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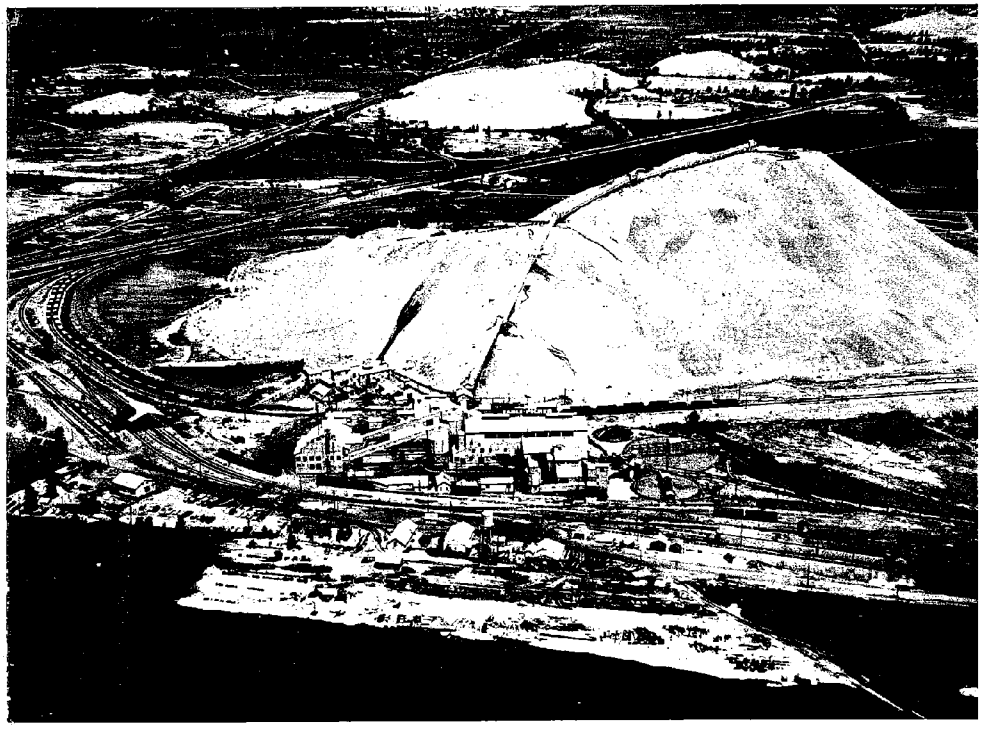
OKLAHOMA GEOLOGY NOTES



ZINC AND LEAD MINING, OTTAWA COUNTY

OKLAHOMA GEOLOGICAL SURVEY • THE UNIVERSITY OF OKLAHOMA • NORMAN, OKLAHOMA

Cover Picture

MINERAL INDUSTRIES IN OKLAHOMA

Zinc and Lead

Since 1891, Oklahoma has produced nearly 10 million tons of zinc concentrate and more than 1.5 million tons of lead concentrate. The yield of metals has been approximately 5.2 million tons of zinc and 1.3 million tons of lead, valued at about $780 million and $195 million, respectively. The ores, sphalerite and galena, were recovered from mineralized zones in Mississippian rocks in Ottawa County. This county constitutes the Oklahoma part of the Oklahoma-Kansas-Missouri Tri-State district.

Although mining began in the Tri-State district at Joplin, Missouri, in the 1840's, the richest ore body, that in the Picher field of Ottawa County, was not discovered until 1914. From that year onward, Oklahoma improved its position among the zinc-producing states so that by 1918 it was the principal producer. It maintained this position for all years but two until 1945. The record production of 283,000 tons made the State the leading producer in the world in 1925.

With depletion of the higher grade ores and decline of the market price, zinc and lead production in Oklahoma reached low ebb in 1959. Although production is far below that of former years, renewed activity, stimulated by Federal legislation, has resulted in a progressive increase in production and the reopening of more than 40 mines. Currently, Oklahoma provides almost three-quarters of the Tri-State production. The photograph on the cover is that of the central mill of The Eagle-Picher Co. near Miami, Ottawa County.

—A. N.

New Gypsum Plant to Open at Duke, Jackson County, Oklahoma

Kenneth S. Johnson

INTRODUCTION

Late in the summer of 1964, the Republic Gypsum Company expects to begin production of wallboard and other gypsum products at its new plant in southwestern Oklahoma (fig. 1). Construction of the 4-million-dollar plant began in October of 1963 at Duke, a small agricultural community on the Hollis and Eastern Railroad in northwestern Jackson County. Duke has a population of 325 and is 15 miles west of Altus, county seat of Jackson County. Gypsum will be quarried 1½ miles south of Duke (fig. 2) from the Permian Blaine Formation which crops out over an extensive area in this part of the State. When the plant is operating at full capacity, Republic expects to employ 215 persons with an annual payroll of 1¼ million dollars, and will produce 400,000 square feet of wallboard per day.

The Republic Gypsum Company was formed by Rhyne Simpson of Lubbock, Texas, to develop the gypsum resources in the Duke area. Location of the plant at Duke resulted from action by local citizens, who, led by Claude Brown of Duke and Robert Harbison of Altus, made available to Mr. Simpson a report on gypsum deposits in the area. With the aid of various State and Federal agencies, banks, and investments by local citizens, the way was cleared for construction of

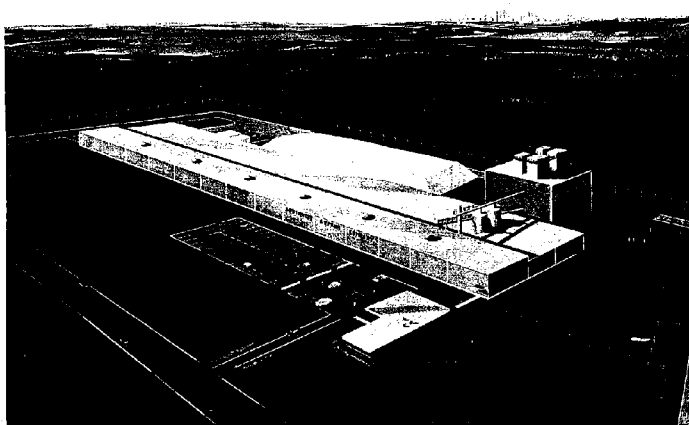


Figure 1. Artist's sketch of wallboard plant to be constructed at Duke by Republic Gypsum Company.

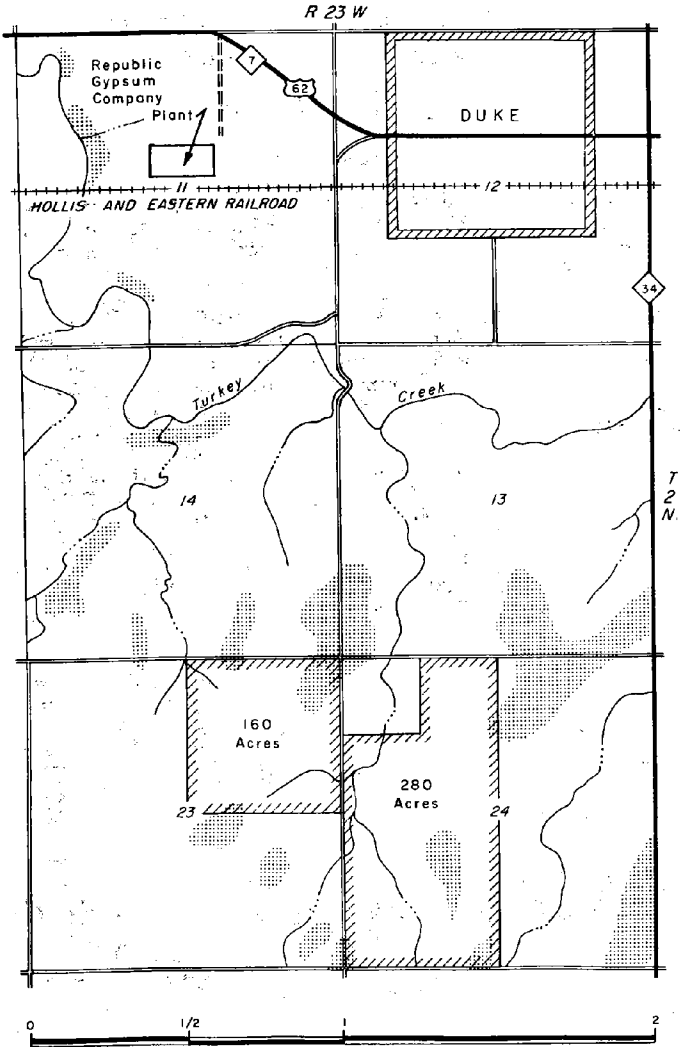


Figure 2. Map of the Duke area showing location of proposed quarry (sections 23, 24) and wallboard plant of Republic Gypsum Company. Exposures of Blaine gypsum are indicated by stippling (modified from Copley, 1961, pl. 1).

what may become the largest wallboard-producing plant in the State. The United States Gypsum Company currently operates a similar plant at Southard, in Blaine County, where more than 100 million square feet of wallboard is produced annually.

Although Republic Gypsum Company will have a plant office in Duke, the company's executive-office mailing address will remain: P. O. Box 949, Lubbock, Texas. Phil Simpson, a vice president of Republic, has kindly provided information on future plant operations and gypsum reserves in the Duke area.

ANTICIPATED WALLBOARD PRODUCTION

Wallboard will be the main product of the Republic Gypsum Company, although some sheathing, which is oil-impregnated wallboard, is also to be produced. Additional products are raw gypsum for cement retarder and for agricultural purposes.

Gypsum ($CaSO_4 \cdot 2H_2O$), reported to have an average purity of 95.5 percent, will be quarried from the Van Vacter Member of the Blaine Formation. The open-pit quarry will be 1½ miles south of Duke on 440 acres of land owned by the company. Reserves in this tract of land are 12.5 million tons of gypsum, occurring in three beds to a maximum depth of about 70 feet. A 1:1 ratio of gypsum to shale and dolomite is anticipated at the site of the proposed quarry.

Processing of the gypsum will follow the practices that are standard in the industry. Quarry-run rock is trucked to the plant and is reduced in size to less than 4 inches in a primary crusher. It is then stacked outside the plant and later dried and further reduced to ½-inch size in a hammermill.

Following a final grinding, the gypsum is calcined whereby free water and three-fourths of the water of crystallization are driven off. Calcining takes place in two 20-ton kettles, fired by gas burners, during a cycle of 2½ hours. The calcined material, or stucco, ideally having a chemical composition represented by the formula $CaSO_4 \cdot \frac{1}{2}H_2O$, is then placed in three storage bins.

The second processing phase, actual wallboard production, commences in a mixer where the stucco is blended with additives including K_2SO_4, starch, paper pulp, and foam. After addition of water, this slurry is fed into the board machine between face and back papers, supplied from two 10,000-foot rolls. A squeeze roll feeds the uniformly thick 4-foot-wide board onto a conveyor belt, where the initial setting takes place. The board machine is rated at a maximum speed of 125 feet per minute and can produce about 400,000 square feet of ½-inch wallboard (10 railroad carloads) in 24 hours.

The board is cut in lengths of 6 to 16 feet and continues on rollers into an 8-deck, 3-zone dryer. After passing through the cooling section (third zone of the dryer), the wallboard is bundled and moved to a storage area or directly to railroad boxcars.

Similar wallboard-producing installations have been constructed recently in other parts of the United States, and a more detailed outline of one such plant, American Gypsum Company at Albuquerque, New Mexico, is given by Herod (1962).

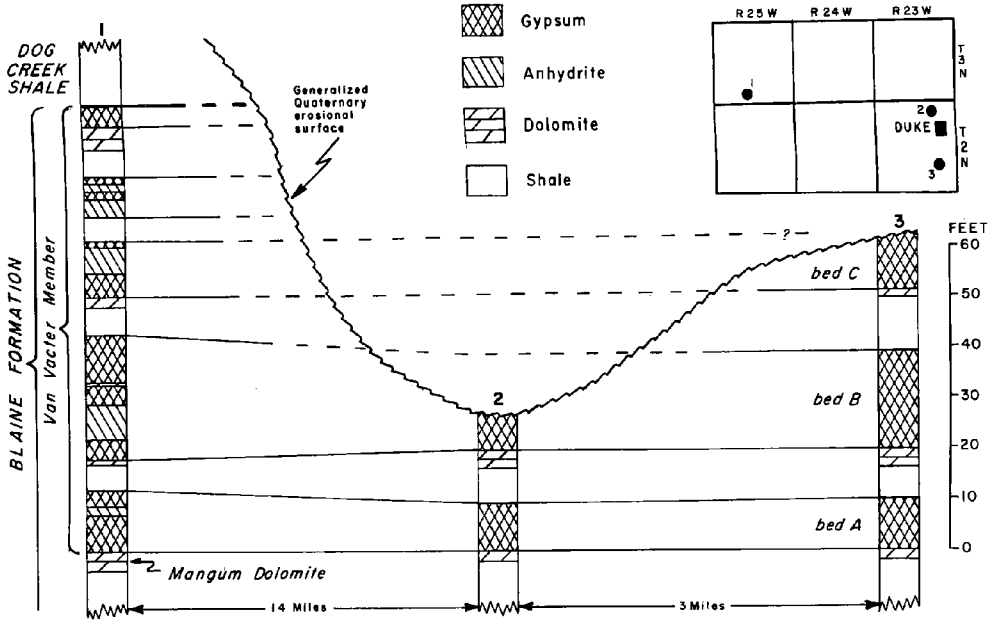


Figure 3. Cross section showing stratigraphic position of gypsum beds to be quarried by Republic Gypsum Company. Sections 1 and 2 are from continuous cores and section 3, a composite section in the vicinity of the proposed quarry, is based upon surface and nearby subsurface data.

Republic Gypsum Company intends to market its products in Oklahoma, Texas, New Mexico, Colorado, Kansas, Arkansas, and Louisiana. This area includes such major cities as Amarillo, Austin, Lubbock, El Paso, Wichita Falls, San Antonio, Dallas, Houston, and Fort Worth in Texas, and Altus, Lawton, Tulsa, and Oklahoma City in Oklahoma.

GEOLOGY

A detailed examination of the Blaine Formation in the Duke area was made by Copley (1961) as part of an extensive study that was started by the Oklahoma Geological Survey in 1953. In all, seven candidates for Master of Science degrees at The University of Oklahoma have contributed to mapping the Blaine and associated formations throughout southwestern Oklahoma, and their work will be the core of a forthcoming report to be published by the Survey. An earlier report by Scott and Ham (1957) set forth the basic stratigraphic relationships of these Permian strata in this part of the State.

The Blaine Formation, of Middle Permian age, crops out over an extensive area in southwestern Oklahoma. It is a sequence of interbedded gypsum and shale with relatively thin dolomites underlying most of the gypsum layers. In northwestern Jackson County, the Blaine is about 200 feet thick. Individual gypsum beds are 5 to 20 feet thick.

Four gypsum members are recognized in the Blaine of southwestern Oklahoma. They are named, in ascending order, Haystack, Cedartop, Collingsworth, and Van Vacter (Scott and Ham, 1957). Whereas the three lower members are generally single beds, the Van Vacter consists of five separate gypsum layers in most of Jackson, Harmon, and Greer Counties (fig. 3). This is known from studies of several continuous cores and the logs of numerous water wells drilled in the area. The logs of two of these cores are shown in figure 3; section 1 represents a core from sec. 33, T. 3 N., R. 25 W., and section 2 represents a core from sec. 2, T. 2 N., R. 23 W. All gypsum exposed in the vicinity of Republic's proposed quarry is in the Van Vacter Member.

The Van Vacter is 80 to 85 feet thick in northwestern Jackson County, but only the lower 63 feet is present in the area south of Duke. The two uppermost gypsum beds have been removed by erosion or solution and only the three lower beds (herein referred to as beds A, B, and C) of this member will be quarried. Based upon surface and nearby subsurface data, the following thicknesses of gypsum and intervening strata should be expected at the quarry: bed A, 10 feet, overlain by 10 feet of shale and dolomite; bed B, 19 feet, overlain by 12 feet of shale and dolomite; bed C, 12 feet (fig. 3, section 3). The thicknesses of beds A, B, and C vary greatly in the vicinity of the quarry inasmuch as parts of individual beds, and even the entire Van Vacter, have been removed locally by solution and erosion.

Beds in the quarry area are nearly flat-lying with an over-all dip of about 15 feet per mile towards the northwest. However, con-

siderable small-scale disturbance of some of the beds is present because of solution and slump. Several of the higher hills are capped by slumped blocks of a light-gray platy dolomite, 2 feet thick, which underlies the uppermost gypsum of the Van Vacter several miles to the west.

Anhydrite or anhydritic gypsum, objectionable in producing wallboard, will probably not be encountered in the quarry. Examination of cores from this part of the State indicates that anhydrite generally occurs only at depths greater than 75 feet. Furthermore, as much evidence of solution has been found in the Van Vacter beds south of Duke, it seems likely that the pre-existing anhydrite has been entirely hydrated in the presence of circulating ground water. The top of the uppermost anhydrite shown in section 1 (fig. 3) is 100 feet below ground level.

Immediately underlying bed A is the Mangum Dolomite which, at the outcrop, is normally 2 feet thick and weathers out in honeycombed blocks. The Mangum crops out 4 miles east and southeast of Duke (Copley, 1961, pl. 1) and caps numerous prominent escarpments in that area. The next lower gypsum member of the Blaine is the Collingsworth. In the core drilled 1 mile northwest of Duke, the Collingsworth is 50 feet below bed A and therefore too deep to be economically mined at this time.

References Cited

Copley, A. J., 1961, Areal geology of the Duke area, Oklahoma: Okla., Univ., unpublished Master of Science thesis, 100 p.

Herod, B. C., 1962, American Gypsum sets sights on growth of southwest: Pit and Quarry, vol. 54, no. 9 (Mar.), p. 108-111, 126.

Scott, G. L., Jr., and **Ham, W. E.**, 1957, Geology and gypsum resources of the Carter area, Oklahoma: Okla. Geol. Survey, Circ. 42, 64 p.

New Theses Added to O. U. Geology Library

The following Master of Science thesis was added to The University of Oklahoma Geology Library in December 1963.

Geomorphology of the western part of the Ouachita province, Oklahoma, by James Kirk Ervin.

A doctoral dissertation, *Paleogeologic and quantitative lithofacies analysis of the Simpson Group, Oklahoma,* by Martin William Schramm, Jr., was also added.

Foreign Literature in Geology

Carl C. Branson

The science of geology is a complex of information which overlaps many other disciplines, such as chemistry, geography, biology, physics, and engineering. Partly because of the vague borders of the science, the volume of printed matter of geology has become appalling. The *Bibliography and Index of Geology Exclusive of North America* for 1961 (the last one available) consists of 799 pages and is, even so, by no means exhaustive.

Non-North American geologic literature in that year, exclusive of abstracts, biographies, and annual reports, is distributed among languages as follows:

LANGUAGE	TITLES	PAGES	PERCENT OF PAGES
English	2,059	51,489	30
Russian	898	43,221	25
French	959	24,891	14
German	559	19,661	11
Spanish	230	12,038	7
Polish	47	5,486	3
Portuguese	171	4,647	3
Czech	39	3,128	2
Italian	46	1,986	1
Slovenian	74	1,432	
Rumanian	30	1,189	
Japanese	111	1,124	
Danish	10	976	
Hungarian	21	604	
Latvian	1	516	
Afrikaans	4	500	
Yugoslav	1	296	
Norwegian	10	267	
Chinese	8	238	
Finnish	21	222	
Swedish	20	148	
Esthonian	1	90	
Flemish	1	55	
Ukranian	1	47	
Icelandic	2	47	
Georgian	1	33	
Dutch	1	8	
Turkish	1	4	
Total	5,327	174,343	

The 1958 bibliography had 5,233 titles and 211,228 pages, as opposed to the 1961 totals of 5,327 titles and 174,343 pages. The bibli-

ography is contaminated by hundreds of titles of abstracts from the Indian Science Congress Association Proceedings. It would improve the book, would shorten it, and would save us all money if abstracts of all kinds were omitted.

References

Branson, Carl C., 1962, Volume of geologic literature: Okla. Geol. Survey, Okla. Geology Notes, vol. 22, p. 111-112.

Siegrist, Marie, Grier, Mary C., and others, 1963, Bibliography and index of geology exclusive of North America, vol. 26: Geol. Soc. America, 799 p.

Oklahoma City Geological Society Reference Book

Volume I of *Oil and gas fields of Oklahoma—Reference report* was published by the Oklahoma City Geological Society in November 1963. Under the editorship of Richard D. Cramer, Leroy Gatlin, and Hubert G. Wessman, the book is the joint effort of 42 authors and numerous other members of the Society and gives critical information on 70 oil and gas fields in the Anadarko and Arkoma basins.

The report is in loose-leaf format to permit future revisions and additions. Volume I deals mainly with fields in the above-mentioned areas, although a few other fields are also included. It is hoped that future volumes will cover the remainder of the State.

The fields described are:

Anadarko Basin

Ames, NE	Doby Springs, NW	Meno, SE
Avard, NW	Dover	Mocane
Binger	Elk City	Okarche
Buffalo	Elmwood, W	Okeene, NW
Camrick	Fairview, NE	Payne
Catesby	Gate Lake, NE	Putnam
Cedardale	Gotebo, N	Rich Valley
Chaney	Hennessey	Ringwood District
Cherokee, NE	Homestead, N	Rosston, N
Chester, W	Keyes	Salon, N
Cheyenne Valley	Laverne	Salt Fork, SE
Cleo, W	Lenora	Seiling, NE
Cogar	Light Gas Area	Sentinel, W
Columbia, NW	Luther Hill	Tangier, NW
Criner	Luther Hill, E	Waynoka, NE
Custer City, N	Mayflower, NW	Yellowstone
Doby Springs, NE	Meno, S	

Arkoma Basin

Brent	Gilmore	Poteau
Carney	Henryetta	Quinton
Carson, N	Hoffman	Red Oak
Dustin, S	Kinta	Roland
Featherston	Muldrow	Salem
Gans	Norris	Wilburton, W
Gans, SW	Potato Hills	

The reference report consists of 204 pages and may be purchased from the Oklahoma City Geological Society, P. O. Box 609, Oklahoma City, Oklahoma, 73112, for $13.50 per copy.

Silurian-Ordovician Age of the Blaylock Sandstone

William D. Pitt* and Charles B. Spradlin†

During the summer of 1958, while remapping Beavers Bend State Park in McCurtain County, Oklahoma, Spradlin made a significant fossil discovery in the lower part of the Blaylock Formation in SW¼ of sec. 9, T. 5 S., R. 25 E., along the north bank of the Mountain Fork near a high-water island. Spradlin (1959) stated that "no forms later than *Dicellograptus complanatus* . . . were discovered in the lower Blaylock . . . " This, of course, means that at least part of the Blaylock is Ordovician, not Silurian, as it is reported to be in Arkansas (Croneis, 1930, p. 102). The Ordovician form, *Dicellograptus complanatus,* is especially common and some specimens are pyritized. The shales containing these Upper Ordovician graptolites are interbedded with typical sandstones of the Blaylock and some beds are as much as 18 inches thick. On the south side of the river and slightly to the east of the above-mentioned locality, shales in the creek beds are interbedded with sandstone layers; these shales contained several species of *Dicellograptus* and *Climacograptus,* as well as one species of *Diplograptus.* These shales do not carry the large numbers of specimens of the genera *Orthograptus* and *Diplograptus,* nor of *Climacograptus mississippiensis,* all of which are so prevalent in the Polk Creek at almost every locality.

The specimens collected at this locality were identified by the late C. E. Decker and by William B. N. Berry as follows:

Dicellograptus gurleyi
divaricatus
divaricatus var. *bicurvatus*
forchammeri var. *flexosus*
cf. *pumilus*
elegans
complanatus var. *ornatus*
Climacograptus parvus
putillus
Diplograptus crassitestus

References Cited

Croneis, Carey, 1930, Geology of the Arkansas Paleozoic area, with especial reference to oil and gas possibilities: Ark. Geol. Survey, Bull. 3, 457 p.

Spradlin, C. B., 1959, Geology of the Beavers Bend State Park area, McCurtain County, Oklahoma: Okla., Univ., unpublished Master of Science thesis.

*Eastern New Mexico University, Portales, N. Mex.
†Raymond Oil Co., Wichita, Kans.

Dolomite in the DeNay Limestone, Seminole County

Ataolah Mogharabi

The DeNay Limestone Member was named and described by Morgan (1924, p. 110) as the basal unit of a dominantly shale and sandstone sequence, the Francis Formation (Missourian), in the Stonewall quadrangle, Pontotoc and Seminole Counties, Oklahoma. The unit extends discontinuously from sec. 3, T. 2 N., R. 5 E., Pontotoc County, through the southeast corner of Seminole County, to sec. 20, T. 7 N., R. 8 E., Hughes County, a distance of approximately 32 miles. Although it is as much as 5 or 6 feet thick locally (Tanner, 1956, p. 65), its thickness generally ranges from a few inches to one foot. North of the Canadian River, which is the boundary between Pontotoc and Seminole Counties, the DeNay is regarded as the basal unit of the Coffeyville Formation, the stratigraphic equivalent of the lower part of the Francis (Weaver, 1954; Tanner, 1956).

Descriptions of the unit have been consistently those of a fossiliferous limestone. Morgan (p. 110) described it as slightly to abundantly crinoidal, and Tanner (p. 68) reported 12 species of invertebrates from three localities (fig. 1, locs. 3094, 3097, 3100).

Incidental to a recent investigation of carbonate rocks in southeastern Seminole County, two samples of the DeNay Member were collected from sites approximately 4 and 6 miles north of Sasakwa (fig.1). Sample A was collected from NE¼ sec. 12, T. 6 N., R. 7 E., and sample B from SE¼ sec. 30, T. 7 N., R. 8 E. The two samples are uniform in faunal content, matrix, and grain size, both being dolomitic crinoidal biosparrudite. The average grain size of the matrix is 0.16 mm. Crinoid plates and columnals are the only allochems present, although sample A shows some fusulinid ghosts. X-ray diffractograms of the samples show that the matrix is pure dolomite. To my knowledge, the occurrence of dolomite in the DeNay Member has not been previously reported.

The extent of the occurrence of dolomite in the DeNay Limestone in Seminole County is not known because of inadequate exposures. Despite the close similarity of the two samples, the degree of dolomitization is evidently not uniform over a wide area because Tanner's most prolific DeNay fossil-collection sites (locs. 3094 and 3097, 0.18 mile E of C sec. 31, T. 7 N., R. 8 E.) are between the two dolomite localities. Had the dolomitization process affected the intervening area to a degree equal to that at sites A and B, the faunal content at Tanner's localities would have been reduced by recrystallization to crinoid fragments, with only scant representation of other fossil types. Actually, Tanner (p. 68-69) collected identifiable specimens of bryozoans, brachiopods, and trilobites, in addition to crinoid plates and columnals.

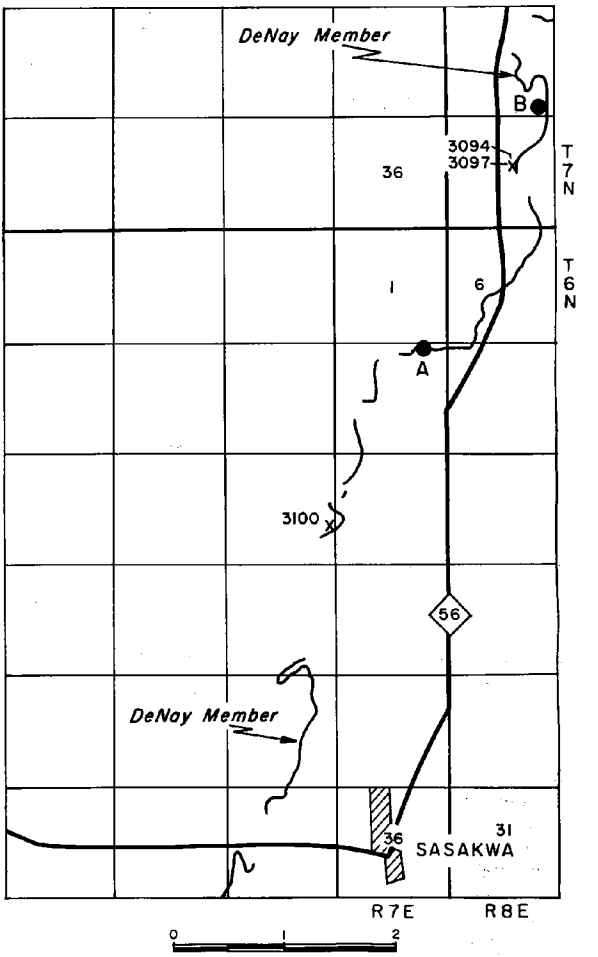


Figure 1. Map showing outcrop of DeNay Limestone Member of the Coffeyville Formation, Tps. 6, 7 N., Rs. 7, 8 E., Seminole County, Oklahoma. Dolomite specimens were collected from the DeNay at sites A and B. Tanner's (1956) fossil-collection sites are indicated by his locality numbers (3094, 3097, 3100).

References Cited

Morgan, G. D., 1924, Geology of the Stonewall quadrangle, Oklahoma: Bur. Geology [Okla.], Bull. 2, 248 p.

Tanner, W. F., 1956, Geology of Seminole County, Oklahoma: Okla. Geol. Survey, Bull. 74, 175 p.

Weaver, O. D., Jr., 1954, Geology and mineral resources of Hughes County, Oklahoma: Okla. Geol. Survey, Bull. 70, 149 p.

Ouachita Geology

The Oklahoma Geological Survey released two reports on the geology of the Ouachita Mountains in December 1963. Each report contains a colored geologic map at a scale of 1½ inches per mile.

Bulletin 101, *Structure and stratigraphy of the Rich Mountain area, Oklahoma and Arkansas,* by Donald R. Seely, was released on December 13. The bulletin consists of 173 pages, 57 figures, and 2 plates. The area described is in Le Flore County, Oklahoma, and Scott and Polk Counties, Arkansas, in that segment of the Ouachita fold belt between the Windingstair and Choctaw faults.

Bulletin 103, *Geology of the eastern part of Winding Stair Range, Le Flore County, Oklahoma,* by Orville Dorwin Hart, was released on December 14 and consists of 87 pages, 15 figures, and 1 plate. The area of this report is contiguous to that of Bulletin 103 on the west and the maps of the two reports overlap slightly.

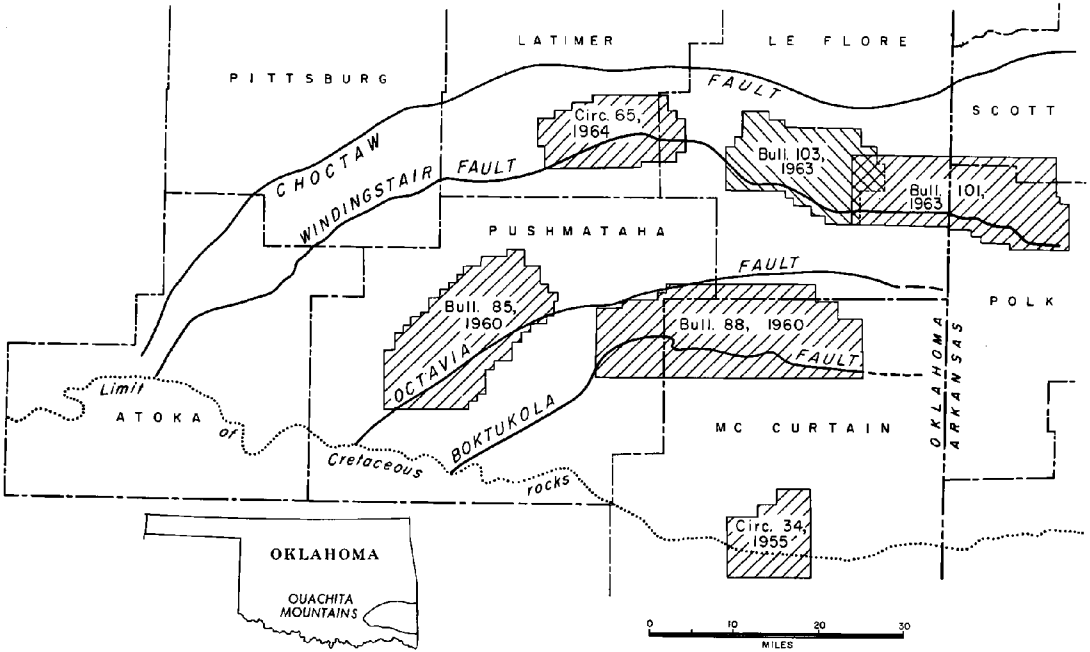
These are the fourth and fifth detailed reports on Ouachita geology to be published by the Survey since 1955; the sixth, Circular 65, *Geology of the western part of Winding Stair Range, Latimer and Le Flore Counties, Oklahoma,* by L. D. Fellows, is scheduled for publication in 1964.

On the page opposite is an index map of the Ouachita Mountains on which are outlined the areas covered by detailed mapping in Oklahoma Geological Survey publications. Previously published reports are:

Circular 34, *Geology of the core of the Ouachita Mountains of Oklahoma,* by William D. Pitt, June 21, 1955.

Bulletin 85, *Stratigraphy of the Late Paleozoic rocks of the Ouachita Mountains, Oklahoma,* by L. M. Cline, August 27, 1960.

Bulletin 88, *Geology of the Boktukola syncline, southeastern Oklahoma,* by O. B. Shelburne, September 20, 1960.



Areas of Ouachita Mountains described in Oklahoma Geological Survey Publications.

Gravity Data on Northeastern Oklahoma

The U. S. Geological Survey, on November 15, 1963, released to open file the raw data used in a regional gravity survey of northeastern Oklahoma and southeastern Kansas, the results of which were published in 1956.* The open-file report is entitled *Principal facts for a gravity survey made in northeastern Oklahoma and southeastern Kansas during 1948* and is compiled by Kenneth L. Cook, U. S. Geological Survey, and Albert J. Hoskinson and George R. Shelton, U. S. Coast and Geodetic Survey. It is a tabulation of gravity measurements made at 370 stations in 30 counties in Oklahoma and 180 stations in 24 counties in Kansas. The data given for each station are: location by county and by longitude and latitude, elevation, theoretical gravity, observed gravity, and free-air anomaly.

A copy of the 23-page report is available for consultation at the offices of the Oklahoma Geological Survey, Norman, Oklahoma. Other copies are available at the regional libraries of the U. S. Geological Survey at Washington, D. C., Denver, Colorado, and Menlo Park, California, and at the State Geological Survey, Lawrence, Kansas.

*Cook, K. L., 1956, Regional gravity survey in northeastern Oklahoma and southeastern Kansas: Geophysics, vol. 21, p. 88-106.

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