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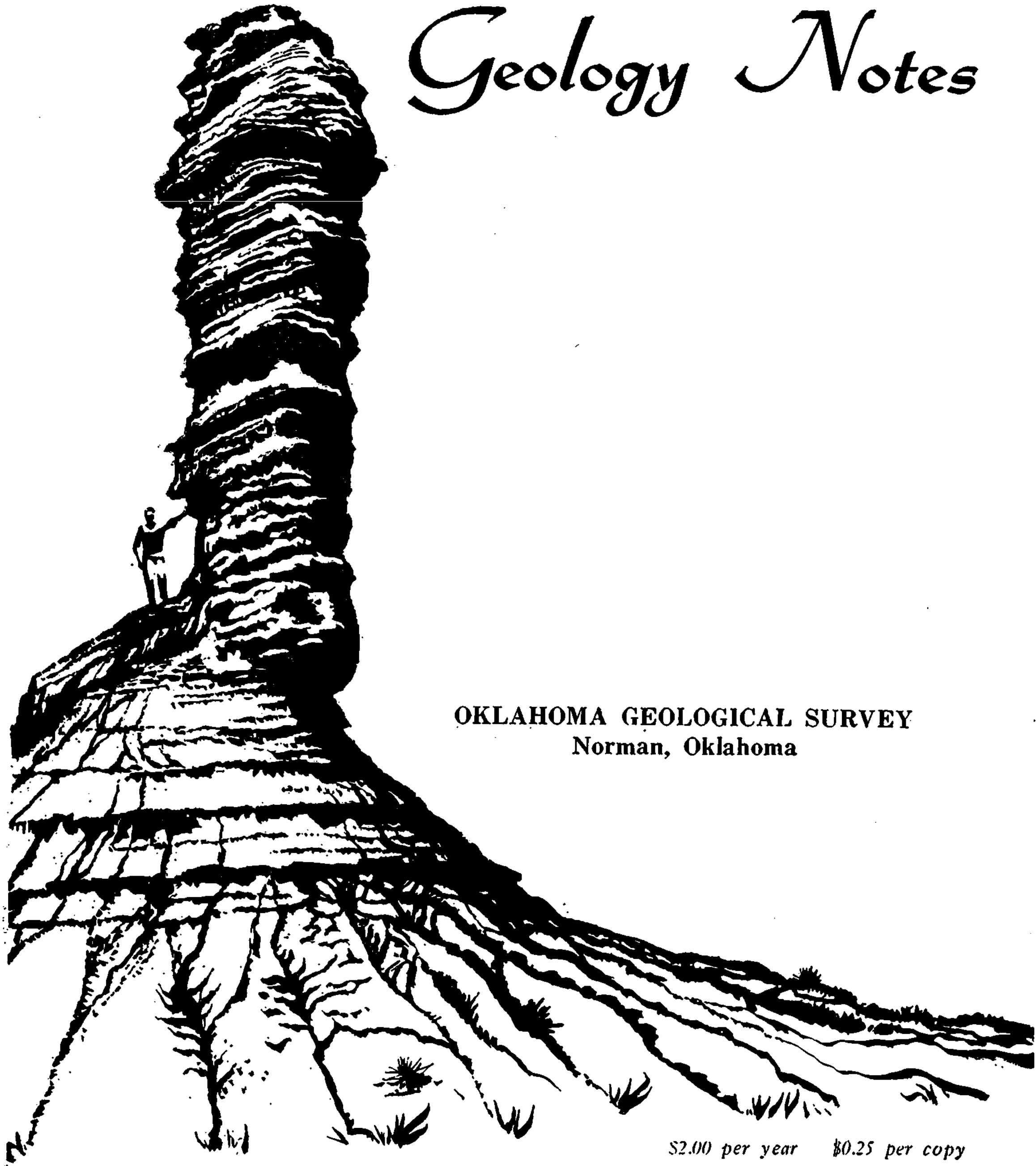
Geology Notes



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Geology of the Southwest Dover Field, Kingfisher County, Oklahoma

John T. Bado*

Exploration seismic surveys conducted by the Superior Oil Company led to the discovery of the Southwest Dover field, located six miles north-northwest of Kingfisher, Oklahoma (fig. 1).

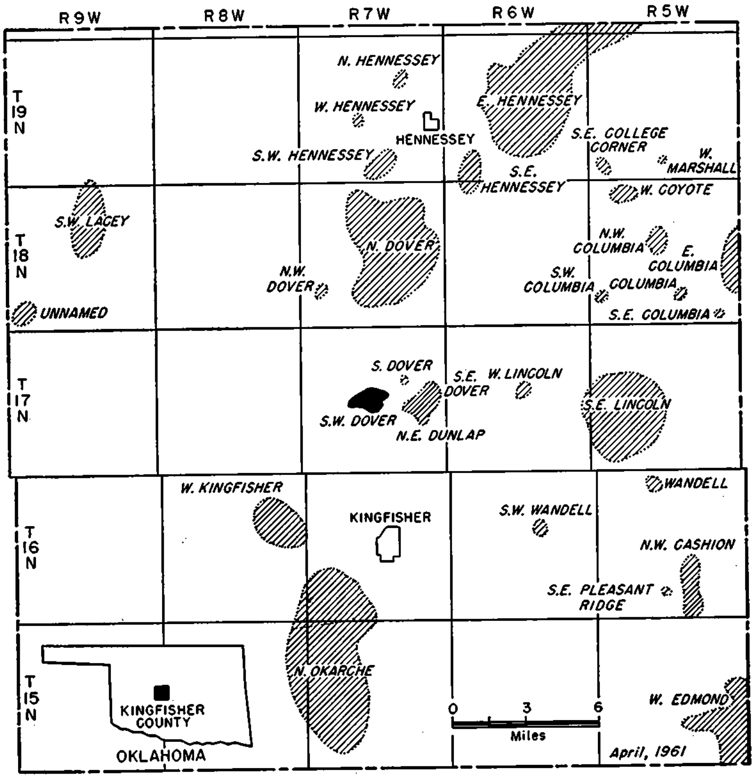

Figure 1. *Oil and gas fields in Kingfisher County, Oklahoma. Southwest Dover Field is indicated by solid black.*

The field was opened, in 1948, by the Superior No. 1 Long (SE¼ SE¼ SE¼ sec. 16, T. 17 N., R. 7 W.) which was dually completed, flowing 4,000,000 cubic feet of gas daily plus 81 barrels of distillate in 9 hours from the Hunton dolomite, and 3,854,000 cubic feet of gas per day plus 43 barrels of distillate in 15 hours from the Simpson dolomite.

Additional development in the field has yielded 13 commercial wells out of 18 tests drilled, and the Misener, a sandstone below the Woodford shale and above the Hunton dolomite, is also productive.

Production records from the field indicate that 639,235 barrels of

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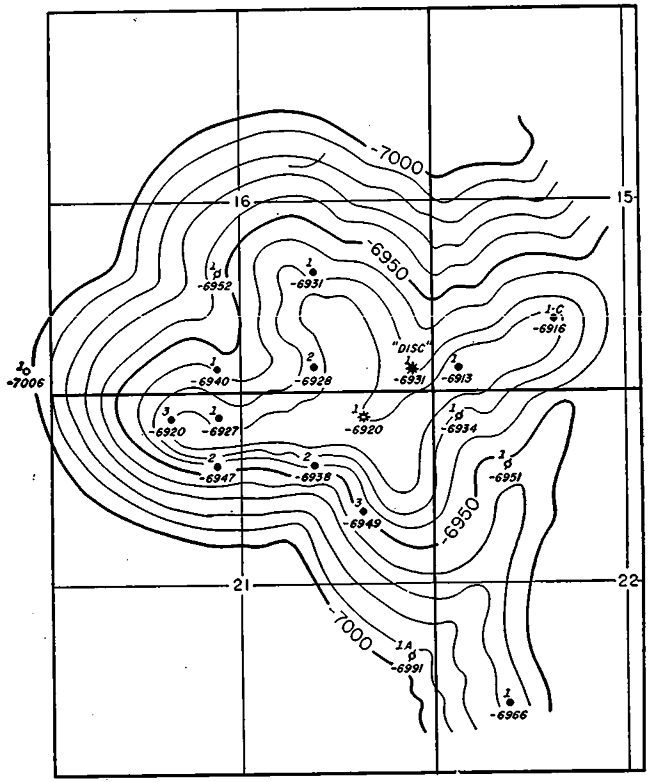

FIGURE 2. *Structure map of the Southwest Dover Field contoured on top of Hunton, T. 17 N., R. 7 W. Contour interval is 10 feet. Well in section 17 is a dry hole.*

oil have been produced from January, 1949, through December, 1960 (Vance Rowe Reports, Tulsa, Oklahoma, December, 1960).

Average production per well in the field is 52,947 barrels to September, 1960. The discovery well, the No. 1 Long, has produced 85,794 barrels of oil from January, 1949, to September, 1960.

Structural closure (fig. 1) in the field is approximately 36 feet, and the productive limits of the field enclose 360 acres (fig. 2). Wells have been drilled on a ten-acre spacing pattern.

The Misener sand pay in the field area is extremely thin and ranges from zero to ten feet in thickness. The sandstone is extremely difficult to find in samples. Electrical log analysis presents the same difficulty and at times it is impractical to identify the Misener because of its limited distribution (fig. 3).

Production in the Hunton formation occurs in the upper 30 to 50 feet and is obtained from a white to gray, vuggy, coarsely crystalline dolomite and dolomitic limestone with excellent vuggy and intercrystalline porosity carrying good oil stain and odor. Some evidence of fractures is present in the tighter zones with calcite filling in the fractures.

TABLE 1.—DEVELOPMENT HISTORY, SOUTHWEST DOVER FIELD

Operator- Well name- Completion date-	Location- Elevation (feet)-	Depth to top of producing fm. (feet)-	Perforations- Total zone perforated-	Initial potential	Total depth- Deepest formation penetrated- Remarks-
Superior No. 1 E. G. Long December 13,1948	SE SE SE 16-17N-7W 1,128 DF	Misener 8,050 Hunton 8,058 Simpson 8,570	8,050-8,080 8,565-8,640 105 feet	Hunton- F 4,000 MCF & 81 bbls condensate in 9 hrs Simpson- F 3,854 MCF & 43 bbls condensate in 15 hrs	9,026 Simpson Discovery well SW Dover Field
Superior No. 1 Kremke May 10, 1949	SE SE SW 16-17N-7W 1,132 KB	Simpson 8,570	8,569-8,600 31 feet	F 2,166 MCF & 92 bbls oil in 15 hrs	8,863 Simpson
Magnolia No. 1 E. H. Martin March 19, 1951	SE NW NW 22-17N-7W 1,129 KB	Non-producing	None	Non-producing	8,723 Simpson Plugged & abandoned
Trigg No. 1 Porter March 24, 1953	NW NE NE 21-17N-7W 1,128	Hunton 8,050	8,051-8,063 12 feet	COF 33,000 MCF/D	8,078 Hunton
Trigg No. 1 Kremke August 4, 1953	SE NE SW 16-17N-7W 1,114 KB	Non-producing	None	Non-producing	8,829 Simpson Plugged & abandoned
E. M. Carter No. 1 Peck August 31, 1953	SE SE SE 17-17N-7W 1,139 KB	Non-producing	None	Non-producing	8,175 Hunton Plugged & abandoned
Trigg No. 2 Porter March 30, 1954	SE NW NE 21-17N-7W 1,137 KB	Hunton 8,075	Open hole 8,087-8,101	F 100 bbls oil 47° grav. & 500 MCFG/D	8,181 Hunton
Trigg No. 1 Wendt April 13, 1954	NE NE NW 21-17N-7W 1,133 KB	Hunton 8,060	Open hole 8,059-8,077	F 240 bbls oil 44° grav. & 465 MCFG/D	8,077 Hunton

Trigg No. 1 Boescher April 20, 1954	SE NW SE 16-17N-7W 1,124 KB	Hunton 8,055	8,056-8,066 10 feet	F 9,325 MCF/D & 80 bbls condensate per MM	8,074 Hunton
Armer No. 1 E. Boeckman May 18, 1954	SW SW SW 15-17N-7W 1,128 KB	Hunton 8,041	8,042-8,062 20 feet	F 2,144 MCF/D & 149 bbls condensate per day	8,603 Simpson
Trigg No. 2 Boecher August 24, 1954	SE SW SE 16-17N-7W 1,137 KB	Hunton 8,065 Simpson 8,570	8,064-8,078 8,604-8,610 8,622-8,624 22 feet	F 18,000 MCF/D & 83 bbls condensate per MM. F 18 bbls 48° grav oil per day	8,795 Simpson
Trigg No. 2 Wendt August 31, 1954	SE NE NW 21-17N-7W 1,130 KB	Hunton 8,077	8,078-8,086 8 feet	F 35 bbls 48° grav oil & 35 bbls water	8,086 Hunton
Trigg No. 1 Schroeder December 15, 1954	NE SW SW 22-17N-7W 1,108 KB	Hunton 8,074 Oswego 6,848	Information incomplete 6,859-6,871 12 feet	COF 35,000 MCF/D & 70 bbls condensate per MM P 15 bbls oil & 15 bbls water per day	8,085 Hunton Recompleted in Oswego May 30, 1956
Trigg No. 3 Porter December 15, 1954	NW SE NE 21-17N-7W 1,129	Hunton 8,078	8,085-8,090 5 feet	P 50 bbls oil & 100 bbls water per day	8,095 Hunton
Trigg No. 3 Wendt December 15, 1954	NW NE NW 21-17N-7W 1,130 KB	Hunton 8,050	Open hole? 8,050-8,073	F 100 bbls 47° grav oil per day	8,073 Hunton
Armer No. 1 Martin January 19, 1955	NW NW NW 22-17N-7W 1,025 KB	Hunton 8,056	None	Non-producing	8,067 Hunton
Trigg No. 1 Boecher "A" February 16, 1955	SE NE NE 21-17N-7W 1,109 KB	Hunton 8,057	None	Non-producing	8,115 Hunton
Armer No. 1 Boeckman "C" March 9, 1955	NW SE SW 15-17N-7N 1,131 KB	Hunton 8,047	8,044-8,050 8,050-8,052 8 feet	F 96 bbls oil & 158 bbls salt water per day	8,105 Hunton

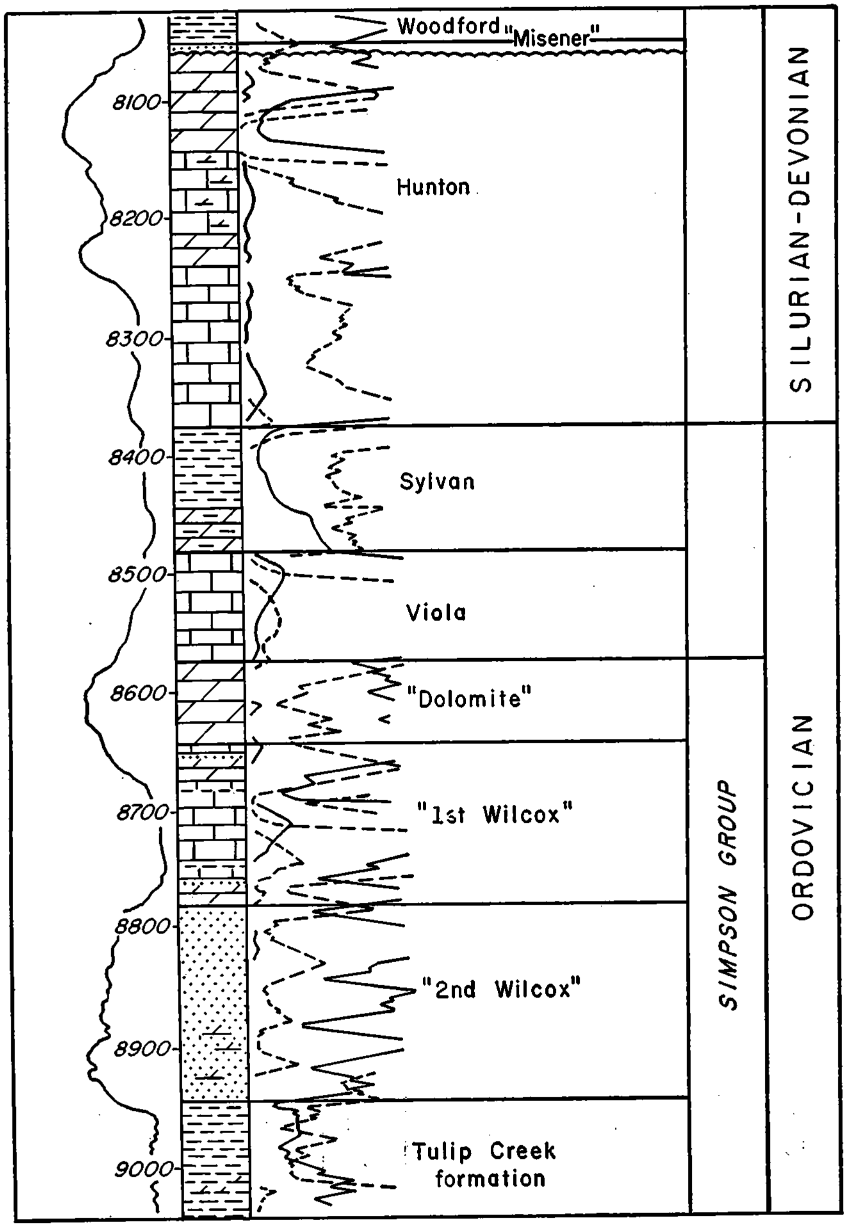

FIGURE 3. *Electric and lithologic log of productive section of Superior Oil Company No. 1 (88-16) Long, SE¼ SE¼ SE¼ sec. 16, T. 17 N., R. 7 W., Southwest Dover Field, Kingfisher County.*

Simpson production is found in three wells in the field in a brown, white, and light-gray, very fine- to coarse-crystalline dolomite. Thickness of the Simpson dolomite in the field area approaches 70 feet.

The "1st Wilcox sand" of the Simpson group is not sandstone in this area but is an interbedded brown and gray dolomite and dolomitic limestone with scattered traces of quartz grains.

The "2nd Wilcox sand" of the Simpson group is a 165-foot-thick, white, quartzitic, and friable sandstone with spotted oil staining, and it has a fair to good odor of oil. Perforations in the "2nd Wilcox sand" have indicated slight shows of gas and distillate, and, after acidizing and swabbing, production tests have produced salt water with a scum of green oil and a slight show of gas.

The Arbuckle dolomites of Cambrian-Ordovician age have not been tested in the field area.

Development history of the Southwest Dover field is listed in table I.

Arkoma Basin and North-Central Ouachita Mountains Field Conference

Some 170 geologists, interested in seeing the geology of the Arkoma basin and north-central Ouachita Mountains, made the field trip sponsored jointly by the Tulsa and Fort Smith Geological Societies, April 14 and 15, 1961.

The group, riding in four buses, on the first day left Fort Smith and travelled southward, crossing the Massard Prairie, Backbone, Midland, and Heavener anticlines, across the Choctaw fault, stopping to examine the exotic boulders in the Johns Valley shale, the faulted lower Atoka sandstones near the summit of Spring Mountain, and the Stanley and Jackfork rocks near the crest of Kiamichi Mountain.

Although the road log in the guidebook describes the section going back to Fort Smith through Arkansas, this part was omitted because of high-water conditions and the buses returned directly north to point of origin. Field trip leaders were H. H. Hall, R. B. Laudon, and Ed Bloesch.

On the second day, Roger Planalp and James C. Perryman guided the group to Wilburton via Bokoshe, McCurtain, and Kinta, returning to Fort Smith via Red Oak and Poteau.

Two supplementary road logs, Tulsa to Fort Smith via U. S. Highway 64 and Tulsa to Muskogee via Wagoner (Highways 51 and 69), by H. H. Hall, are included in the guidebook.

Among the interesting features of the guidebook are eight oblique aerial photographs showing areas visited on the field trip. These were taken by James C. Perryman and Roger N. Planalp, who consider themselves amateur aerial photographers. The point and direction of each photograph are shown on the route maps.

In addition, the following articles are included in this excellent guidebook:

Fox, O. O., *A brief history of Fort Smith.*

McClain, K. M., and Planalp, R. N., *General geology of the Red Oak gas area, Latimer and Le Flore Counties, Oklahoma.* Includes structure map (T. 6, 7 N., R. 21-23 E.), contoured on top of Hartshorne sandstone, and structure cross section of deep tests.

Lahoud, J. A., *Cartersville gas field.* Includes surface structure map on top of Hartshorne and subsurface structure on top of Wapanucka in Cartersville Field (T. 9 N., R. 24 E.)

Woncik, John, *Geology of the Kinta gas district.* Includes subsurface structure map contoured on top of Wapanucka (parts of T. 7, 8 N., R. 19, 20 E.), and electric-log cross section.

Rose, W. A., *Significant fields and prolific recent discoveries in and near field trip area.* Includes table I, recent discoveries, and table II, list of 21 fields giving location of field, year of discovery, number of active and inactive wells, producing formation, average depth of production, cumulative production, structure, and additional remarks.

Diggs, W. E., *Structural framework of the Arkoma basin.* Figures illustrate compressional belts formed by the Ouachita orogeny, and tectonic provinces of the Arkoma basin.

McDaniel, Cary, *Surface stratigraphy of the Hartshorne formation, Le Flore, Latimer and Pittsburg Counties, Oklahoma.* Figures show outcrop of Hartshorne formation and measured sections.

Laudon, R. B., *Carboniferous stratigraphy of the Ouachita Mountains.* Figures illustrate main tectonic features of the Ouachita Mountains of Oklahoma and Arkansas, and correlation diagrams of the frontal and central Ouachitas rocks.

Branson, C. C., *Arkoma basin, a Middle Pennsylvanian geosyncline.* Figures illustrate correlation of Arkoma basin Desmoinesian rocks with those of the platform, and usage of the name Hartshorne.

The guidebook, priced at $6.00, may be purchased from either the Tulsa Geological Society, P. O. Box 263, Tulsa, Oklahoma, or the Fort Smith Geological Society, P. O. Box 1123, Station A, Fort Smith, Arkansas.

THE TYPE SPECIES OF *Monoschizoblastus* CLINE, 1936

ROBERT O. FAY

The name *Monoschizoblastus* was proposed by Cline (1936) for a small spiraculate blastoid from the Lower Carboniferous (Mississippian) limestone of northern Ireland, with type species designated as *Schizoblastus rofei* Etheridge and Carpenter (1886). The genus is characterized by having 9 openings around the oral opening, comprising 8 spiracles plus the anispiracle, with 1 hydrospire fold on each side of an ambulacrum, long deltoids that overlap the short radials, the anispiracle between a short epideltoid and a long hypodeltoid, lancet exposed along medial one-third of its width for its entire length, apparently one hydrospire pore per side plate along ambulacral margins, and concave base.

Monoschizoblastus rofei (Etheridge and Carpenter), 1886, new comb. Cline, 1936

Plate I, figures 1-4

Granatocrinus rofei Etheridge and Carpenter, 1882, p. 239. A manuscript name or nomen nudum.

Schizoblastus rofei Etheridge and Carpenter, 1886, p. 228-229, pls. 6, fig. 17; 8, figs. 9-11; 17, fig. 2.

The specimen is silicified and imperfectly preserved. Theca subglobose, with concave base, 6.5 mm long by 6.5 mm wide, periphery near midheight, with 5 linear ambulacra that are slightly incurved on the aboral surface. Basalia lobed pentagonal, approximately 1.5 mm in diameter, with 3 normally disposed basals, in basal concavity.

Radials 5, short, subpentagonal, each approximately 2.75 mm wide by 2.5 mm long, forming most of aboral surface, partly seen in side view, overlapped by the deltoids. In side view the radials appear to be 1 mm long, well below the periphery. The radial sinus is approximately 1 mm long, slightly recurved below, and is almost 1 mm wide.

Deltoids 4, extremely elongate, triangular, each 5.5 mm long by 2.5 mm wide, with an angle of approximately 160 degrees formed along the radiodeltoid suture, measured from center at intersection with interradial suture. Deltoid septa and lips wide, with 2 spiracles notched in the sides of each deltoid septum, one on each side along the ambulacral margins. On the anal side the large rounded anal opening is between a short adorally disposed pentagonal epideltoid and an elongate truncated subtriangular hypodeltoid. The oral opening is surrounded by the 4 deltoid lips and the epideltoid. The deltoids (including hypodeltoid) overlap the radials, extending well below the periphery aborally.

Ambulacra 5, linear, with medial one-third of the width of each lancet exposed the length of an ambulacrum; each ambulacrum 7.5 mm long by 1 mm wide, with approximately 30 side plates in 10 mm length of an ambulacrum. There is apparently one hydrospire fold on each side of an ambulacrum, one pore per side plate along radial and deltoid (including hypodeltoid) margins, and no hydrospire plate. The

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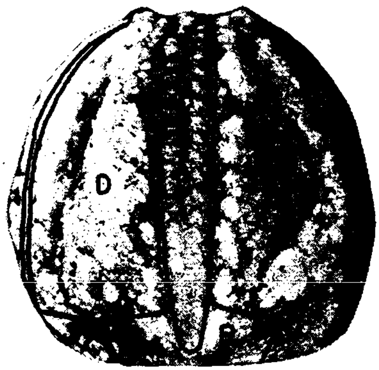

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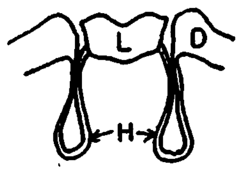

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Plate I

Monoschizoblastus rofei *(Etheridge and Carpenter) 1886. Lower Carboniferous (Mississippian) limestone, County Fermanagh, Northern Ireland.*

FIGURE 1. *Oral view showing anal opening and spiracles in black, x7.4. Topotype, British Museum of Natural History, E 30599.*

FIGURE 2. *Anterior ambulacral view showing long deltoids overlapping short radials, x7.4. Same specimen as in figure 1.*

FIGURE 3. *Aboral view, with anterior ambulacrum toward bottom of page, x7.4. Same specimen as in figure 1.*

FIGURE 4. *Cross section of an ambulacrum showing one hydrospire fold on each side of the ambulacrum, x10.0. Specimen from Wexford (after Etheridge and Carpenter, 1886).*

An—anal opening	*HD—hypodeltoid plate*
B—basal plate	*L—lancet plate*
D—deltoid plate	*R—radial plate*
ED—epideltoid plate	*S—spiracle*
H—hydrospire fold	*Z—azygous basal plate*

surfaces of the radial and deltoid plates are ornamented with coarse pustules arranged along growth lines.

Occurrence.—Lower Carboniferous limestone, foot of Beneachlin, Florence Court (E 30599), and Wexford (pl. I, fig. 4), County Fermanagh, Northern Ireland.

Types.—The holotype is on deposit in the British Museum of Natural History. The described specimen is a topotype, E 30599, Lord Enniskillen collection (1855) reregistered from old number E 817, British Museum of Natural History. The specimen is part of a collection of blastoids kindly loaned to the author by Dr. Leslie Bairstow and the Trustees of the British Museum in order to complete studies for the forthcoming *Treatise on Invertebrate Paleontology, Part S, Echinodermata I.*

References Cited

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Etheridge, R., Jr., and Carpenter, P. H., 1882, On certain points in the morphology of the Blastoidea, with descriptions of some new genera and species: Annals Mag. Nat. History, ser. 5, vol. 9, no. 52, art. 25, p. 213-252.

__________ 1886, Catalogue of the Blastoidea in the Geological Department of the British Museum (Natural History): London, British Museum Catalogue, i-xvi, p. 1-322, pls. 1-20, figs. 1-8.

New Theses Added to O. U. Geology Library

The following Master of Science theses were added to The University of Oklahoma Geology Library during the month of April 1961:

Subsurface disposal of natural brines in western Oklahoma and northern Texas, by Brian E. Ausburn.

A subsurface study of the Simpson group in Harper County, Kansas, by Wilbur C. Bradley.

A faunal description and age determination of the Simpson Birdseye limestone (Ordovician) of the Criner Hills, by Reggie W. Harris, Jr.

Stratigraphic position of the coal seam near Porter, Wagoner County, Oklahoma, by Maurice J. Higgins.

Areal geology of the Starvation Creek area, Roger Mills and Beckham Counties, Oklahoma, by Joseph G. Meinert.

Geology of the Doc Creek sandy limestone, northwestern Oklahoma, by Alton O'Neil Riley.

Subsurface geology of Rich Valley and Southeast Rich Valley oil fields, Grant County, Oklahoma, by Robert L. Rountree.

—L. F.

RELIABILITY OF THE HYDROCHLORIC-ACID FIELD TEST FOR DOLOMITE AND LIMESTONE

WARD S. MOTTS

For several years the author worked in the Guadalupe Mountains of southeastern New Mexico where rocks of the Permian shelf area are excellently exposed. Here carbonate rocks of all varieties range widely in texture and chemical composition. The adequate classification of the carbonates in the field as limestone, dolomite, calcic dolomite, or dolomitic limestone was an objective of the field work. The author used the dilute-hydrochloric-acid (10%) test for carbonates, and investigated the literature to see if any precise determinations had been made relating the nature of the acid test to the limestone-dolomite ratio. The search through the literature was fruitless. There was a general but an unproved opinion that if a rock showed a strong reaction it was limestone and if a weaker reaction it was dolomite; however, the concept of the difference between "strong and weaker" reaction varied with each field geologist. Wishing to check the hydrochloric acid

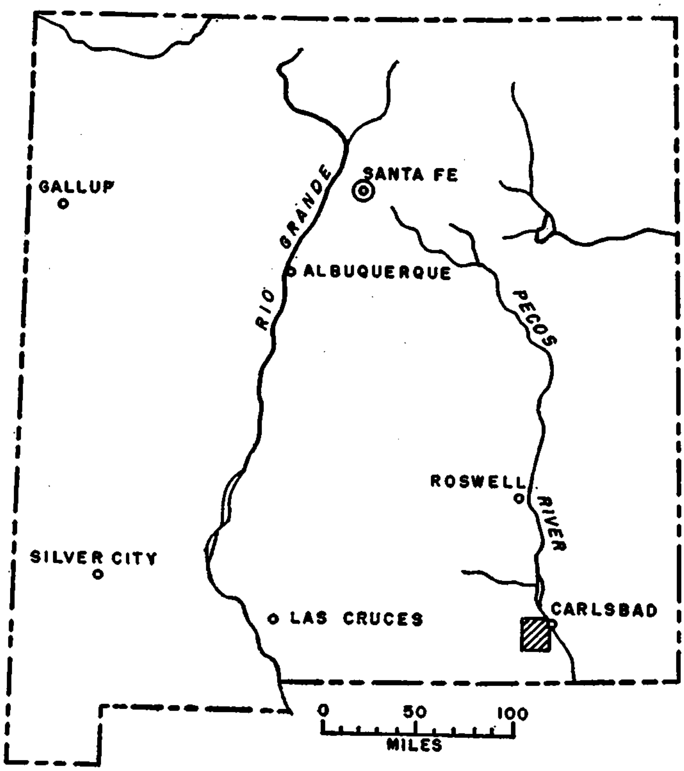

FIGURE 1. *Index Map.*

method more accurately, the author collected and field-tested samples that were sent to a laboratory for a more accurate determination of the ratio. In this manner the validity of the field tests was checked, giving the author more confidence in his field determinations. The author is grateful to D. L. Graf who analyzed the samples at the X-ray laboratory of the Illinois Geological Survey.

The carbonate rocks investigated and tested are from the shelf rocks of the upper part of the Guadalupean series (Capitan-Bell Canyon equivalent) in an area west and southwest of Carlsbad, New Mexico (fig. 1). Carbonates of each formation change in texture and composition from its reef equivalent into the shelf. In a shelfward direction, the carbonate rocks grade into evaporite rocks, consisting almost entirely of gypsum. The Capitan consists of two distinct members; a massive member (reef facies) that is cream-colored to light-gray, massive, calcareous limestone, and the breccia member (reef-talus facies) that is composed of cemented, partly dolomitized breccia derived from the reef zone. In the shelf, the three principal textural subfacies of the carbonates are: a coarse detrital and fragmental subfacies (generally calcarenite) adjacent to the reef; an intermediate subfacies of fine-grained detrital carbonate rocks interbedded with pisolites, oolites, and micro-oolites; and a dense sublithographic subfacies of fine-grained rocks adjacent to the evaporite facies. By Folk's (1959) classification the rocks range from microcrystalline allochemical rocks (calcarenite and calcirudite), adjacent to the reef, to dolomicrites and finely crystalline intraclastic dolomite in the direction of the shelf. The lateral gradational zone between limestone and dolomite is irregular and the transition zone is wide. The reef and coarser grained carbonates are predominantly limestone; and shelfward the finer grained carbonates are predominantly dolomite. A more complete description of the carbonate rocks in the Guadalupe Mountain area is given by Newell et al. (1953) and by Motts (Bjorklund and Motts, 1959).

When acid-testing such a wide variety of carbonates it is important to differentiate whether the acid reaction is affecting the allochems or the microcrystalline ooze matrix. This was in most cases difficult; however, it could be accomplished in many cases by carefully examining a wetted surface of the rock with a hand lens after applying the hydrochloric acid. Calcarenites and calcirudites consisting of limestone particles in a dolomite-micrite matrix will generally effervesce immediately. Calcarenites and calcirudites consisting of dolomite particles in a limestone-micrite matrix will normally not effervesce immediately but will do so slowly several seconds after the acid has been applied. Crystalline dolomite or limestone, micrite or dolomicrite, or allochemical rocks whose allochems or matrix have the same chemical composition generally show a more nearly uniform reaction with a rate dependent on the limestone-dolomite ratio. The specimens were classified in the field as limestone, dolomite, dolomitic limestone, and calcic dolomite, by means of the rates of the acid reaction which are described as high, moderately high, moderately low, and low. These described rates were empirical and based on observations of the author during field work. A high reaction is one in which the rocks effervesce rapidly and with violence—a nearly pure

TABLE 1.--COMPARISON OF FIELD AND LABORATORY DETERMINATIONS OF LIMESTONE-DOLOMITE CONTENT OF CARBONATE ROCKS

Sample No.	Formation	Position in carbonate facies	Type of carbonate*	Reaction with dilute HCl	Field classification	Laboratory analysis
1	Capitan (Tansill equivalent)	Reef-zone breccia (Talus facies)	Angular intramicrudite	Moderately low	Calcic dolomite	60% Dolomite 40% Calcite
2	Capitan (Tansill equivalent)	Reef zone (Massive facies)	Microsparite	High	Limestone	95% Calcite 5% Dolomite
3	Capitan (Seven Rivers equivalent)	Reef zone (Massive facies)	Microsparite	High	Limestone	90% Calcite 5% Dolomite 5% Other
4	Seven Rivers	Shelf zone (Intermediate facies)	Intramicrite	Moderately high	Dolomitic limestone	20% Dolomite 60% Calcite 20% Quartz
5	Seven Rivers	Shelf zone (sublithographic facies)	Finely crystalline intraclastic dolomite	Low	Dolomite	90% Dolomite 10% Quartz

*Classification of Folk (1959)

limestone. A low reaction is one in which the rock effervesces very slowly—a nearly pure dolomite. A mid-point exists between the high and low reaction. Reactions described between the low and mid-point are described as moderately low; reactions described between the mid-point and high are described as moderately high.

As shown on Table 1, the field determinations agreed with those obtained in the laboratory. This is only a preliminary study as a limited number of samples were taken. The author hopes to follow up this initial study with a more complete investigation involving many textural types tested by various staining methods as well as by the dilute-hydrochloric-acid method. From this investigation the following conclusion and recommendation can be made:

(1) The dilute hydrochloric acid method can be used with moderate to good success in differentiating among limestone, dolomite, calcic dolomite, and dolomitic limestone in the Permian shelf rocks in the Guadalupe and Sacramento Mountains.

(2) It is recommended that field geologists, in areas of carbonate rocks, differentiate the rocks texturally and then apply the hydrochloric acid test to selected samples. The samples then should be sent to the laboratory for precise determination for the limestone-dolomite ratio, thus giving the field geologist an accurate base on which to evaluate his field tests.

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Bjorklund, L. J., and Motts, W. S., 1959, Geology and water resources of the Carlsbad area, New Mexico; N. Mex. State Engineer, Open-File Report, 322 p., 54 figs. In preparation as a Water Supply Paper by the United States Geological Survey.

Folk, R. L., 1959, Practical petrographic classification of limestones: Amer. Assoc. Petroleum Geologists, Bull., vol. 43, p. 1-38.

Newell, N. D., et al., 1953, The Permian reef complex of the Guadalupe Mountains region, Texas and New Mexico—A study in paleoecology: San Francisco, W. H. Freeman and Co., 236 p.

Trilobite from the Francis Shale near Ada

Carl C. Branson

Trilobites from Pennsylvanian rocks are rather rare, and most specimens are isolated pygidia. Morgan (1924, p. 118) listed *Phillipsia major* as common in the shale pit at the brick plant south of Ada. He figured a pygidium identified as *Phillipsia sangamonensis* from that locality (p. 236, pl. 53, fig. 11) although his list does not show the species as found at that place. Morgan also listed the species from the McAlester, Wewoka, and Holdenville formations.

Allen Graffham has found and has sold to The University of Oklahoma a fine specimen of *Ameura sangamonensis* (Meek and Worthen), 1865, new combination by Weller (1936). It is cataloged as OU No. 4201 (figs. 1, 2). The specimen is a complete cephalon, and the first four thoracic segments are exposed. The remaining segments are perhaps present, curled under into the shale block. The specimen is 2.5 cm wide, 1.3 cm long across the glabella, and the cheek spines extend 1.6 cm back of the occipital furrow. Two lateral glabellar furrows are present on each side, but are indistinct.

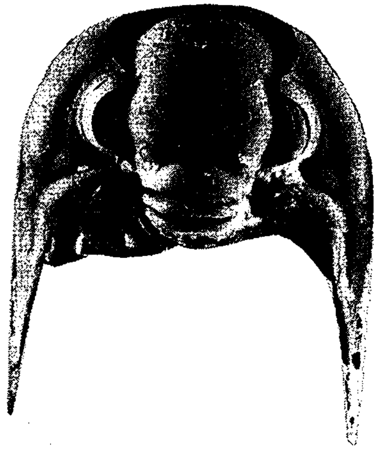

FIGURE 1. *Dorsal view of* Ameura sangamonensis, *x2. (Photograph by Neville M. Curtis, Jr.)*

The surface of much of the cephalon bears minute tubes of serpulid worms of the sort generally referred to *Cornulites* (fig. 2).

Girty (1915, p. 265-268, pl. 18, figs. 10-13a) described and figured *Ameura sangamonensis* from the Wewoka formation of the Wewoka and Coalgate quadrangles. He figured four specimens, all somewhat crushed.

Ameura major (Shumard) was listed by Ries (1954, p. 60) from the Coffeyville of Okfuskee County, and *A. sangamonensis* from the Wewoka and Holdenville formations (p. 45). Weaver (1954) listed *A. sangamonensis* from the Wewoka and Holdenville of Hughes County.

FIGURE 2. *Glabellar surface, same specimen, x10, showing specimens of* Cornulites (?). *(Photograph by Neville M. Curtis, Jr.)*

It appears probable that *A. sangamonensis*, *A. major*, *A. missouriensis* (Shumard), *Proetus longicaudus* Hall, and *Phillipsia nodocostata* Hare all belong to a single species. Under that concept the species ranges from Marmaton into Lower Permian.

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