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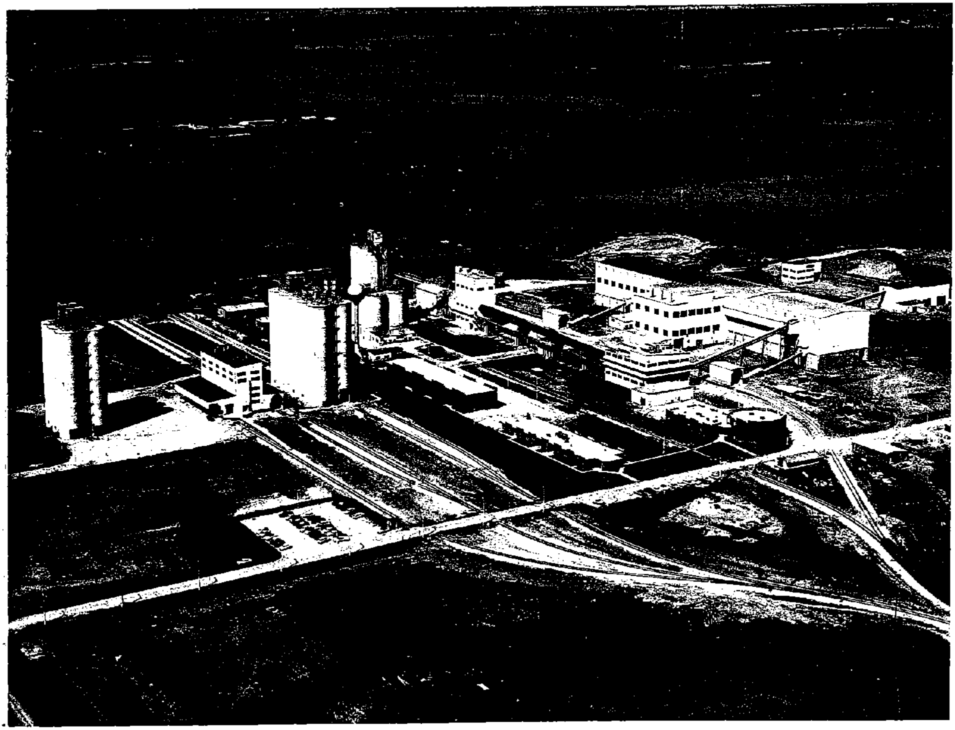

PORTLAND CEMENT PLANT, ROGERS COUNTY

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

Cover Picture

MINERAL INDUSTRIES OF OKLAHOMA

Portland Cement

Oklahoma's portland cement industry began in 1906 when two plants were established, one at Ada in Pontotoc County and one at Dewey in Washington County. These were the only plants to operate successfully in the State until 1960 when a new installation was completed at Pryor in Mayes County, followed by still another in 1961 near Tulsa in Rogers County. The plants at Ada, Pryor, and Tulsa are currently active, but the one at Dewey was closed during 1963.

From an initial production of about 2 million barrels of cement in 1906, the industry in Oklahoma has grown to an annual capacity of nearly 9 million barrels. Of the mineral industries in Oklahoma, cement has been the leading nonmetal product (excluding fuels) in terms of value during five of the last six years.

Rocks being quarried for cement production in the State include: Fernvale Limestone and Sylvan Shale of Ordovician age at Ada, limestone from the Hindsville Formation and shale and limestone from the Fayetteville Formation of Mississippian age at Pryor, and Oologah Limestone and Labette Shale of Pennsylvanian age near Tulsa. Additional sources of material for cement manufacture are found in the Arbuckle Mountains, the Limestone Hills of the Wichita Mountains area, the outcrop belt of the Cretaceous Goodland Limestone in southeastern Oklahoma, and in wide areas of limestone and shale outcrop in northeastern Oklahoma. Also of great importance to the existing plants and to the future of cement production in Oklahoma is the proximity of extensive gypsum and anhydrite deposits in the western part of the State, and the availability of abundant natural gas and coal for fuel.

Shown on the cover is the $12-million plant of the Dewey Portland Cement Co., Division of the American-Marietta Co., in Rogers County, east of Tulsa.

—K. S. J.

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1963

Prepared by Kenneth S. Johnson

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Index

Magnetic Delineation of the Basement Surface at Greenleaf Lake, Muskogee County, Oklahoma

J. A. E. Norden, D. A. Kotila, and G. C. Glaser

INTRODUCTION

One problem encountered in a recent biostratigraphic study of reef facies in the Bloyd Formation (Pennsylvanian, Morrowan) in northeastern Oklahoma (Kotila, 1963) was the determination of the lateral extent and thickness of discontinuous reef development in the dominantly shale formation. One area of partly exposed Bloyd reef development is in the valley of Greenleaf Creek below Greenleaf Lake dam, Muskogee County, Oklahoma (fig. 3). Because of the success of an earlier vertical-magnetic-intensity survey in delineating a reef in Adair County (Norden and others, 1963), the same method was used in an attempt to map the reef facies at Greenleaf Lake. Field observations were made by the authors on July 10, 1963, along a line which crossed the reef exposures from Atoka Formation outcrops on the south to the northwest end of the dam (figs. 1, 3). The instrument used was a Ruska type V-3 vertical magnetometer with a sensitivity setting of 10.45 gammas per scale division.

Magnetic-susceptibility measurements of samples of the Bloyd reef rock and of the Atoka sandstone, made with a magnetic-susceptibility bridge, model MS-3*, yielded values of 0.39×10^{-6} cgs unit for the reef rock and 8.9×10^{-6} cgs unit for the sandstone. The resultant susceptibility contrast of 8.51×10^{-6} cgs unit would produce, in a magnetic field of H = 0.516 oersted, a polarization contrast of 4.39×10^{-6} cgs unit so that the magnetic relief to be expected to be produced by the reef rock would be only about 3 gammas. In contrast, the actual magnetic relief detected along the profile was 36 gammas

*Geophysical Specialties Co., Hopkins, Minn.

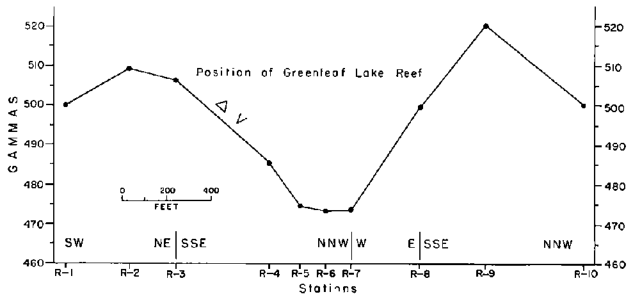

Figure 1. Vertical-magnetic-intensity profile 1. Measurements taken across Greenleaf Lake dam.

(fig. 1), a value far in excess of the effect attributable to the presence of the reef rock alone. The character and magnitude of the anomaly indicate that it is, instead, an effect due to basement relief with erosional entrenchment below the Greenleaf Lake dam site.

Examination of aerial photographs of the area revealed the presence of fine linears related to the microfracture pattern of the surface rocks, and it was decided to run two more magnetic profiles across the strike of a northwestward-trending linear which passes through the reef exposures at the Greenleaf Lake dam site.

MAGNETIC DELINEATION OF THE BASEMENT SURFACE

Profile 2 (figs. 2, 3) was selected to run west of the reef exposures and to intersect the linear. At stations 6 and 14 it shows vertical-magnetic-intensity drops of about 25 and 70 gammas, respectively. These are believed to reflect the configuration of the basement surface. Magnetic studies in northeastern Oklahoma (Norden and Langton, 1963) have demonstrated the utility of the magnetometer in basement-surface mapping. This utility derives from the fact that the basement complex and the overlying sedimentary rocks exhibit a susceptibility contrast of more than 1,000 × 10^{-6} cgs unit. The magnetic anomaly in

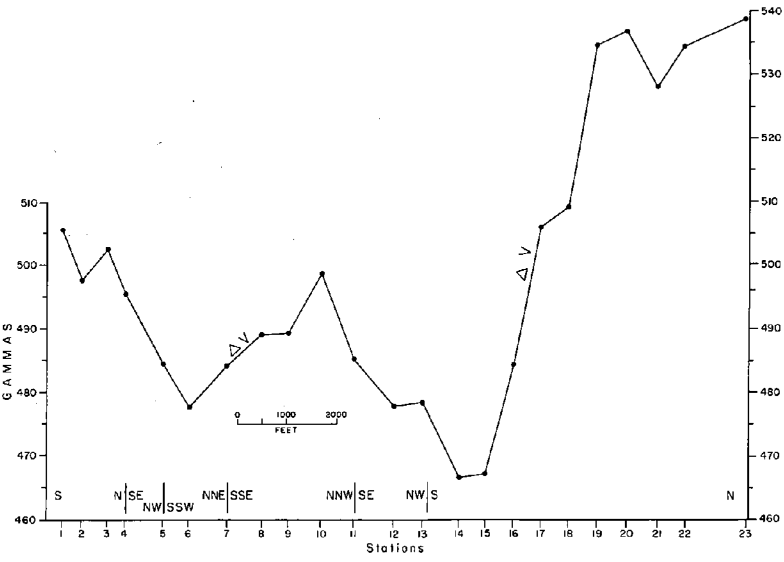

Figure 2. Vertical-magnetic-intensity profile 2. Measurements taken along south-north line west of Greenleaf Lake dam.

the Greenleaf Lake area is considered to be caused by a geophysical condition of similar nature.

The basement relief at the entrenchment between stations 14 and 20 was computed to be 0.862 kilo-feet (862 feet). Applying a susceptibility contrast of 1,180 $\times$ 10^{-6} cgs unit between the basement rocks and the overlying sediments in a field of H = 0.516 oersted, the polar-

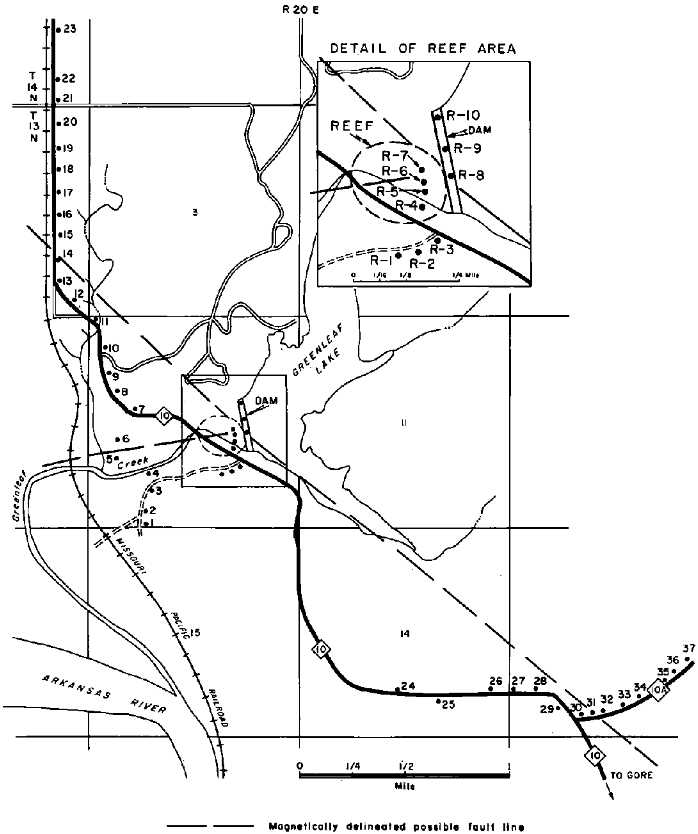

Figure 3. Map of vicinity of Greenleaf Lake dam, showing locations of stations along the three magnetic profiles. Line of profile 1 (fig. 1), stations R-1 to R-10, is shown in detail in inset map at upper right. Profile 2 (fig. 2) is from station 1 to station 23, and profile 3 (fig. 4) is from station 24 to station 37.

ization contrast was found to be 6.0888×10^{-4} cgs unit. By the analogy of a faulted escarpment (Nettleton, 1942) between stations 14 and 20, the depth to the center of the buried escarpment was found to be 1.5 kilo-feet (1,500 feet).

Theoretical magnetic effect of a buried escarpment

$$V = 2 \times I \times t(x^2 + z^2)^{-1}$$

$$= K \times f(\frac{x}{z})$$

$$\text{where } f(\frac{x}{z}) = \frac{x}{z}(1 + \frac{x^2}{z^2})^{-1}$$

$$\text{and } K = 2 \times 10^5 \frac{I \times t}{z}$$

I is the polarization contrast
t is the thickness of the buried escarpment
z is the depth in kilo-feet to the center of the buried escarpment
x is the distance in kilo-feet from the ledge of the buried escarpment

Applying for x = 1.65 kilo-feet (1,650 feet) which is one-half of the distance between stations 14 and 20 and with the value of z = 1.5 kilo-feet (1,500 feet)

$$f(\frac{x}{z}) = 0.498$$

$$K = 2 \times 10^5 \times \frac{6.0888 \quad 10^{-4} \quad 8.62 \quad 10^{-1}}{1.5} = 70 \text{ gammas}$$

For a distance of 1,650 feet from the ledge of the buried escarpment the relative magnetic relief

$$V = 35 \text{ gammas}$$

The theoretical value of 70 gammas total relief across the escarpment accords with the actual field value of 70 gammas observed between stations 14 and 20.

Profile 3 (fig. 4) at stations 30 and 31 shows about a 33-gamma drop of the vertical magnetic intensity. This drop of the gamma values may be correlated in trend with the drop of vertical magnetic intensity at stations R-5, R-6, and R-7 of profile 1 (fig. 1) and with the drop in magnetic intensity at stations 14 and 15 of profile 2 (fig. 2). This trend of correlation coincides with the linearity of the depression of the southeast branch of Greenleaf Lake along which the back flooding of water is noticed. On profile 2 (fig. 2) at station 6, the 25-gamma drop of magnetic values may indicate another entrenchment in the basement surface. This drop in the vertical magnetic intensity ties to the low magnetic values at stations R-5, R-6, and R-7 on profile 1 (fig.

1). Greenleaf Creek along its upper section follows the trend of this entrenchment which may continue east-northeast across Greenleaf Lake.

GEOLOGICAL INTERPRETATION OF THE MAGNETIC PROFILES

The considerable magnetic-susceptibility contrast between the basement rocks and the overlying sediments may support the assumption that the magnetic profiles are the geophysical indications of the basement surface. Correlation between the profiles points toward a linear tie along the erosional entrenchment on the basement surface. The fact that this linear trend is reflected by the photogeologically recognized linears in the surface formations may contribute to the assumption that the erosional entrenchment on the basement surface was oriented by fracture and fault systems. Perhaps the basement surface was fractured and faulted prior to the erosion, and the erosional forces could work deeper along the fracture and fault zones. The surface linears may be interpreted as a small-scale adjustment in the sediments overlying linear erosional and fracture zones on the basement surface. Epeirogeny and tectonic small-scale adjustments along the fracture zones of the eroded basement surface may also have contributed to originate microadjustments in the overlying sediments and give an explanation for the trend correlation of photogeological surface linears and the basement surface tectonic and erosional configuration. The two magnetically delineated possible fault lines (fig. 3), by their intersection at the Greenleaf Lake dam site, suggest a conjugate shear pattern. The lower section of Greenleaf Creek follows a trend parallel to the possible fault line and erosional entrenchment magnetically de-

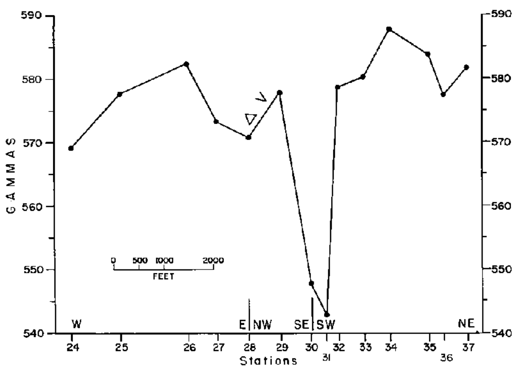

Figure 4. Vertical-magnetic-intensity profile 3. Measurements taken along west-east line southeast of Greenleaf Lake Dam.

tected between stations R-5, R-6, and R-7 of profile 1 and stations 30 and 31 of profile 3.

CONCLUSION

A vertical-magnetic-intensity survey across a Morrowan (Pennsylvanian) reef mass in the Bloyd Formation at the Greenleaf Lake dam site, Muskogee County, Oklahoma, delineated below the reef an erosional entrenchment in the basement surface. Two other magnetic-profile lines to delineate the trend of this basement entrenchment confirmed the assumption that, at the Greenleaf Lake dam site, shear-pattern-oriented erosional entrenchments characterize the basement relief. These erosional entrenchments, owing to their tectonic linearity, seem to be fracture controlled. A definite correlation can be established between the photogeologically recognized linears in the surface formations and the trend of this erosional basement entrenchment. This correlation may be explained by the tectonic adjustments of younger series overlying the fracture- and erosion-controlled basement relief.

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Potonieisporites elegans (Wilson and Kosanke, 1944) Wilson and Venkatachala Comb. Nov.*

L. R. Wilson and B. S. Venkatachala†

Palynological studies in Oklahoma during the last several years have revealed many specimens of the sporomorph genus *Potonieisporites* Bhardwaj, 1954. These discoveries led to a detailed study of the genus and of the type species, *P. novicus,* the holotype of which is deposited in the collections of the Geologisches Landesamt, Krefeld, Germany. Upon completion of this study, the generic assignment of the species *Florinites elegans* Wilson and Kosanke, 1944, was found to be with *Potonieisporites* rather than with *Florinites*; therefore the following transfer is proposed.

Potonieisporites elegans (Wilson and Kosanke, 1944) comb. nov.
1944. *Florinites elegans* Wilson and Kosanke. Iowa Acad. Science, Proc., vol. 51, p. 330-331, fig. 3.

*One project supported by National Science Foundation Grant G-22083.
†Birbal Sahni Institute of Palaeobotany, Lucknow, India.

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Potonieisporites elegans **(Wilson and Kosanke, 1944) comb. nov. Holotype, length 197 microns, width 135 microns. Angus Coal Company Mine, Oskaloosa, Mahaska County, Iowa. Slide 279 P, Circle 1.**

Figure 1. High focal plane showing smooth outer surface of saccus.

Figure 2. Low focal plane showing the infrareticulate nature of the saccus.

Appreciation is expressed to Dr. Robert Potonié and Dr. Hilde Grebe of the Geologisches Landesamt, for courtesies to the writers while we conducted the examinations of the type material in Krefeld, Germany.

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New Theses Added to O. U. Geology Library

The following Master of Science theses have been added recently to The University of Oklahoma Geology Library:

Foraminifera of the Brownstown Formation (Cretaceous) of southwestern Arkansas, by Jesse L. Tuttle, Jr.

Pre-Chester Mississippian rocks of northwestern Oklahoma, by Edward Arthur Hoffmann, Jr.

OKLAHOMA GEOLOGY NOTES

Volume 24 March 1964 Number 3

IN THIS ISSUE