}Rb/^{86}Sr$
AEC-8, 1607.0–1608.0	26.65	45.61	.7175	0.584	1.693
1610.8–1611.3	14.78	269.53	.7126	0.055	0.159
1622.4–1622.9	1.23	111.80	.7076	0.011	0.032
1636.6–1637.1	39.54	9.54	.7223	4.145	12.016
1645.0–1645.3	0.28	44.29	.7107	0.006	0.018
1671.2–1671.8	0.78	42.16	.7083	0.019	0.054
1715.4–1715.7	1.11	83.88	.7071	0.013	0.038
1762.0–1762.3	1.07	37.59	.7081	0.028	0.082
1782.2–1782.4	0.22	4.95	.7156	0.044	0.129
ERDA-9, 1404.8–1405.8	70.69	2.36	.9625	29.953	88.857
1621.9–1622.2	0.94	142.84	.7086	0.007	0.019
1633.6–1634.1	0.31	144.93	.7207	0.002	0.006
1648.5–1649.0	0.29	43.30	.7081	0.007	0.019
1652.8–1653.1	0.25	64.06	.7100	0.004	0.011
1709.0–1709.5	0.99	8.44	.7100	0.117	0.340
1713.6–1714.0	2.02	34.20	.7075	0.059	0.171
1759.1–1759.8	1.83	52.84	.7085	0.035	0.100
1772.0–1772.4	1.49	57.81	.7073	0.026	0.075
ERDA-6, 1421.0–1421.7	1.42	182.64	.7086	0.008	0.023
DV-1C	60.17	4.25	.8623	14.158	41.601
1D	29.08	5.78	.7481	5.031	14.622
2B	20.69	6.71	.7428	3.083	8.957
2C	29.04	0.27	1.6412	107.556	329.012
3A	6.90	5.63	.7616	1.226	3.567
3B	39.36	1.37	.9618	28.730	85.222
4B	4.42	45.28	.7112	0.098	0.283
4C	2.58	26.80	.7112	0.096	0.279
4D	13.11	2.09	.7203	6.273	18.182
4E	13.20	8.08	.7216	1.634	4.736
5A	4.14	4.01	.7076	1.032	2.989
5C	10.98	1.55	.7352	7.084	20.563
MC-1A	1.36	48.61	.7083	0.028	0.081
2A	2.19	65.84	.7099	0.033	0.096
2C2	3.98	93.44	.7074	0.043	0.123
2C3	1.62	60.40	.7121	0.027	0.078
2C4	2.85	76.61	.7076	0.037	0.108
3A	19.92	2.08	.7259	9.577	27.775
Polyhalite and Anhydrite					
Polyhalite					
ERDA-9, 1215.2–1215.3	4.35	1108.37	.7078	0.004	0.011
1499.0–1500.0	5.21	767.63	.7074	0.007	0.020
1784.2–1784.3	3.98	845.53	.7082	0.005	0.014
AEC-8, 1618.9–1619.4	5.68	1563.25	.7081	0.004	0.011
Anhydrite					
ERDA-9, 1630.7–1631.0			.7071		
2836.0–2836.4			.7074		

FIGURE 1. Evaporite minerals (5 data omitted).

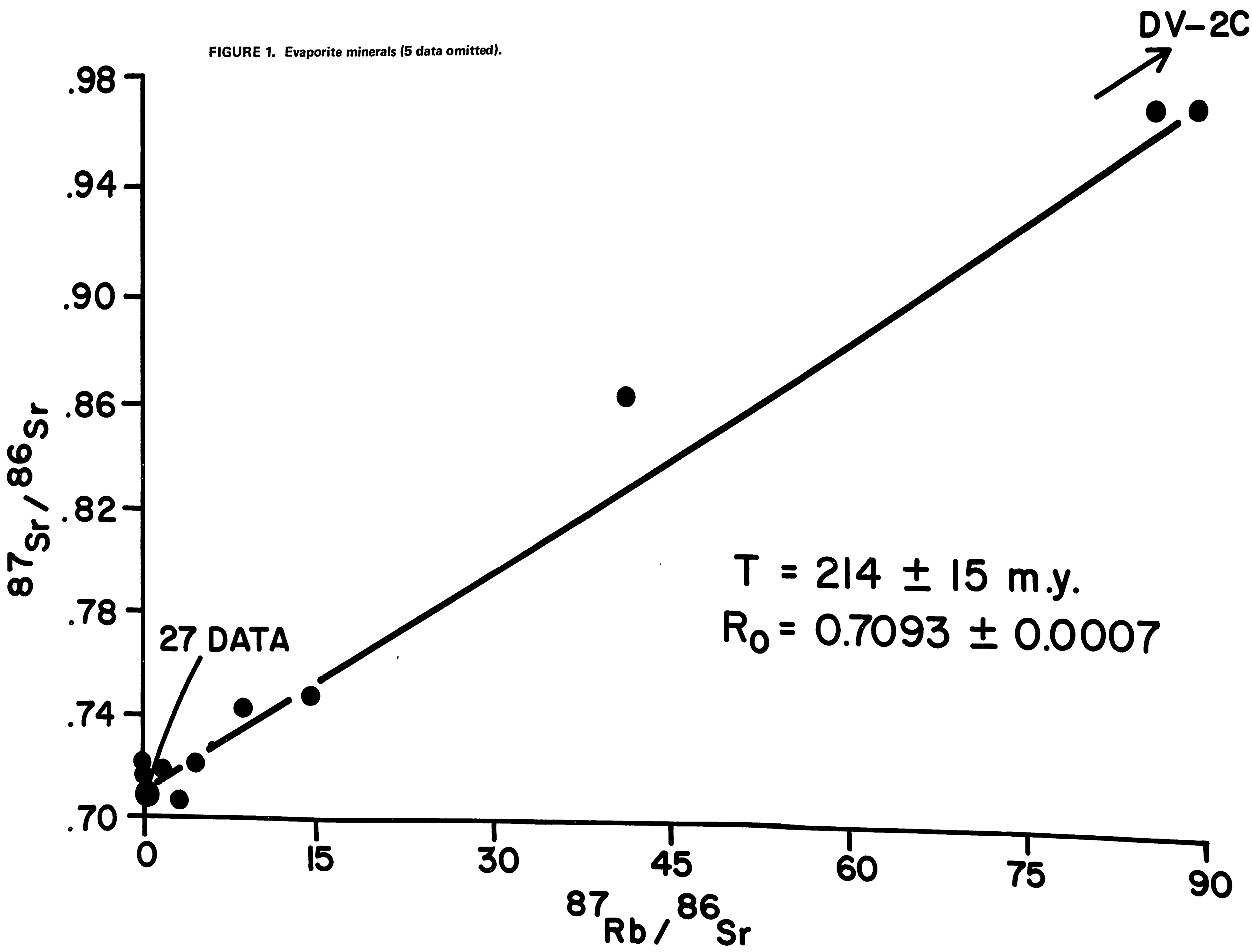

Table 3. Evaporite mineral composition of some samples from the Salado Formation.

[All units given are in percent abundance.]

Sample Number	Loewelte	Halite	Sylvite	Anhydrite	Polyhalite	Magnesite	Langbeinite
ERDA-9, 1713.6–1714.0	—	90	10	—	—	—	—
1759.1–1759.8	—	85	5	—	10	—	—
1709.0–1709.5	—	85	10	—	5	—	—
1621.9–1622.2	—	65	5	—	—	30	—
1633.6–1634.1	—	90	5	—	—	5	—
1652.8–1653.1	—	85	5	—	—	10	—
1648.5–1649.0	—	95	5	—	—	—	—
1404.8–1405.8	—	40	5	5	—	—	50
ERDA-6, 1421.0–1421.7	—	90	10	—	—	—	—
AEC-8, 1782.2–1782.4	25	5	5	—	25	—	—
1762.0–1762.3	—	100	—	—	—	—	—
1671.2–1671.8	—	95	5	—	—	—	—
1715.4–1715.7	—	95	5	—	—	—	—
1636.6–1637.1	—	45	50	—	—	—	5
1645.0–1645.3	—	100	—	—	—	—	—
1622.4–1622.9	—	85	15	—	—	—	—
1610.8–1611.3	—	85	10	—	5	—	—
1607.0–1608.0	—	65	35	—	—	—	—
DV-1A	—	5	5	—	90	—	—
1B	—	40	60	—	—	—	—
1C	—	50	—	—	50	—	—
1D	—	50	50	—	—	—	—
2A	5	45	50	—	—	—	—
2B	—	15	5	—	80	—	—
4A	—	5	5	—	—	15	75
4B	—	95	5	—	—	—	—
4C	—	95	5	—	—	—	—
4D	—	95	—	—	—	5	—
4E	—	15	—	—	—	—	85
5A	—	100	—	—	—	—	—
5B	—	75	20	—	—	—	5

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