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Rb-Sr DATING ATTEMPTS OF CLAY MINERALS FROM THE EAST CHACO CANYON (DOE) DRILLING PROJECT, SAN JUAN BASIN, NEW MEXICO

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The U.S. Department of Energy undertook an investigation of the Westwater Canyon Sandstone Member of the Morrison Formation (Late Jurassic) in the San Juan Basin as part of a nationwide uranium assessment of rocks potentially favorable for mineralization. Twenty seven holes were drilled with core taken from the Westwater Canyon Sandstone Member. The core was studied and logged by Brookins (1979a,b) and by Hicks (1980). Many of the samples were also analyzed for their trace element chemistry by Della Valle (1980). In addition, as part of the geochemical characterization of the rocks, Rb-Sr geochronologic investigations were carried out by Brookins (1979a) and Hicks (1980).

The locations of core samples used in this study are given in table 1. In many cases the minus-two micron size fraction (−2u) was used for the Rb-Sr work, as this fraction usually is made up primarily of authigenic clay minerals found to be suitable for the work based on earlier studies (see Lee and Brookins, 1978).

Standard methods were used for the separation of the clay minerals from the core, for the x-ray diffraction studies of the clay minerals (XRD), and for the analysis of the clay minerals for their Rb-Sr systematics. Analytical details are given in Hicks (1980) and Della Valle (1980). We use 1.42 = 10^{-11}/y as the decay constant for ^{87}Rb and employ the York (1969), model three, method of isochron construction (see below).

In table 2 are presented the Rb, Sr, and Sr isotopic data along with the clay mineralogy of the samples. The possible isochrons constructed from the data are shown in figure 1.

DISCUSSION

Three possible isochrons are shown in figure 1. Curve c is based on analyses of four mudstones (samples 7-4990, 12-4152, 17-4110, 17-4441) and one argillaceous sandstone (5-4635). The mudstones contain 100% 1Md illite or mixed layer smectite/illite. The argillaceous sandstone contains chlorite in addition to illite (1Md) and mixed layer smectite/illite and kaolinite. Since 1Md illite is generally taken as indicative of authigenic material, it is not surprising that the mudstones define a good isochron. The occurrence of the argillaceous sandstone on this line may be spurious.

Curve b is a possible isochron based on seven samples of sandstone (nos. 5-4750, 8-4376, 8-4537, 12-4158,

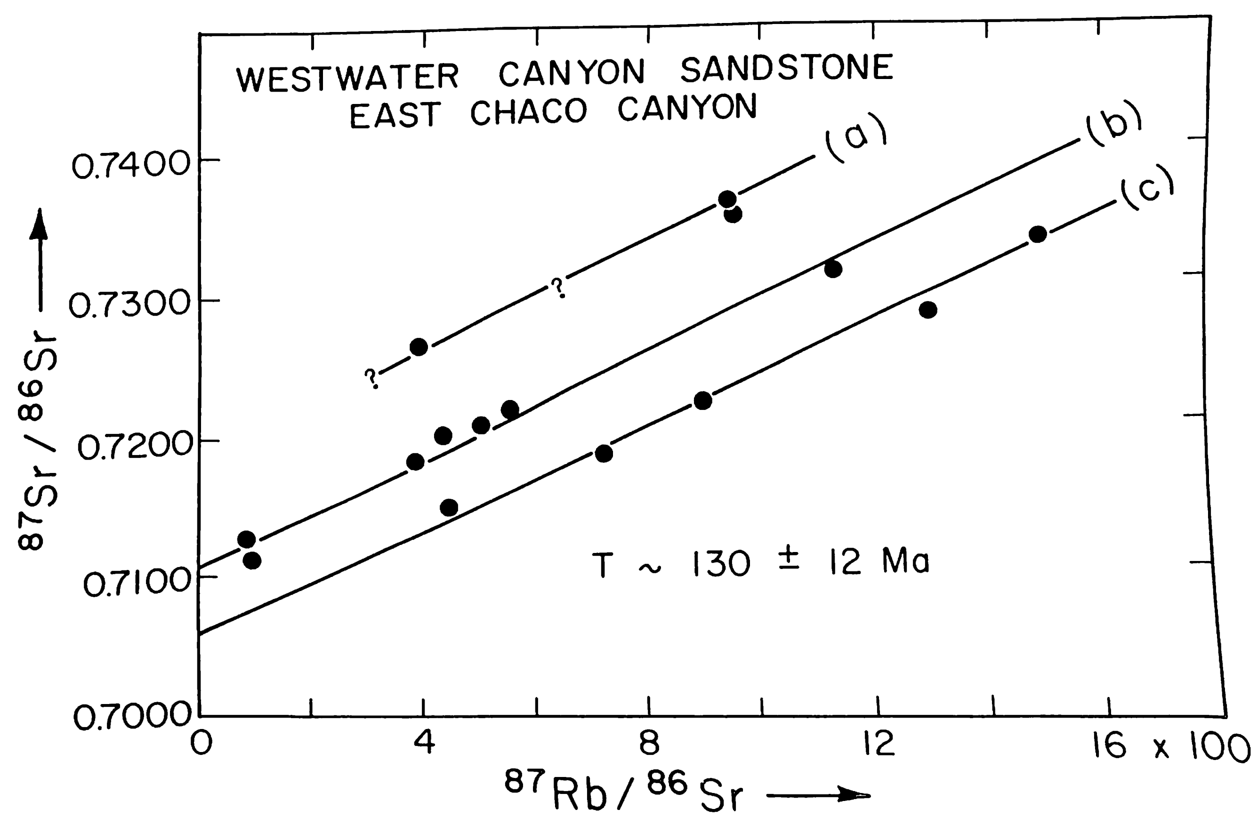

FIGURE 1. Isochron plot for clay minerals and mudstones, Westwater Canyon Sandstone Member. See text for details.

12-4235, 25-3901) and one siltstone (no. 8-4529). Except for the siltstone, which is 100% mixed layer smectite/illite, the other samples contain abundant kaolinite and chlorite and little illite except for 25-3901 which contains 46% illite and 33% mixed layer smectite/illite. Brookins (1980) has noted the difficulty of Rb-Sr studies of kaolinite-bearing samples, yet these seven samples (curve b) are reasonably linear.

Curve a is highly speculative. The three samples (nos. 5-4708, 8-4527, and 12-4212) possess clay mineralogies similar to the samples used for curve b with one exception: the samples used for possible curve a all contain abundant hollow feldspars. This raises the possibility of some excess ^{87}Sr in these samples, fixed in altered material as Rb is preferentially removed. While speculative, this would account for the samples of curve a falling above the curve b.

TABLE 1. Locations of East Chaco Canyon drill holes.

Drill hole	N. latitude	W. longitude
CC 5	35°57'17"	107°37'55"
CC 7	35°52'11"	107°35'24"
CC 8	36°00'11"	107°49'37"
CC 12	36°00'11"	107°55'23"
CC 17	35°51'47"	107°44'35"

The isochrons' date of 130 ± 12 Ma is in reasonable agreement with published dates for the Late Jurassic units studied earlier (Lee and Brookins, 1978; Brookins, 1980). We emphasize, however, that the main thrust of this note is to present the data (table 2), and the isochrons should be viewed with caution.

REFERENCES

Brookins, D. G. (1979a) Study of drill core from the east Chaco Canyon area, San Juan Basin: Geochemical studies: U.S. Dept. Energy Rpt. BFEC 78-249-E, Part 1.

_______ (1979b) Petrologic description of selected drill core from the east Chaco Canyon area, San Juan Basin (supplement of Brookins, 1979a): U.S. Dept. Energy Rpt. BFEC 78-249-E-S.

_______ (1980) Geochronologic studies in the Grants Mineral Belt: N.M. Bur. Mines Min. Res. Mem. 38, p. 52.

Della Valle, R. S. (1980) Geochemical study of the Grants Mineral Belt, New Mexico: PhD dissertation, University of New Mexico.

Hicks, R. T. (1980) Diagenesis of the Westwater Canyon Member, Morrison Formation, East Chaco Canyon drilling project, New Mexico: MS thesis, University of New Mexico.

Lee, M. J., and Brookins, D. G. (1978) Rb-Sr investigation of the Morrison Formation (Late Jurassic), Grants Mineral Belt, New Mexico: minimum ages of sedimentation-uranium mineralization and provenance: Amer. Assoc. Petrol. Geol. Bull., v. 62, p. 1673.

TABLE 2. Rb-Sr data for sandstones and mudstones, Westwater Canyon Sandstone Member.

Sample drill hole - depth	Rock type	Dominant clay	Secondary clays	Rb (ppm)	Sr (ppm)	^{87}Sr^{86}Sr	^{87}Rb^{86}Rb	K	Ch	S	I	S/I
curve a:												
5 - 4708	sandstone	Ch	I	137.90	41,83	0.7352	9.57	43	37	—	20	—
8 - 4527	sandstone	Ch	I	70.05	21.40	0.7362	9.49	47	36	—	—	18
12 - 4212	sandstone	I/S	Ch, I	86.37	63.61	0.7263	3.94	28	17	—	6	49
curve b:												
5 - 4750	sandstone	Ch	I/S	136.48	70.89	0.7218	5.58	36	51	—	—	13
8 - 4376	sandstone	I/S	Ch, I	112.44	64.35	0.7206	5.07	38	27	—	3	32
8 - 4537	sandstone	I/S	Ch	80.98	270.03	0.7124	0.87	30	30	—	—	40
12 - 4158	sandstone	I/S	Ch	120.60	79.63	0.7201	4.39	48	70	—	10	22
12 - 4235	sandstone	Ch	I, I/S	155.35	476.40	0.7112	0.94	30	53	—	11	6
8 - 4529	siltstone	I		190.24	48.68	0.7311	11.34	—	—	—	—	100
25 - 3901	sandstone	I	I/S	198.16	148.33	0.7180	3.87	21	—	—	46	33
curve c:											9	34
5 - 4635	sandstone	I/S	Ch, I	192.46	76.71	0.7185	7.27	33	24		100	
7 - 4990	mudstone	I		184.63	35.63	0.7331	15.04	M			100	
12 - 4152	mudstone	I		170.92	54.75	0.7219	9.05				M	
17 - 4110	mudstone	I		237.13	153.97	0.7148	4.46					98
17 - 4441	mudstone	I/S		180.46	39.95	0.7278	13.10	2				

Notes: 1. I/S = illite/smectite; Ch = chlorite; I = illite
K = kaolinite; M = major; S = smectite
2. Data from Hicks (1981)
3. Sample grouping (a,b,c)