GYPSUM, PLASTERS, ETC.

GYPSUM IN NORTHWESTERN NEW MEXICO.

By MILLARD K. SHALER.

INTRODUCTION.

The field work on which the following notes are based was carried on in connection with a reconnaissance survey of the Durango-Gallup coal field during the fall of 1905.

Extensive deposits of gypsum occur at many places in New Mexico, particularly in the southeastern and northwestern parts of the Territory,[a] but they are developed only at Ancho, on the line of the Rock Island Railroad, where a plaster mill has been in operation for several years.[b]

The gypsum along the western base of the Sierra Nacimiento was known at least as early as 1849, when Simpson[c] mentioned its occurrence in his journal. In 1859 Newberry[d] saw these deposits and described them as "immense masses of snowy gypsum." Cope[e] in 1875 also refers to extensive deposits of gypsum along the western base of Sierra Nacimiento. Cope regarded these deposits as Jurassic, but Newberry was inclined to the belief that they are of Triassic age.

It is highly probable that these beds were formed by precipitation of salts from sea water evaporated in a partly or entirely inclosed basin. This seems to have been the opinion of Cope, who says:[f]

> In the badland tract I obtained satisfactory evidence of the lacustrine character of the formation, a point of much importance, inasmuch as the nature of these beds has remained very obscure up to the present time. The evidence consists of numerous specimens of bones and teeth of two or three species of saurians, one of which at least was of terrestrial habits, according to our present knowledge.

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a Herrick, H. N., Gypsum deposits in New Mexico; Bull. U. S. Geol. Survey No. 223, pp. 89-99.

b Eckel, E. C., Gypsum and gypsum products in 1905: Mineral Resources U. S. for 1905, pp. 1105-1115.

c Simpson, James H., Journal of a military reconnaissance from Santa Fe, N. Mex., to the Navajo country, pp. 25-26.

d Newberry, J. S., Exploring expedition from Santa Fe to junction of Grand and Green rivers, 1859, p. 177.

e Cope, E. D., U. S. Geog. Survey W. 100th Mer., vol. 4, pp. 1-13.

f Loc. cit., p. 9.

STRATIGRAPHY AND STRUCTURE.

The Sierra Nacimiento consists of a north-south trending series of even-crested ridges and serrated peaks. It is approximately 35

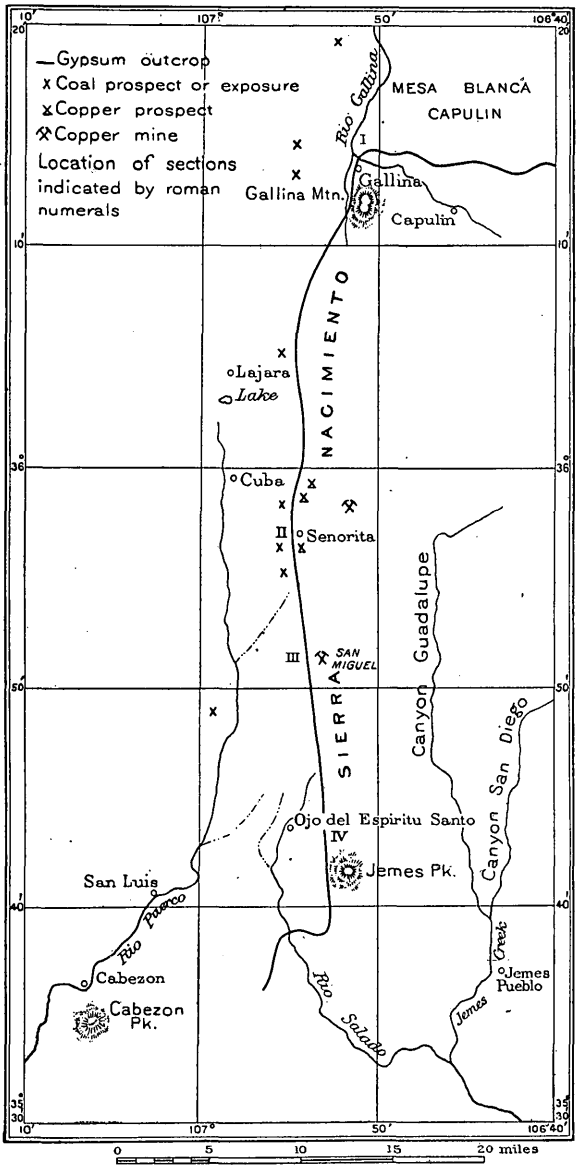

FIG. 9.—Sketch map showing line of outcrop of gypsum bed.

miles long, extending from the latitude of Gallina, N. Mex., on the north to the latitude of Cabezon on the south. Gallina Mountain marks the northern and Jemes Peak the southern terminus of the range. These peaks rise to an elevation of more than 9,000 feet above

sea level, their summits lying 3,000 feet above the lowland area that extends westward from the base of the mountains. The main mountain mass is made up of pre-Carboniferous (pre-Cambrian?) granites, schists, and gneisses, which are overlain in patches by Carboniferous limestone and sandstone and Permo-Carboniferous rocks and flanked on all sides by Mesozoic strata. The Mesozoic rocks are tilted at a high angle along the western front of the range, dipping steeply westward away from the mountain mass except where locally overturned.

The gypsum deposits along the western base of the range lie near the top of the "Red Beds" series. They are apparently at all places underlain by a bed of bright yellow, poorly consolidated sand, and are overlain by dark shales and yellowish brown sandstone of Dakota or Jurassic age, from which they are occasionally separated by a thin bed of limestone. The Mesozoic rocks are tilted generally westward throughout the length of the mountain range, but at its extremities, at the northern and southern ends of the gypsum outcrop, as mapped, the strike of the beds changes to a northeast-southwest direction and the dip becomes northwesterly and less steep. A fault, whose extent and relations are not yet clearly understood, trends north-south between the vicinity of Cuba and a point east of the southern end of the Nacimiento Range. This fault appears to involve only the Cretaceous rocks overlying the Dakota formation.

GYPSUM DEPOSITS.

During the hasty examination of the deposits time was not available to measure sections in the pre-Cretaceous rocks except at great intervals along the outcrop, and the measurements made were not all accurate. At Gallina, on Gallina Creek, near the northern limit of the gypsum outcrop as here mapped, a bed of massive white gypsum outcrops within the limits of the village, where it has been, to a very limited extent, quarried and burned, the product being used by the inhabitants for plastering their adobe houses. The deposit is readily accessible and is mined by open cut. The gypsum bed may be traced eastward from Gallina for many miles, as it outcrops along Gallina Creek in the southward-facing bluff of Mesa Blanca Capulin. The rocks in this mesa lie almost flat, having a very low northwesterly dip, about equal in grade to the fall of the creek. A section of the lower Mesozoic rocks containing the gypsum deposits is given below.

Section of rocks in Mesa Blanca Capulin.

	Feet.
Dakota red sandstone	80
Red and green shale (Dakota or Jurassic)	300
Gypsum	40+
Yellow, poorly consolidated sand	50
Red sandstone (Jurassic-Triassic)	300+

Farther south, between Gallina and Senorita, the same gypsum bed was observed at many places, but its thickness and its relations to the overlying and underlying rocks were not particularly noted. East of Lajara the bed, if present, is completely covered by flat-lying Tertiary sediments, which overlap the Mesozoic section from the west. This condition probably exists at several localities between Gallina and Senorita.

At Senorita the rocks that include the gypsum dip very steeply to the west. The gypsum bed outcrops above a limestone bed 50 feet in thickness, from which lime has been burned for local use. So far as known, the gypsum has not been utilized at Senorita, where it outcrops, striking north-south about one-fourth mile west of the post-office. The company that has a copper smelter situated at Senorita has opened a 6-foot coal bed which outcrops about one-half mile west of the gypsum outcrop. This bed furnishes a good grade of bituminous or subbituminous coal and its outcrop parallels the gypsum outcrop throughout its extent as mapped. The presence of this coal should do much to hasten development of the gypsum bed at this point. As will be seen from the section that follows, the gypsum bed has a thickness of 54 feet at Senorita.

Section of rocks exposed at Senorita.

	Feet.
Mesaverde coal measures, containing 6-foot coal bed	
Mancos shale	2,500+
Dakota sandstone (shale and sandstone at base of unknown age)	600
Gypsum; massive, white	54
Limestone, white, crystalline	50
Shale, red and greenish drab	600
"Red Beds" sandstones and shales (copper bearing at base)	750

About 3 miles west of San Miguel copper mine, at present abandoned, a bed of massive white gypsum 60 feet thick outcrops, dipping nearly due west at an angle of 40°. Here the gypsum is overlain by a bed of limestone 40 feet thick. The following section shows the relations of the underlying and overlying rocks to the gypsum.

Section of rocks exposed at San Miguel mine.

	Feet.
Dakota sandstone and shale at base (shale may be Jurassic)	100+
Crystalline limestone	40
Massive white gypsum	60
Light pinkish sandstone, red shale at base	80
Light pinkish sandstone, copper bearing	40
Red sandstone, with some shale interbedded (Jurassic-Triassic)	300+
Pre-Carboniferous (pre-Cambrian?) granite.	

The gypsum deposit at this point is easily accessible by the wagon road to Bernalillo, and could be mined over an extensive area, at first by open cut and later, as necessity demanded it, by slope or incline.

It is reported that the gypsum has been used locally for making plaster for a number of years, although no workings were seen by the writer.

A partial analysis by W. T. Schaller, of the United States Geological Survey, of a sample taken from the gypsum bed at the surface at this point is as follows:

Analysis of gypsum from west of San Miguel copper mine.

Calcium oxide (CaO)	34.24
Sulphur trioxide (SO_3)	46.61
Water	18.89
Insoluble residue	.18
Loss	.08

This analysis shows that the gypsum at this point is practically pure. It contains about 2.5 per cent of calcium oxide, more than can be in combination with the sulphur trioxide present. It is likely that this excess is in combination with CO_2, which has been included as water and loss.

At the head of a tributary to Rio Salado, about 3 miles southeast of Ojo del Espiritu Santo, at an elevation between 7,500 and 8,000 feet, the gypsum bed reaches a maximum thickness of about 100 feet. Near the mountains the bed is conformable with the underlying rocks, which dip westward at an angle of 70°. Within a short distance, however, across the dip, the gypsum bed becomes very flat, conforming with the dip of the overlying Dakota(?) formation. The relations here are not plain, but it is believed that the dip of the underlying Mesozoic strata decreases westward an equal amount. As a consequence of this flattening away from the mountains and the presence of a valley heading near this locality, a large area of gypsum is exposed and can be mined to advantage by open cut. It should be accessible by a wagon road built at slight expense up the valley of a tributary of Rio Salado. In appearance the gypsum is identical with that analyzed from near San Miguel mine. In the section it will be noticed that the limestone bed, which was 50 feet thick at Senorita, is absent here.

Section of rocks exposed near Ojo del Espiritu Santo.

	Feet.
Alternating shales and sandstones (Dakota?)	500+
Massive, white gypsum	100
Shales and argillaceous sandstone	[a] 250
Red sandstone (Jurassic-Triassic)	200
Pre-Carboniferous (pre-Cambrian?) granite	

The gypsum bed outcrops continuously for several miles in a zone extending northward from the locality just described. It dips westward at an angle of 50° and extends to a point 4 miles farther south,

[a] The exposure in the upper part was too poor to enable the writer to affirm or deny the presence of the yellow sand below the gypsum.

where, the strike abruptly changing to a nearly east-west direction, the line of outcrop crosses the Cabezon-Albuquerque wagon road and then courses southwestward for an unknown distance. Where the gypsum outcrop crosses the wagon road the bed dips gently west-northwest. At this point it is covered by a thin bed of shale and could probably be exposed over a considerable area by stripping. It is here, apparently, that Simpson[a] observed gypsum and salt deposits. Salt was not seen by the writer, but it is undoubtedly present in the vicinity in some quantity, for the Rio Salado, whose head tributaries drain the area, is exceedingly salty. The section exposed at this point is in all respects similar to that measured at the locality just described. Here the yellow, unconsolidated sand bed, 50 feet thick, underlies the gypsum.

RÉSUMÉ.

As has been already noted above, the deposits are practically inexhaustible and are accessible by wagon road, but railroad facilities are lacking. The nearest railroad station is Bernalillo, on the Atchison, Topeka and Santa Fe Railroad. This place is 25 miles distant from the gypsum deposit last described—so far that a wagon haul is quite out of the question under present conditions. It is not thought likely that the deposits will be worked on a commercial scale until the gypsum beds of the territory that are situated nearer railroad lines have been practically exhausted or until the demand for gypsum products greatly increases. It is not at all improbable, however, that a railroad line will soon be built into the area, the promoters having in view primarily the development of the coal and copper resources of the region, a description of which has been given in other Survey publications.[b] The presence of the coal beds will do much to promote the development of the gypsum industry in this region, for the gypsum may be burned on the ground cheaply. The analysis given above shows that the gypsum is of exceptional purity where the sample was taken. Throughout its occurrence its physical characteristics are similar, and in so far as one may be guided by appearance it is everywhere of similar purity. The gypsum is suitable for any purpose to which gypsum is adapted.

[a] Loc. cit.

[b] Schrader, F. C., The Durango-Gallup coal field of Colorado and New Mexico: Bull. U. S. Geol. Survey No. 285, 1905, pp. 250-251. Lindgren, W., and Graton, L. C., A reconnaissance of the mineral deposits of New Mexico: Bull. U. S. Geol. Survey No. 285, 1905, p. 86. Lindgren, W., Graton, L. C., Gordon, C. H., and Schrader, F. C., Reconnaissance of the mineral deposits of New Mexico: Prof. Paper U. S. Geol. Survey, in preparation.

SURVEY PUBLICATIONS ON GYPSUM AND PLASTERS.

The more important publications of the United States Geological Survey on gypsum and plasters are included in the following list:

ADAMS, G. I., and others. Gypsum deposits of the United States. Bulletin No. 223. 123 pp. 1904.

BOUTWELL, J. M. Rock gypsum at Nephi, Utah. In Bulletin No. 225, pp. 483–487. 1904.

ECKEL, E. C. Salt and gypsum deposits of southwestern Virginia. In Bulletin No. 213, pp. 406–416. 1903.

ORTON, E. Gypsum or land plaster in Ohio. In Mineral Resources U. S. for 1887, pp. 506–601. 1888.

RICHARDSON, G. B. Salt, gypsum, and petroleum in trans-Pecos Texas. In Bulletin No. 260, pp. 573–585. 1905.

SIEBENTHAL, C. E. Gypsum of the Uncompahgre region, Colorado. In Bulletin No. 285, pp. 401–403. 1906.

——— Gypsum deposits of the Laramie district, Wyoming. In Bulletin No. 285, pp. 404–405. 1906.

SURVEY PUBLICATIONS ON SALT, BORAX, AND SODA.

The more important publications of the United States Geological Survey on the natural lime, sodium, and potassium salts included in this group are the following:

CAMPBELL, M. R. Reconnaissance of the borax deposits of Death Valley and Mohave Desert. Bulletin No. 200. 23 pp. 1902.

——— Borax deposits of eastern California. In Bulletin No. 213, pp. 401–405. 1903.

CHATARD, T. M. Salt-making processes in the United States. In Seventh Ann. Rept., pp. 491–535. 1888.

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DAY, W. C. Potassium salts. In Mineral Resources U. S. for 1887, pp. 628–650. 1888.

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KINDLE, E. M. Salt resources of the Watkins Glen district, New York. In Bulletin No. 260, pp. 567–572. 1905.

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RICHARDSON, G. B. Salt, gypsum, and petroleum in trans-Pecos Texas. In Bulletin No. 260, pp. 573–585. 1905.

YALE, C. G. Borax. In Mineral Resources U. S. for 1889–1890, pp. 494–506. 1902.