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The Red Rock talc deposit occurs in Hembrillo Canyon on the Sierra–Doña Ana County line midway along the long north-trending San Andres Mountains in south-central New Mexico. The canyon is eroded approximately two-thirds of the way through the range from its eastern base. The deposit and mine are located in SE¼NW¼ sec. 1, T. 16 S., R. 3 E. in Sierra County just north of the Sierra–Doña Ana line. Entry to the area is restricted because it is within the White Sands Missile Range. Access is by paved road that follows the eastern base of the mountains 42 mi northward from US-70 (linking Las Cruces and Alamogordo). Approximately 6 mi up the canyon (westward) via a rough gravel road, a precarious 4-wheel-drive road leads about ¾ mi to the mine (fig. 1). The deposit occurs at 5,050 ft, approximately 500 ft up a steep spur slope toward Kaylor Mountain (7,050 ft).

Geologic setting

Through much of their length and especially in the Hembrillo Canyon area, the San Andres Mountains are a rather simple tilted fault block. Dips are 10–15° west as the result of uplift on the large, normal San Andres fault, whose throw between the uplift and the Tularosa Basin may easily approach 10,000 ft. Presence of the fault is indicated by fan scarps that run for miles along the eastern base of the range. The upper part of the range consists of thick (5,000 ft ±) Paleozoic units of dolomites, limestones, shales, sandstones, and gypsums that range from Upper Cambrian at the base (only about 200 ft above the mine) to Middle Permian in the hogbacks along the western slope of the mountains.

A narrow belt of Precambrian rocks extends nearly the entire length of the eastern side of the range beneath the Paleozoic section (fig. 2). The Precambrian rocks are mostly gneisses and granites, with short stretches of interspersed schists, quartzites, and phyllites. Sills and dikes are locally present as dioritic to gabbroic or diabasic rock intrusions. A thick section of phyllites and quartzites occurs in Hembrillo Canyon. These rocks strike about N. 40–50° W., with dips ranging from nearly vertical to about 70° NE. The metamorphic section is at least 12,000 ft thick, possibly twice that if the section is not isoclinally folded and repeated in its northeastern part. In the immediate vicinity of the Red Rock deposit, the rocks are reddish-brown, dark-gray, or greenish phyllites and sericitic schists, intruded locally by diabase or gabbro.

Talc mine

The Red Rock talc deposit was supposedly discovered by Watson L. Ritch, Jr., when a horse he was riding slipped on the talc. Reportedly, however, Oscar M. Nelson discovered the deposit and interested Nate Smith, Nelson H. Cross, and L. C. Butler in the property. The Red Rock claim was filed September 1, 1941, by Ritch, Cross, and Butler. See Page (1942) for earliest history and production. On March 30, 1942, the Big Horn Talc No. 1 was located, overlapping the southeast end of the Red Rock claim. The main entry to the mine is on the Big Horn claim but enters the Red Rock claim 36 ft inside the portal. This adit, begun in January 1943, was known as the Maire mine (Walter, 1953). The property was operated by Sierra Talc Company under a bond-and-lease working agreement beginning October 14, 1942. Sierra Talc reportedly advanced money to Ritch and paid him $12.50 per ton of talc delivered to Engle, New Mexico. About the same time, the United States spent $5,670 building a 10-mi access road from the west that involved expensive cuts through the limestone cliffs below Hembrillo Pass. Sierra Talc also spent $3,000 building the road down the canyon to the mine road. A total of 2,602 tons of talc was reportedly shipped from the deposit between 1942 and 1945, after which the property was appropriated as a part of the missile range.

The talc appears to be a lens within sericite schist or phyllite, which becomes increasingly chloritic as the talc is approached. The lens measures about 100 ft in length, is exposed vertically to about 90 ft, and has a width that ranges to 12 ft but averages roughly 8 ft. Dip-slip lineation in some of the associated schist suggests that the original vertical dimension may have been two to three times the horizontal dimension. Based on measured dimensions of the body in the mine and at the surface, the deposit contains about 62 tons of talc per foot of depth. If the body is projected to 100 ft below the lower level, a probable reserve of about 6,500 tons of talc is indicated.

Talc body

Foliation in the talc body is parallel to the foliation and layering of the country rock. The foliation appears in the orientation of talc grains and in the presence of lenticular aggregates 0.1–0.3 mm long and approximately 0.02 mm wide at the thickest part of the lens. The lenses are aligned parallel with the foliation. Talc flakes within the lenses are generally oriented transverse to the general foliation of the rock. The grain size of the talc is very fine and rather uniform (fig. 3).

The main part of the body seems to be very pure, monomineralic talc; but, in the outer 2 or 3 ft of the body, scattered remnants of carbonate (dominantly calcite) and chlorite appear. The presence of these two components explains the small amounts of calcium, iron, and aluminum obtained in chemical analyses (table 1). The talc body grades rather abruptly to slightly banded quartz-chlorite phyllite; the banding is caused by variable proportions of quartz and chlorite. Lighter bands are approximately 80 percent quartz and 20 percent chlorite; the darker bands are about 20 percent quartz and 80 percent chlorite. Intermediate proportions are also present. The chlorite-dominant bands are thicker than chlorite-poor bands; chlorite probably forms over 60 percent of the rock. In the zone of gradation, however, numerous stringers of calcite and quartz are present, commonly exhibiting embayed zones of corrosion or replacement by chlorite and talc.

All marginal and country rocks contain numerous patches and granular aggregates of a dusky to opaque material that is chalk white in reflected light and occasionally preserves the wedge shape of sphene. Most of this

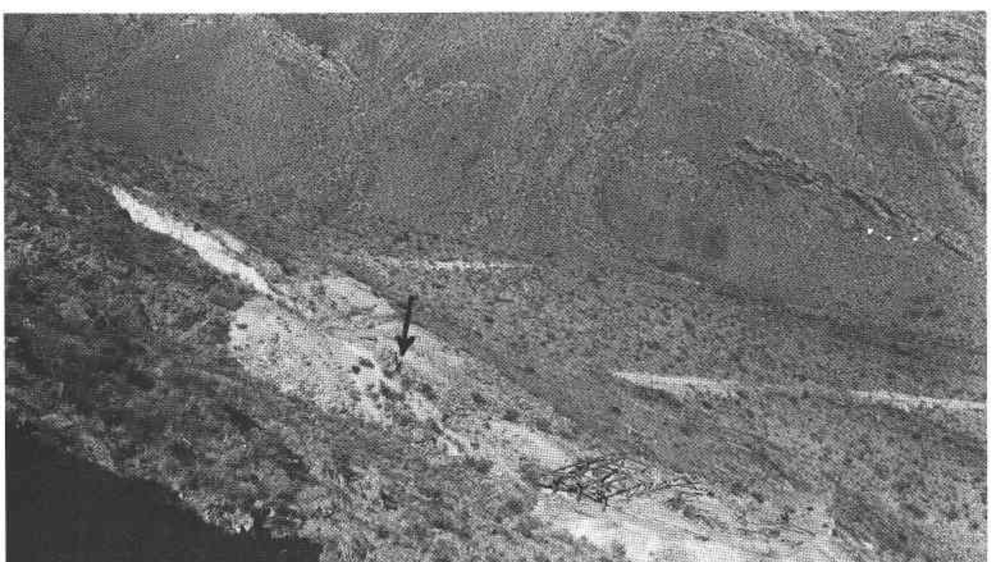

FIGURE 1—View northeast of main workings, Red Rock talc claim. Framework of sorting shed in foreground; arrow indicates marker at southeast end line of claim.

material is now leucoxene, derived from the original sphene. Occasional grains of muscovite and more diffuse patches of biotite are present in the rocks at the margin of the talc body. The biotite seems to be genetically related to crosscutting veinlets of iron-stained material. The biotitic mica is darkest next to these reddish-brown veinlets and grades to colorless mica within a few millimeters. The bulk of this rock consists of quartz and chlorite.

On the surface at the northwest end of the body, the zone of talc is scarcely more than 1 ft wide. It contains numerous inclusions of carbonate, occasional chlorite, and scattered patches of granular sphene-leucoxene. This zone of dominant talc grades northeast to a strongly sheared, brecciform phyllitic rock with flaser-like fragments consisting of quartz-rich rocks and minor chlorite and surrounded by chlorite-abundant material, whose foliation bends around the fragments. To the southwest, the talc-abundant zone gives way to a sheared carbonate stained with iron oxide and containing occasional lenses of fine-grained quartz. Within 3–4 ft the rock becomes quartz-chlorite phyllite and then quartz-chlorite-sericite schist.

The talc body seems to have been formed by replacement of carbonate and possibly quartz-chlorite phyllite; these rocks are present in the stratigraphic position of the talc beyond the end of the body. The occurrence of remnants of carbonate, quartz-carbonate, and quartz-chlorite in the marginal parts of the talc body provides more direct evidence. Many of these remnants exhibit embayed and corroded relations with the talc. However, parallelism of shearing planes and general schistosity of both the talc body and the country rocks suggest a practically simultaneous origin for all the rocks. If the talc formed after the episode of low-grade metamorphism that produced the country rocks, the origin of the talc was still accompanied by shearing movements that left imprints upon both the talc and the country rocks, and the shearing movements occurred along the same planes involved in the earlier metamorphism. The shearing movements possibly facilitated the migration of the components necessary for replacement of carbonate and quartz-chlorite phyllite by talc. Meladiorite dikes (80 percent original augite and 15–20 percent intermediate plagioclase) occur in the vicinity of the talc body, but evidence does not suggest that the talc is genetically related to such intrusive masses. Contacts between the talc and meladiorite dikes do not exist. Furthermore, metamorphism or alteration of the country rock adjacent to the dikes is not found.

Ten samples were taken across talc widths of 5–12 ft in the workings from the surface to the lower level, shown in the accompanying mine maps (figs. 4 and 5). Maps of the surface and mine workings show the pinching out of the talc body to the northwest in the outcrop (fig. 6), the upper cut, and the lower level. The southeast pinching of the orebody is only observed in the lower adit. Analyses of these

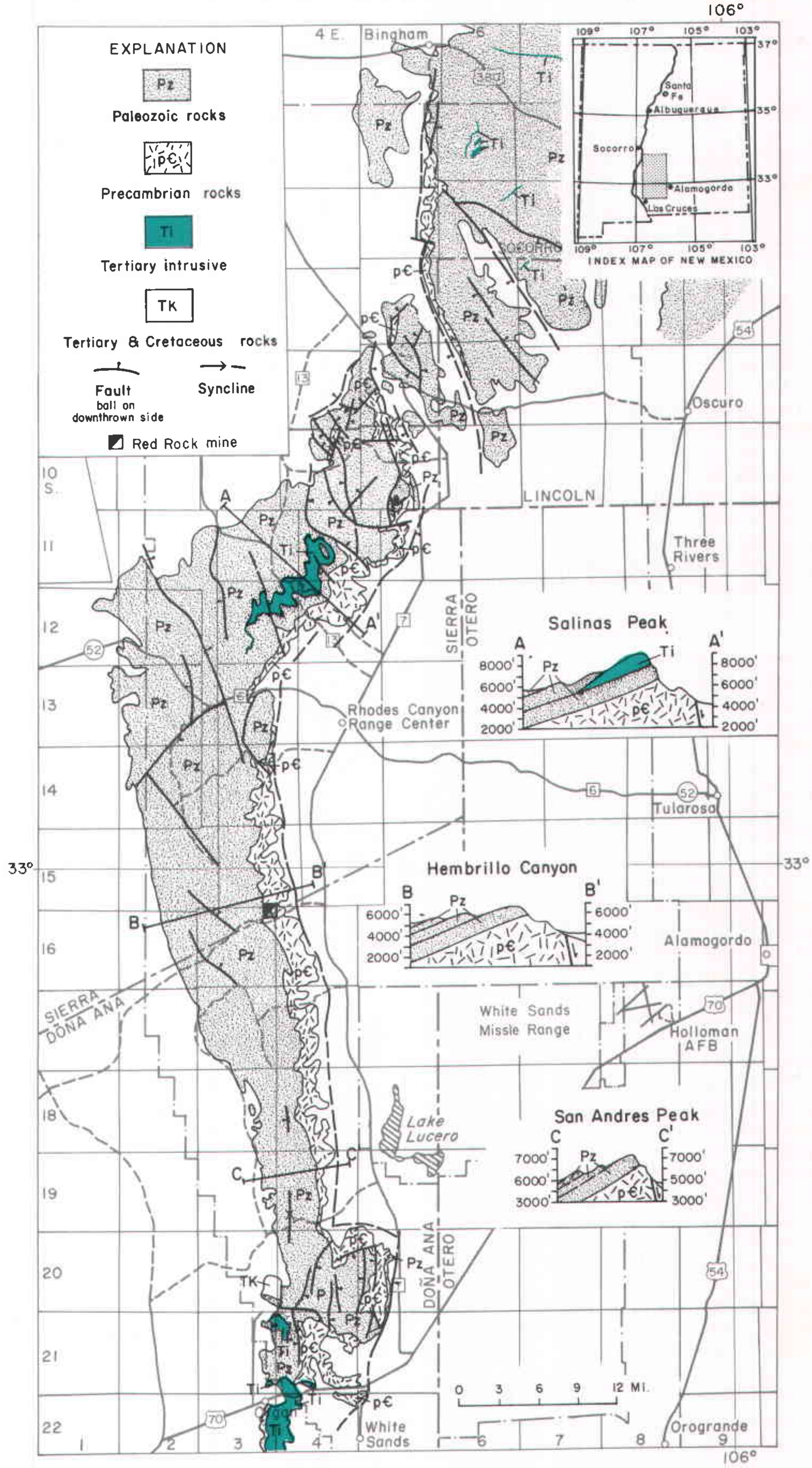

FIGURE 2—Geologic map of San Andres Mountains.

samples are shown in table 1. Analyses made by others of selected talc samples have yielded silica percentages of 61.18 and 61.67 (Chidester, Engel, and Wright, 1964).

FIGURE 3—SCANNING ELECTRON MICROSCOPE PHOTOMICROGRAPH OF TALC PARTICLES; enlargement approximately × 1,400 (courtesy University of New Mexico School of Medicine, by D. G. Brookins and R. Hicks).

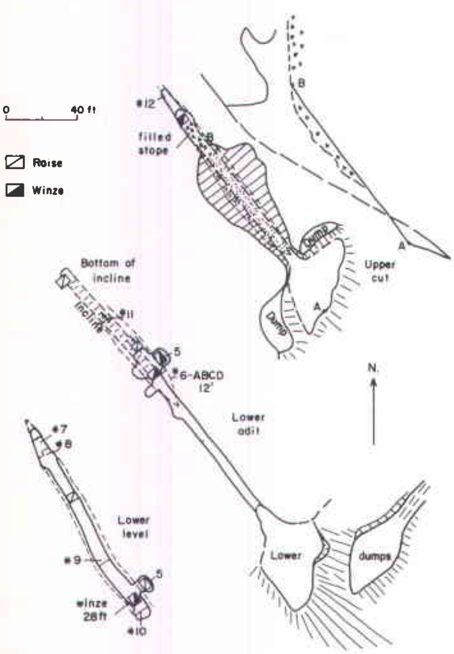

FIGURE 4—PLAN AND SECTION, RED ROCK TALC WORKINGS.

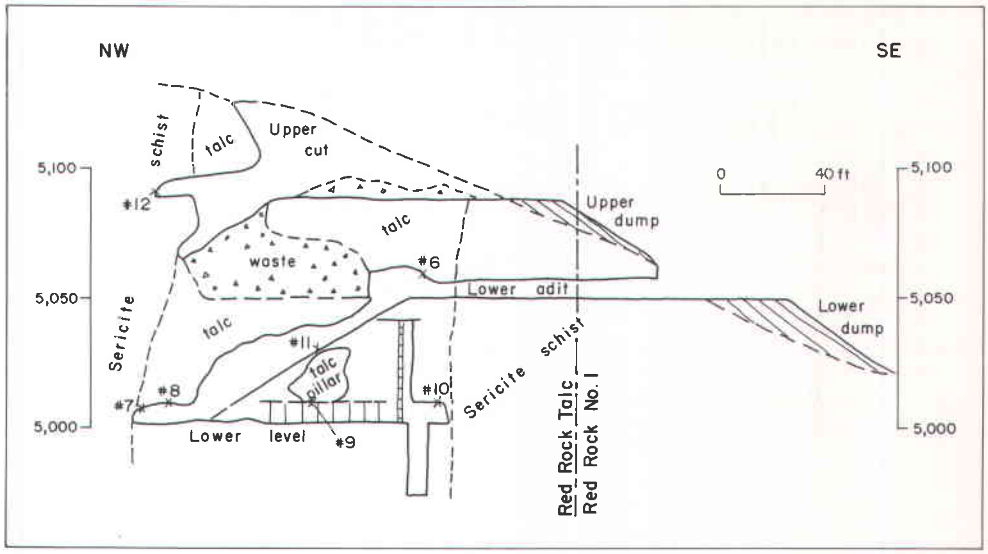

FIGURE 5—LONGITUDINAL SECTION, RED ROCK TALC WORKINGS.

FIGURE 6—VIEW NORTHWEST INTO OPEN CUT AND INCLINE TO STOPE showing mine stalls in place and talc in face of cut.

TABLE 1—CHEMICAL ANALYSES OF VARIOUS PARTS OF THE TALC BODY. Location of samples given in figs. 4 and 5. Analyses by John Husler.

Sample	Fe_2O_3	Al_2O_3	CaO	MnO	Na_2O	K_2O	Mgo
6A	2.50	6.33	2.91	0.284	0.023	0.001	27.2
6B	1.50	2.08	4.06	0.226	0.0314	0.006	28.2
6C	1.36	3.97	0.539	0.129	0.015	0.002	34.2
6D	3.72	14.5	3.15	0.310	0.005	0.004	28.3
7							
8	1.57	3.02	4.05	0.226	0.015	0.002	28.6
9	0.858	1.51	2.74	0.129	0.007	0.001	29.7
10	1.79	4.53	0.259	0.116	0.007	0.002	31.0
11	0.500	0.945	1.19	0.097	0.013	0.002	31.0
12	0.929	1.04	1.85	0.180	0.012	0.002	26.4

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New Mexico uranium statistics

A report from the U.S. Department of Energy, May 7, 1980, lists New Mexico \$50/lb uranium reserves on January 1, 1980, as 482 million tons of ore at a grade of 0.09 percent U_3O_8. This grade gives 449,000 tons of U_3O_8 or 48 percent of \$50/lb ore in the United States. In New Mexico, 6.9 million tons of ore were processed in 1979; the ore contained 8,040 tons of U_3O_8 or 44 percent of production in the United States. Exploration and development drilling in New Mexico dropped to 6 million ft in 1979 from 10 million ft in 1978.