OKLAHOMA
GEOLOGY NOTES

OKLAHOMA GEOLOGICAL SURVEY
THE UNIVERSITY OF OKLAHOMA • NORMAN, OKLAHOMA

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An Igneous Cobble in an Oklahoma Coal Bed

Carl C. Branson and C. A. Merritt

Ray L. Six of Stillwater recently gave the Survey a specimen of igneous rock collected from the Lower Hartshorne coal bed in the Gillie mine at Bokoshe, Le Flore County, Oklahoma. The discoidal mass, 7 inches in diameter and 2 inches thick and weighing 4½ pounds, was tentatively identified as quartz monzonite. Knechtel reported this occurrence as well as that of a dark-gray quartzite in the same coal (1949, p. 46).

A thin section was prepared and was examined petrographically by Merritt, who reports the following characteristics of the rock.

The rock is a light-colored medium-grained quartz monzonite. Dark-gray quartz is scattered irregularly throughout the rock, giving it a mottled light- and dark-gray appearance. The texture is hypidiomorphic inequigranular. The rock is essentially fresh and unaltered, although microscopically it shows evidence of some deuteric alteration.

A point count of the minerals in a thin section gave the following mode:

Quartz	24.5%
Oligoclase (An_{22})	29.4
Perthite	38.4
Muscovite and sericite	4.7
Biotite	2.3
Chlorite	.2
Magnetite	.1
Calcite	.2
Epidote	.2
Myrmekite	trace
Hematite	trace

Feldspar is anhedral to subhedral with oligoclase grains ranging from 0.3 to 2.0 mm and perthite from 1.0 to 3.0 mm. The average size of feldspar grains is 1.5 mm, and the rock is medium grained. The feldspar is slightly altered to sericite, epidote, calcite, and clay, the latter mineral producing a cloudy appearance. Perthite is somewhat more altered than oligoclase.

Oligoclase exhibits albite twinning, and some grains also have pericline or Carlsbad twinning. Perthite has parallel lamellae and is considered to have formed by exsolution of albite from potassium feldspar on cooling. The lamellae are so minute that it is difficult to determine the identity of the potassium feldspar. The plagioclase of the intergrowth has indices of refraction lower than that of Canada balsam and is albite. Some of the perthite grains show Carlsbad twinning. The plagioclase is identified as oligoclase, An_{22}, with the universal stage.

Quartz is anhedral and ranges from 0.1 to 1.0 mm in grain size. Many of the grains show marked shadowy extinction.

A small amount of sericite is associated with the feldspar as an alteration product, but most of the white mica is coarser and is identified as muscovite. In part it is intergrown with biotite, and in part it is scattered throughout the rock. A few flakes of mica contain inclusions of small feldspar grains in a crystalloblasticlike texture.

Biotite occurs mainly as shreds, some slightly contorted and intergrown with muscovite or chlorite. Epidote is present as small anhedral grains in plagioclase and biotite. Magnetite occurs as small irregular unaltered grains.

The rock has suffered minor deuteric alteration as shown by the trace of myrmekite and the replacement of feldspar edges by biotite,

Figure 1. Two views of exotic quartz monzonite cobble from Lower Hartshorne coal bed, Gillie mine, Bokoshe, Le Flore County. Cobble has been broken into two parts and a wedge has been cut from one for petrographic examination and thin sectioning. Lower photograph is an edge view of the lower half of the specimen.

muscovite, and epidote. The crystalloblasticlike muscovite and marked shadowy extinction of the quartz suggest that the rock also had been subjected to incipient metamorphism.

Dr. C. J. Mankin tested a fragment of the rock. He reports that X-ray analysis shows quartz, feldspar (close to albite), and muscovite (dioctahedral).

This rock type is unlike any of the Arbuckle-Wichita, or northeastern Oklahoma provinces so far known on outcrop or in 275 wells investigated (W. E. Ham, personal communication, July 19, 1963). No possible source of the cobble is known to us.

Cobbles of igneous rock and of other rock types are not especially rare occurrences in coal. The first instances reported were by Binney (1851) and by Phillips in 1855 (p. 220). The latter stated that "quartz and hard sandstone" boulders had been found in Upper Carboniferous coal at Newcastle and at Norbury, near Stockport.

Spencer (1887, p. 734-735) reported a 6-pound boulder in the Gannister coal near Bacup, Lancashire, 180 feet below the ground surface. It and other boulders and pebbles of the area are isolated, are waterworn and rounded, and are of granite, quartz, and quartzite.

Gresley (1885, p. 553-555) reported five boulders of quartzite entirely embedded in the Lount Nether coal at the Coleorton colliery in Leicestershire. The coal is 4½ feet thick and the boulders were about 20 inches from the top. They weighed 6¾ ounces to 11½ pounds. Four were within a space of 20 yards and one was 500 yards away.

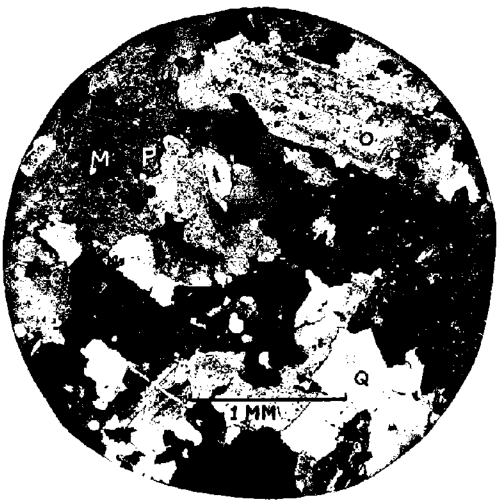

Figure 2. Photograph of quartz monzonite with nicols crossed. (M) muscovite, (P) cloudy perthite, (Q) quartz, (O) oligoclase. Most of the black minerals are quartz and feldspar at extinction.

All were rounded. The coal has many "horses," or gaps, where sandstone or shale occurs in place of the coal. Gresley also noted a waterworn pebble of lead ore at the top of a coal seam in Shropshire and a sandstone boulder and quartzite pebbles in the underclay of the Little Coal seam of Derbyshire.

A summary of known occurrences was given by Stur (1885), and he described exotics from Moravian coals.

Roemer (1864) described the occurrence of boulders of gneissic rock in the Caroline coal bed near Kattowitz in Upper Silesia. The three boulders were in the coal itself and were spheroidal, the largest 11 inches in greatest dimension.

In 1923, Stutzer (1940, p. 273-277) summarized reported occurrences of exotic rocks in coal. In a French coal seam 300 boulders of varied rock types and ages were collected, and a total of 1,073 such boulders was assembled from the region. Similar occurrences have been described in Belgium, Bohemia, Westphalia, Silesia, and at several places in England.

Cobbles have been found in coal at few places in the United States. Andrews (1871, p. 78) reported a gray quartzite boulder in the Nelsonville coal bed at Zaleski, Vinton County, Ohio. The boulder was 17 inches long, 12 inches in least dimension, and was rounded. The boulder was half embedded in the coal.

Newberry (1874, p. 174-175) reported a 4-inch boulder of talcose slate in an ironstone parting of Coal No. 1 at Mineral Ridge, Mahoning County, Ohio.

Gresley (1896, p. 332) mentioned a quartzite boulder taken from the Mammoth seam at Mt. Carmel, Pennsylvania, and a limestone boulder from the fireclay over the workable part of the Pittsburgh coal.

The largest boulder known is the 400-pound quartzite mass taken from the Middle Kittanning seam at Shawnee, Perry County, Ohio (Orton, 1892). Scores of cobbles were found in the mine at Zaleski, Ohio, in the same seam. A 10½-pound cobble was found embedded in the Sharon coal at Mineral Ridge, Mahoning County, Ohio. The specimen was angular and showed no signs of wear.

The Sewell coal of Greenbrier County, West Virginia (equivalent to the Sharon coal), in the New River Group of the Pottsville, yielded 40 exotics ranging from less than an ounce to 161½ pounds (Price, 1932). These are mainly of quartzite, but some are vein quartz, sandstone, and conglomerate. Two are of igneous rocks. A quartzite boulder had earlier been reported from the New River coal field of West Virginia (White, 1915).

A boulder of metarhyolite was found in a coal seam in the Etna coal mines near Chattanooga, Tennessee (McCallie, 1903). The waterworn specimen of some 20 or 30 pounds is of a rock type not known to occur in the region. Dana (1895, p. 664) stated that F. H. Bradley had found a quartzite boulder in coal along Coal Creek in eastern Tennessee.

Foreign rocks occur in limestone at places. Cady (1919, p. 69) reported small pebbles of greenish igneous rock and of quartz in a local fossiliferous white limestone 46 feet above the La Salle Limestone Member of the Bond Formation. Savage and Griffin (1928) discussed the same occurrence. They stated that the pebbles were embedded in the limestone, and that here and in the Spring Valley Limestone at nearby Spring Valley about 75 specimens were found. About half of the specimens were quartz, and the others were greenstone, granite, schist, and quartzite. The larger pebbles were about four inches in diameter; they are rounded, and some have smoothed sides. The authors concluded that the pebbles were derived from northern Wisconsin or from that general area and that they were carried in ice floes down a Pennsylvanian river.

Other reports of crystalline rocks in such sediments are of unlike occurrences. Twenhofel's (1917) find is a Cretaceous intrusive. The occurrence of exotics in the Johns Valley Shale and other units of the Ouachita Mountains presents another type of problem. These exotics were clearly not transported by ice. Angular fragments, such as those described by Ball (1888), are apparently of different origin.

Theories on the origin of the boulders and on the means of transport are varied. Binney (1851) thought that three quartzite boulders he observed were meteorites. Stur (1885) considered the boulders in the coal of Moravia to be pseudomorphs after ironstone concretions. Many of the British coals are channeled and the boulders in the coal would seem to have been transported by streams which later cut and filled channels. Gürich (1891), Gresley (1896), and Savage and Griffin (1928) explained the presence of exotics by river transport in contemporary streams. Price (1932, p. 71) concluded that the exotics of Greenbrier County, West Virginia, were carried 60 miles from the Blue Ridge by a Pennsylvanian river. He considered that the rafting could have been accomplished in ice, by rafting of trees with cobbles held in their roots, by prior stream deposition and elevation of the cobbles upward into the bog in root pads of trees. Newberry (1874) and Schmitz (1894) thought that cobbles were held in the roots of floating trees. Ball (1888) and Schmitz (1894) thought that the exotics were transported in rafts of marine plants.

Potonié (1920) considered that cobbles could be transported into the bogs by waves moving the rocks by aid of attached seaweeds. Several authors considered that transportation was in ice floes (Spencer, 1887; Gresley, 1887; Andrews, 1871).

Hypotheses of glacial transport or ice rafting are considered to be invalid because the plants in the coal seams could have survived only in a warm climate.

The use of the term erratics to designate the boulders is ill-advised. The word carries the connotation that the rocks were glacially transported. Few writers have termed them exotic boulders and cobbles, but it is more descriptive of their characteristics to call them exotics and they should be referred to as such.

Nearly all reported occurrences of exotics in coal are of finds in Pennsylvanian coals. In the United States these range from Pottsville (Morrowan) to Monongahela (Virgilian). The Oklahoma occurrence is in coal of Early Desmoinesian age.

The Oklahoma cobble is flattened ovoid much like a beach cobble. The early Des Moines shoreline could have been to the northeast in Arkansas or Missouri and to the south in the Ouachita Mountains area, but no source of quartz monzonite is known in those regions, and no means of transport into the swamp is satisfactorily indicated.

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Magnetic Delineation of the Basement Surface, Christie-Westville Area, Adair County, Oklahoma

J. A. E. Norden and J. M. Langton

INTRODUCTION

Surface geological mapping of the Christie-Westville area, Adair County, Oklahoma (Langton, 1963), disclosed the need of a geophysical delineation of the basement conditions of this area, which is within the Ozark uplift, near its southwestern flank. Owing to the nature of the problem involved, the senior author suggested a vertical-magnetic-intensity survey. Magnetic investigation of the basement conditions, however, depends largely on the magnetic-susceptibility contrast between the media of the overlying sedimentary complex and that of the underlying basement. Magnetic-susceptibility measurements of outcrop samples of the sedimentary formations of the Christie-Westville area and of the Spavinaw Granite, which is a member of the basement complex, showed that the susceptibility contrast was sufficiently great to justify a magnetic survey.

On June 5, 1963, the authors formed a magnetic-surveying party, including J. P. Cannon, W. W. Van Dahl, and J. M. Hancock, Jr. Survey lines were laid out in general north-south trends along roads. Magnetic-observation stations were established in general at one-mile intervals; however several stations were more closely spaced. All lines were reduced to a common base with base-tie operations for magnetic correlation and mapping.

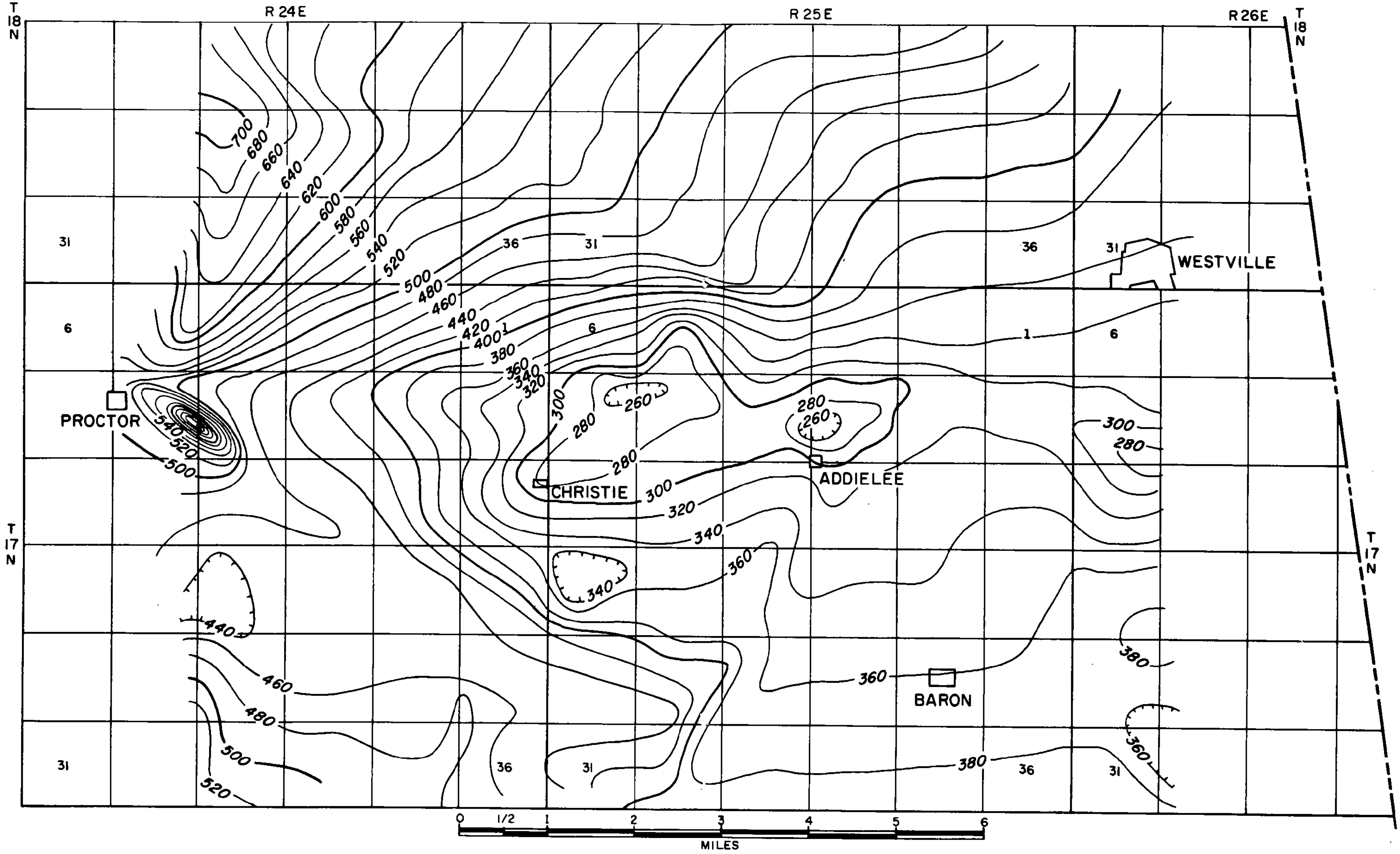

Figure 1. Vertical-magnetic-intensity-anomaly map of the Christie-Westville area, Adair County, Oklahoma. Contour interval is 20 × 10^{-5} cgs unit.

MAGNETIC SURVEY

A regional magnetic picture of the area (Spraragen, 1928) shows a general increase of vertical magnetic intensity to the northwest. The purpose of this investigation was to add greater resolution to this general picture by more detailed local measurements. In the field survey a Ruska type V-3 vertical magnetometer (serial no. 5708) was used. The instrument sensitivity was set to 10.43 gammas per scale division, and the temperature correction factor was +0.1 gamma per 1°C. Observed field data were corrected for temperature, diurnal, and geomagnetic latitudinal and longitudinal variations and reduced to a common base for plotting. The change in vertical magnetic intensity was contoured at a 20×10^{-5}-cgs-unit interval to produce a vertical-magnetic-intensity map of the area (fig. 1).

INVESTIGATION OF THE MAGNETIC SUSCEPTIBILITY

To evaluate the magnetic-susceptibility contrast between the sedimentary overburden and the basement, detailed susceptibility measurements were made on samples of the formations involved. Magnetic susceptibility was measured by using a magnetic-susceptibility bridge, model MS-3*, which provides accurate measurements made in a magnetic field of the same order of magnitude as that of the Earth's field. The field used in the MS-3 is produced by alternating current, and the instrument neither measures nor is affected by remanent magnetization (Geophysical Specialties Co., 1962).

Table I is a list of the sedimentary and igneous rocks involved, with the measured magnetic-susceptibility value given for each. The nearest outcrop of Spavinaw Granite, which is the oldest rock exposed in Oklahoma (Cram, 1930), is 36 miles northwest of the area; however, it is considered as a unit of the basement complex under the Christie-Westville area. The two samples of Spavinaw Granite tested for magnetic susceptibility were collected by Louise Jordan and G. G. Huffman in Spavinaw Creek, Mayes County, Oklahoma. Their contribution to susceptibility testing on this basement rock is gratefully acknowledged.

According to the data in table I, a considerable magnetic-susceptibility contrast exists between the sedimentary complex and the Spavinaw Granite. Calculated susceptibilities of granites, based upon magnetite dissemination, range from a minimum value of 600×10^{-6} cgs unit to a maximum of $5{,}700 \times 10^{-6}$ cgs unit (Dobrin, 1960). Thus the average magnetic susceptibility of the Spavinaw Granite ($1{,}190 \times 10^{-6}$) is nearly 21 percent of the calculated maximum susceptibility of granite. Susceptibilities of the sedimentary formations tested are insignificant in comparison with the average susceptibility of the Spavinaw Granite, and one may assume the general variation of vertical magnetic intensity in the area to be due chiefly to the polarization effect of the basement. A susceptibility of $1{,}190 \times 10^{-6}$ cgs unit in a field of $H = 0.56$ oersted will produce a magnetic polarization of 0.00067 cgs unit.

*Geophysical Specialties Co., Hopkins, Minn.

In the Christie-Westville area, vertical-magnetic-intensity variations were recorded in the general range of 260 to 700 gammas (fig. 1). The central part of the area is occupied by a magnetic depression with a general east-west trend. The axis of this depression, however, shows a slight rise to the east. The center of the depression is about one mile northeast of Christie. A distinct local magnetic high with a closure of about 180 gammas can be recognized about one mile east of Proctor. The general run of the magnetic contour lines at places (such as west of Baron) suggests the fault-controlled character of the basement configuration. In this respect the vertical-magnetic-intensity-anomaly map may be considered as a geophysical "reflection" of the tectonically depressed, faulted, and eroded surface of the basement. Two profiles were constructed from the map. One profile (fig. 2) is a general north-south line across the Christie area. Magnetic relief on the basement depression, corrected for a southward regional slope of about 32 gammas per mile, is 177 gammas. The depth of the depression, computed by measuring the "half-width" and the inflection-point distance on the anomaly curve, is estimated to be 2,100 feet. Overlying this magnetic depression, the Reeds Spring Formation is at the surface.

TABLE I.—MAGNETIC-SUSCEPTIBILITY VALUES FOR FORMATIONS IN THE CHRISTIE-WESTVILLE AREA

AGE	FORMATION	MAGNETIC SUSCEPTIBILITY $K\ 10^{-6}$
Pennsylvanian	Hale Sandstone	7.0
Mississippian	Fayetteville Shale	12.5
	Wedington Sandstone Member	7.7
	Hindsville Limestone	6.0
	Moorefield Limestone	
	Bayou Manard Member	1.6
	Keokuk Chert	6.1
	Reeds Spring Limestone	0.8
	St. Joe (reef) Limestone	1.0
Devonian	Chattanooga Shale (Noel Member)	41.0
	Sylamore Sandstone	5.8
Ordovician	Tyner green shale	23.1
	Tyner sandy dolomite	24.2
	Burgen Sandstone	1.1
	Cotter Dolomite	0.9
Precambrian	Spavinaw Granite (average of two samples)	1,190.0

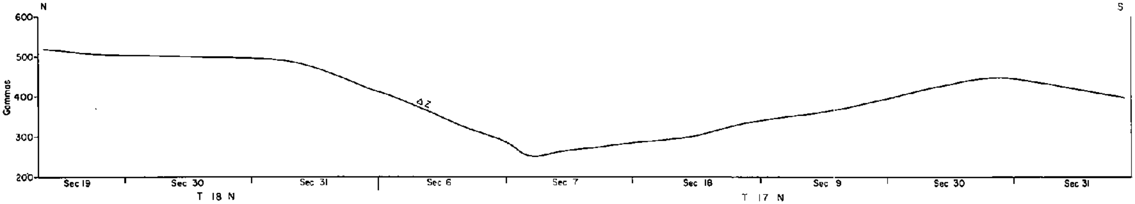

Figure 2. General north-south vertical-magnetic-intensity-anomaly profile across Christie area, Tps. 17, 18 N., R. 25 E.

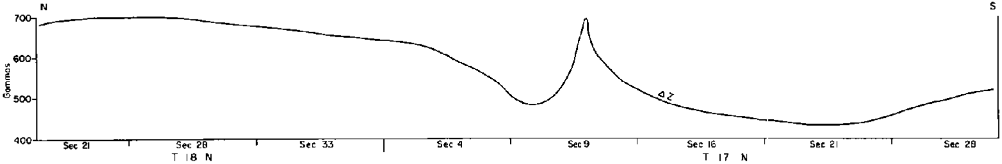

Figure 3. General north-south vertical-magnetic-intensity-anomaly profile across Proctor area, Tps. 17, 18 N., R. 24 E.

Assuming a normal stratigraphic sequence and typical thicknesses, the sedimentary section in this area is probably composed of Reeds Spring, 200 feet; Chattanooga, 70 feet; Tyner, 70 feet; Burgen, 100 feet; Canadian section, including the Cotter Dolomite, 1,600 feet; and granite wash, 50 feet. This estimated total thickness of 2,090 feet of sedimentary cover above the basement depression corresponds closely with the 2,100-foot depth of the basement depression computed from geophysical data alone.

The second magnetic profile (fig. 3), which crosses the Proctor area in a north-south direction, distinctly depicts the character of the local magnetic high east of Proctor. The depth of this basement high was estimated, by the measurement of the "half-width" and the distance of the inflection point on the anomaly curve, to be about 1,200 feet. This figure may explain the geological conditions above this magnetic high. On the surface above the magnetic high is a wide outcrop of the Tyner Formation. Upon the basis of geological evidence, it is assumed that the Burgen is 100 feet thick in this area and that a somewhat reduced Canadian section is about 1,100 feet thick. The total assumed estimated thickness of 1,200 feet is the same as the geophysically estimated depth of the local anomaly.

The vertical-magnetic-intensity high of about 700 gammas north of Proctor may be interpreted as a basement rise, above which the Canadian section has a reduced development. An over-all interpretation of the magnetic-survey data of the Christie-Westville area indicates that the basement is a depressed, faulted, and eroded surface upon which the sedimentary sequence was deposited in variable thicknesses determined by local relief of the invaded sinking basement.

CONCLUSION

Vertical-magnetic-intensity mapping in the Christie-Westville area, Adair County, Oklahoma, has demonstrated the usefulness of the magnetic survey in the delineation of the surface of the basement complex.

In the area of investigation particularly favorable conditions exist owing to the significant susceptibility contrast between the weakly magnetic sedimentary cover and the considerably magnetic basement. This condition facilitates more accurate depth estimations for the basement surface. The survey disclosed a basement depression about 2,100 feet deep in the Christie area. It has a general east-west trend with a slight axial rise towards the east. In the Christie-Westville area the basement is a depressed, faulted, and eroded surface, upon which the sedimentary series transgressed and developed in variable thickness, determined by the relief of the invaded sinking basement.

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Ninth Volume of Russian Paleontological Treatise

Carl C. Branson

Russia has either a fantastic fauna of fossil insects or a prolific group of scientists interested in these forms. Martynov has published many papers between 1927 and 1940, and his widow, O. M. Martynova, has continued work in the field. G. Zalessky and M. Zalessky have written a number of papers, and Becker-Migdisova and Rohdendorf have been especially active in recent years.

The book summarizes and illustrates Russian fossil "Mandibulata," of which insects are by far the most important, and fossil chelicerates.

As in many of the preceding volumes, the several authors have sprinkled the volume with new names and with taxonomic changes. Some of these affect Oklahoma taxonomy. The new taxa are:

Insecta

Parelmoidae Rohdendorf, new family (p. 71), for *Pseudelmoa* and *Parelmoa* Carpenter, 1947, from Noble County, Oklahoma.

Parakuloja Rohdendorf, new genus (p. 72), and new combination for type species *Kuloja paurovenosa* Martynov, 1931, of the Kazanian of the Archangel district.

Eukuloja Rohdendorf, new genus; type species *Kuloja cubitalis* Martynov, 1931, Kazanian of the Archangel district (p. 72; fig. 121).

Kargalotypus Rohdendorf, new genus, based upon *Megatypus kargalensis* Martynov, 1932, Permian, Orenburg district (p. 74; fig. 127).

Hemizygopteron G. Zalessky, 1955, is referred to synonymy of *Ditaxineurella* Martynov, 1940 (p. 75).

Ishanablattina Becker-Migdisova, new genus, with type species *Drepanoblattina fodinensis* Becker-Migdisova, 1961 (p. 99; fig. 218; pl. 4, fig. 4), Upper Carboniferous of the Kuznetsk Basin.

On page 119 the type species of *Archidelia* Sharov, 1961, is given as *A. elongata* Sharov, 1961. The cut-line of figure 286 and the explanation of plate 5, figure 3 give what is apparently the same species as *A. ovata.*

Pseudohagla Sharov, new genus, is established for *Hagla pospelovi* Martynov, 1949, Jurassic of the Kuznetsk Basin (p. 152; fig. 399; pl. 11, fig. 3).

Zeuneroptera Sharov, new genus, type species *Palaeorhenia scotica* Zeuner, 1939 (p. 153; fig. 402), is from the Tertiary of Scotland.

New subfamily Pseudotettigoniinae Sharov (p. 155).

Evanscicada Becker-Migdisova is a new generic name for *Evansia* Becker-Migdisova, 1961, said to be a nude name. In any case, it is a junior homonym of *Evansia* Cambridge, 1900 (Arachnida), of *Evansia* Scott, 1906 (Crustacea), and *Evansia* Raillet and Henry, 1913 (Nematoda). The type species is *Evansia speciosa* Becker-Migdisova, 1961 (p. 170; fig. 466; pl. 12, fig. 2), Lower Permian of the Kuznetsk Basin.

In the explanation of plate 12, figure 7, *Permocicada umbrata* is credited to Becker-Migdisova, but the species is actually of Martynov, 1928. It is type species of the genus according to my records, although the Osnovy (p. 168) lists *P. nigronervosa* as type species.

Asionecta J. Popov, new genus; type species *A. curtipes* J. Popov, new species (p. 214; fig. 641). Upper Jurassic of Kazachstan.

Miridoides Becker-Migdisova, new genus; type species *M. mesozoicus* Becker-Migdisova, new species (p. 217; fig. 650). Upper Jurassic of Kazachstan.

Karanabis Becker-Migdisova, new genus; type species *K. kiritshenkoi* Becker-Migdisova, new species (p. 219; fig. 651). Upper Jurassic of Kazachstan.

Karatavocoris Becker-Migdisova, new genus; type species *K. asiatica* Becker-Migdisova, new species (p. 222; fig. 665). Upper Jurassic of Kazachstan.

Meseumolpites Ponomarenko, new name for *Eumolpites* Martynov, 1926, not *Eumolpites* Heer, 1865. Type species *Eumolpites jurassicus* Martynov, 1926 (p. 266; fig. 832).

Protochoristinae Martynova, new subfamily (p. 286).

Protopanorpoides Martynova, new genus, with *Protopanorpa elongata* Martynov, 1933, as genotype (p. 287; fig. 901).

Permochoristinae Martynova, new subfamily (p. 288) (should be credited to Tillyard for family Permochoristidae, 1917).

Tipulodictyidae Rohdendorf, new family (p. 310), for *Tipulodictya* Rohdendorf, new genus; type species *T. minima* Rohdendorf, new species (p. 311; fig. 974).

Eopolyneuridae Rohdendorf, new family, for *Eopolyneura* Rohdendorf, new genus; type species *E. tenuinervis* Rohdendorf, new species (p. 311; fig. 975). Upper Triassic of Middle Asia.

Musidoromimidae Rohdendorf, new family, for *Musidoromima* Rohdendorf, new genus; type species *M.* (as *H.*) *crassinervis* Rohdendorf, new species (p. 311; fig. 977). Upper Triassic of Middle Asia.

Diplarchitipula Rohdendorf, new genus; type species *D. multimedialis* Rohdendorf, new species (p. 313; fig. 979). Upper Triassic of Middle Asia.

Eolimnobiidae Rohdendorf, new family (p. 313).

Tanyderophryneidae Rohdendorf, new family; *Tanyderophryne* Rohdendorf, new genus; type species *T. multinervis* Rohdendorf, new species (p. 314; fig. 989). Upper Jurassic of Kazachstan.

Architendipedidae Rohdendorf, new family; *Architendipes* Rohdendorf, new genus; type species, *A. tshernovskiji* Rohdendorf, new species (p. 317; fig. 999); and *Palaeotendipes* Rohdendorf, new genus; type species *P. alexii* Rohdendorf, new species (p. 317; fig. 1000). Upper Triassic of Middle Asia.

Protendipedidae Rohdendorf, new family, *Protendipes* Rohdendorf, new genus; type species *P. dasypterus* Rohdendorf, new species (p. 317; fig. 1001). Upper Jurassic of Kazachstan.

Rhaetomyiidae Rohdendorf, new family; *Rhaetomyia* Rohdendorf, new genus; type species *R. necopinata* Rohdendorf, new species (p. 318; fig. 1006). Upper Triassic of Middle Asia.

Mesophantasmatidae Rohdendorf, new family; *Mesophantasma* Rohdendorf, new genus; type species *M. tipuliforme* Rohdendorf, new species (p. 319; fig. 1007). Upper Jurassic of Kazachstan.

Pleciodictyidae Rohdendorf, new family; *Pleciodictya* Rohdendorf, new genus; type species *P. modesta* Rohdendorf, new species (p. 319; fig. 1008). Upper Triassic of Middle Asia.

Protoligoneuridae Rohdendorf, new family; *Protoligoneura* Rohdendorf, new genus; type species *P. fusicosta* Rohdendorf, new species (p. 319; fig. 1009). Upper Triassic of Middle Asia.

Palaeopleciidae Rohdendorf, new family; *Palaeoplecia* Rohdendorf, new genus; type species *P. rhaetica* Rohdendorf, new species (p. 319; fig. 1010). Upper Triassic of Middle Asia.

Rhaetofungivora Rohdendorf, new genus; type species *R. reticulata* Rohdendorf, new species (p. 320; fig. 1011). Upper Triassic of Middle Asia.

Rhaetofungivorella Rohdendorf, new genus; type species *R. subcosta* Rohdendorf, new species (p. 320; fig. 1012). Upper Triassic of Middle Asia.

Rhaetofungivorodes Rohdendorf, new genus; type species *R. defectivus* Rohdendorf, new species (p. 320; fig. 1015). Upper Triassic of Middle Asia.

Protallactoneura Rohdendorf, new genus; type species *P. turanica* Rohdendorf, new species (p. 321; fig. 1016). Upper Triassic of Middle Asia.

Archihesperinus Rohdendorf, new genus; type species *A. phryneoides* Rohdendorf, new species (p. 321; fig. 1017). Upper Triassic of Middle Asia.

Archipleciofungivora Rohdendorf, new genus; type species *A. binerva* Rohdendorf, new species (p. 321; fig. 1018). Upper Triassic of Middle Asia.

Archipleciomima Rohdendorf, new genus; type species *A. obtusipennis* Rohdendorf, new species (p. 321; fig. 1019). Upper Triassic of Middle Asia.

Palaeohesperinus Rohdendorf, new genus; type species *P. longipennis* Rohdendorf, new species (p. 323; fig. 1023). Upper Triassic, Middle Asia.

Archizelmiridae Rohdendorf, new family; *Archizelmira* Rohdendorf, new genus; type species *A. kazachstanica* Rohdendorf, new species (p. 326; fig. 1040). Upper Jurassic of Kazachstan.

Megalycoriomima Rohdendorf, new genus; type species *M. magnipennis* Rohdendorf, new species (p. 326; fig. 1041). Upper Jurassic of Kazachstan.

Tipulopleciidae Rohdendorf, new family (p. 328).

Sinemediidae Rohdendorf, new family; *Sinemedia* Rohdendorf, new genus; type species *S. angustipennis* Rohdendorf, new species (p. 328; fig. 1055). Upper Jurassic of Kazachstan.

Oligophryneidae Rohdendorf, new family, *Oligophryne* Rohdendorf, new genus; type species *O. fungivoroides* Rohdendorf, new species (p. 332; fig. 1068). Upper Triassic of Middle Asia.

Protolbiogastridae Rohdendorf, new family; *Protolbiogaster* Rohdendorf, new genus; type species *P. rhaetica* Rohdendorf, new species (p. 332; fig. 1069). Upper Triassic of Middle Asia.

Phragmoligoneuridae Rohdendorf, new family; *Phragmoligoneura* Rohdendorf, new genus; type species *P. incerta* Rohdendorf, new species (p. 332; fig. 1074). Upper Triassic of Middle Asia.

Protobrachyceridae Rohdendorf, new family (p. 334).

Archisargidae Rohdendorf, new family (p. 334).

Eomyiidae Rohdendorf, new family; *Eomyia* Rohdendorf, new genus; type species *E. veterrima* Rohdendorf, new species (p. 334; fig. 1081). Upper Jurassic of Kazachstan.

Rhagionempididae Rohdendorf, new family (p. 336).

Eurypterida

Slimoniidae Novojilov, new family (p. 410).

Rhinocarcinosoma Novojilov, new genus (p. 413); type species *Carcinosoma vaningeni* Clark and Ruedemann, 1912. Silurian of United States.

Scorpionida

Trigonoscorpionidae W. Dubinin, new family (p. 431), for Upper Carboniferous genera of United States and England.

Garnettiidae W. Dubinin, new family (p. 432), for *Garnettius* of the Upper Pennsylvanian of Kansas.

Acarida

Palaeotyroglyphus W. Dubinin, new name, for *Gamasus* Mani, 1945, 1946 (p. 452).

Protospeleorchestes W. Dubinin, new genus; type species *P. pseudoprotacarus* W. Dubinin, new name for *Protacarus crani* Hirst, 1923 (part, fig. 1B) (p. 462; fig. 1340).

Pseudoprotacarus W. Dubinin, new genus; type species *P. scoticus* W. Dubinin, new name for *Protacarus crani* Hirst, 1923 (part, pl. 11, fig. a) (p. 465; fig. 1343).

Palaeotydeus W. Dubinin, new genus; type species *P. devonicus* W. Dubinin, new name for *Protacarus crani* Hirst, 1923 (part, text-fig. 1) (p. 466; fig. 1346).

Paraprotacarus W. Dubinin, new genus; type species *P. hirsti* W. Dubinin, new name for *Protacarus crani* (?) Hirst, 1923 (part, text-figs. 2, 1a) (p. 466; fig. 1347).

Spiders

Pseudopropetes W. Dubinin, new name for *Propetes* Menge, 1854 (not *Propetes* Walker, 1851, Insecta) (p. 515).

The volume (volume 9) was under the general editorship of B. B. Rohdendorf. It consists of 560 pages, 22 plates, and 1,535 figures. The publication schedule for the 15 volumes is speeding up and volumes 1 to 9 and 13 are now available. Volume 1, General discussion, Protozoa, is being revised and somewhat expanded. It is due for publication in 1963.

A. A. P. G. Meeting

The Mid-Continent Regional Meeting of the American Association of Petroleum Geologists, sponsored by the Oklahoma City Geological Society in cooperation with the Mid-Continent Council of Geological Societies, will be held in Oklahoma City on November 6-8, 1963. Registration begins at 7:30 a.m. on Wednesday, November 6, in the lobby of the Skirvin Tower Hotel, and papers will be presented during morning and afternoon sessions on November 7 and 8.

Twenty papers will be presented, with the theme of the meeting being "Problems of the Pre Desmoinesian-Post Meramecian of the Mid-Continent," or "The Riddle in the Middle."

The Oklahoma Geological Survey will display publications and recent maps, including those concerning the basement rocks of southern Oklahoma and several on the Ouachita Mountains.

Additional information can be obtained from the Oklahoma City Geological Society, P.O. Box 609, Oklahoma City, Oklahoma, and housing reservations can be made by contacting E. W. Sengel, Schlumberger Well Surveying Corp., 630 Liberty Bank Bldg., Oklahoma City, Oklahoma.

ERRATA

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Page 221, last line: For 10^6 read 10^{-6}

Page 222: Equation (1) should read $\Delta \mathfrak{Z} = \frac{\Delta Z}{2\pi}$

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