Mississippian and Pennsylvanian fossils of the Albuquerque country

Stuart A. Northrop

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MISSISSIPPIAN AND PENNSYLVANIAN FOSSILS
OF THE ALBUQUERQUE COUNTRY

STUART A. NORTHRUP
University of New Mexico

MISSISSIPPIAN FOSSILS

Prior to 1951, no diagnostic fossils—with the exception of a foraminifer, *Endothyra baileyi*—had been found in pre-Pennsylvanian strata in New Mexico north of Laderon Peak, between Socorro and Belen. More than a century ago Marcou (1856; 1858) misidentified Pennsylvanian fossils from Pecos, the Sandia Mountains, and Tijeras Canyon as Mississippian species. He concluded that the Madera or Magdalena limestone was "calcaire du carbonifere inferieur" or limestone of the Lower Carboniferous. Later he called it the "Mountain Limestone" and stated that the Sandia rim was "composed of Carboniferous Limestone, which here merits truly its name of Mountain Limestone, for it is the only limestone of any importance met with in the Rocky Mountain region." Within a few years other workers assigned this limestone to the Upper Carboniferous or Pennsylvanian.

Apparently, the first recognition of pre-Pennsylvanian Paleozoic strata in New Mexico north of Laderon Peak was in 1940, when the 7,407-foot well in the Rattlesnake field was completed; Needham and Bates (1942) assigned 215 feet of strata in this well to the Mississippian. This same year Thompson (1942) found 106 feet of pre-Pennsylvanian rocks at the north end of the Sandia Mountains near Placitas. Above the Precambrian he measured 16 feet of conglomerate and sandstone overlain by 90 feet of unfossiliferous limestone and hazarded the opinion that these rocks might be "of lower Paleozoic age" (Thompson, 1942, p. 19). During the period 1942-1947 it was suggested by several members of the U. S. Geological Survey that such scattered remnants of pre-Pennsylvanian strata might be Mississippian or older (Read and Henbest, 1942; Henbest, Read, and others, 1944; Read and others, 1944; Henbest, 1946a, 1946b; Kelley and Wood, 1946; Northrop and Wood, 1946; Northrop and others, 1946; Read and Wood, 1947). On the basis of *Endothyra*, Henbest (1946a, 1946b) correlated this unit in the Sangre de Cristo and Sandia Mountains with the Leadville of Colorado.

It remained for A. K. Armstrong, an undergraduate student at U.N.M., to discover the first diagnostic megafossils in the pre-Pennsylvanian rocks. Early in 1951 Armstrong was engaged in a field problem under the direction of J. Paul Fitzsimmons. He was examining Precambrian rocks at the south end of the Nacimiento Mountains west of Jemez Pueblo, when he found fossils in small patches of limestone faulted down into the Precambrian basement. The first two slabs of this limestone Armstrong submitted to me early in 1951 contained *Conolutaria* sp. and *Eumetria* sp. Recognizing the latter as a Mississippian form, I suggested that Armstrong make further search for fossils. Fitzsimmons concurred and the emphasis of the problem shifted from Precambrian to Mississippian. Further collections were made by Armstrong and some were made by Fitzsimmons and myself. On May 21, 1951, I submitted to Armstrong a memorandum on all the material, tentatively identifying a variety of brachiopods and representatives of five other classes of invertebrates. I wrote as follows:

"The age of these fossils is Mississippian. I had anticipated that any Mississippian strata of northern New Mexico would prove to be older Mississippian, that is, Kinderhook or Osage, because these strata extend farther north in southern New Mexico than do younger Mississippian strata, such as Meramec and Chester. Again, in southern Colorado the Leadville or Madison limestone is chiefly Kinderhook or Osage in age.

"However, the *Eumetria* in your collections seems close to *Eumetria verneuiliana*, which is found in the Middle Mississippian Meramec of the Mississippi Valley region (Salem limestone and St. Louis limestone) and ranges up into the Upper Mississippian Chester series."

I suggested to Fitzsimmons that, because these were the first pre-Pennsylvanian megafossils ever found in northern New Mexico in a distance of 200 miles between Laderon Peak, New Mexico, and Piedra River Canyon, Colorado, the fossils should be submitted to Mackenzie Gordon, Jr., a Mississippian specialist of the U. S. Geological Survey.

It was decided to name the formation the Arroyo Penasco formation. Gordon's report on the fossils, listing 39 species, corroborated my determination of a Meramec, possibly St. Louis, age. A paper by Fitzsimmons, Armstrong, and Gordon (1956) was submitted in June 1955 and published in August 1956. Meanwhile Armstrong (1955) had published independently a report that included observations on Mississippian rocks in the Sangre de Cristo, Sandia, Manzano, and Ladron Mountains. Chiefly on the basis of microfossils, he concluded that the upper part of the "Arroyo Penasco" of the Sangre de Cristos is Meramec in age but that the lower unfossiliferous strata might be equivalent to the Leadville of Colorado or the Caloso of Ladron Peak. In this connection it may be noted that Baltz and Read (1960) collected Early Mississippian fossils at several localities in the Sangre de Cristos; they named two new formations, the Tererro of Early Mississippian (Kinderhook and Osage) age, and the Espiritu Santo of possible Devonian age. In view of the fact that the Meramec fossils of the Arroyo Penasco at the type locality of that formation occur in the upper part, it is possible that the unfossiliferous lower part of the Arroyo Penasco may be Lower Mississippian and equivalent to the Tererro formation.

Fossils of the Arroyo Penasco formation are listed below. Practically all of these are from the type locality of the formation in Penasco Canyon near the southern end of the Nacimiento Mountains, T. 16 N., R. 1 E., Jemez Indian Reservation, San Ysidro quadrangle. The identifications, unless otherwise noted, are by Mackenzie Gordon, Jr. (in Fitzsimmons, Armstrong, and Gordon, 1956). Generic assignments for several of the brachiopods have been changed by me. Names followed by (1) were cited by Armstrong (1955); names followed by (2) were cited by Armstrong (1958).
At the south end of the Sandia Mountains in Tijeras Canyon, Szabo (1953) measured ten sections of the pre-Pennsylvanian sequence, ranging from 8 to 48 feet in thickness. However, in his thickest section, as much as 32 feet of red shale may be Pennsylvanian in age. If the questionable red shale that appears in most of his sections be assigned to the Pennsylvanian, the remaining pre-Pennsylvanian strata range from 8 to 27 feet in thickness. Armstrong (1955) measured only one section in Tijeras Canyon, 16 feet thick. Some of my colleagues hold the opinion that, in the absence of diagnostic fossil evidence, the so-called pre-Pennsylvanian rocks in Tijeras Canyon should be assigned to the Sandia formation. Certainly, along much of the Sandia crest, the pre-Pennsylvanian seems to be missing. On the other hand, Toomey (1953, p. 12) observed that the basal unit of the Sandia formation in the vicinity of the Sandia crest contains numerous, large, reworked fragments of pre-Pennsylvanian limestone.

At Bosque Peak in the southern Manzano Mountains, east of Los Lunas and a few miles southwest of Mosca Peak, Armstrong (1958) found 22 feet of limestone that may be Mississippian. He observed also a few isolated remnants of limestone, 20-30 feet thick, at several places in the Manzanita and Manzano Mountains between Tijeras Canyon and Bosque Peak.

It now seems likely that all of the pre-Pennsylvanian rocks of the Sandia-Manzanita-Manzano area should be assigned to the Tererro (or Tererro and Espiritu Santo formations). As Boltz and Read (1960, p. 1768) have well said, "Further paleontologic studies and studies of the physical stratigraphy must precede correlation, firm assignments of age, and adjustments in the terminology of the Espiritu Santo, Tererro, and Arroyo Penasco formations."

**PENNOSYLVANIAN FOSSILS**

The Pennsylvanian strata of north-central New Mexico, especially in the Albuquerque country, are abundantly fossiliferous at many localities. Good specimens of fossil plants are generally scarce, but marine invertebrates are common, diversified, and often well preserved. The total marine fauna probably numbers several hundred species. Excellent specimens can be collected at a number of localities in the Manzano-Manzanita-Sandia Mountains, in the Nacimiento Mountains, and especially in such canyons cutting the Jemez Plateau as Guadalupe Canyon (of the Rio de las Vacas) and San Diego Canyon (of Jemez River).

Fusulinids, brachiopods, bryozoans, and crinoids are perhaps most abundant; corals, pelecypods, gastropods, ostracods, and echinoids are common; other groups, such as sponges, cnidaria, nautiloids, cephalopods, scaphopods, annelids, trilobites, and shark teeth are less common and generally scarce at most localities. Groups not yet found or reported in the literature include blastoids, asteroids, crustaceans, insects, myriapods, scorpions, and eurypterids. Unfortunately there is no general report dealing with the paleontology of the Pennsylvanian of the State. Illustrations and descriptions of the fossils must be sought in many reference works and scattered papers in various technical journals dealing with the faunas of other regions.

Of possible interest to the professional as well as the amateur collector is the observation that, on the whole, better preserved fossils can be found in the Jemez-Nacimiento area than in the Sandia-Manzano area. At many places in the Jemez country, quantities of excellent fossils weather free from the matrix, with few exceptions, this is not true for the Sandia-Manzano country. Differences in ecology are apparent, also. For example, corals are generally small in size and relatively uncommon in the Jemez area, whereas they are larger and locally quite common in the Sandia Mountains. Their abundance here was...
One of Marcou's plates (X½) illustrating Pennsylvanian fossils from the Sandia Mountains. (Plate 7 of "Geology of North America," by Jules Marcou, published in Zurich, 1858; P. Brugier del. et lith. Zuric; lier Imprimerie.)

noted more than a century ago by Jules Marcou (1858, p. 53). In describing a horn coral that he misidentified as Zaphrentis cylindrica, he wrote:

"This gigantic species of coral, so common in the Mountain Limestone of England, Belgium and France, had not been found previously in America. I saw a great number of specimens in ascending the Sierra de Sandia from [San] Antonio, and several limestone beds were full of them. I also found it at Tijeras [Tijeras]."

And, in describing another horn coral, Zaphrentis stansburyi, of which he "saw a great many at Tijeras, on the summit of the Sierra de Sandia, and at Pecos village," he observed that "the limestone in which it is found is so hard, that it is difficult to obtain well preserved and complete specimens."

Good specimens of brachiopods, bryozoans, and crinoid stems can be collected readily in the Jemez country. Such specimens occur in the Sandias and Manzanos but are usually more difficult to collect. Again, I have never observed any notable abundance of pelecypods or gastropods in the Sandia-Manzano area, such as may be found at several places in the Jemez country.

Two check lists of Pennsylvanian fossils are given below, one for the Jemez-Nacimiento Mountains area and one for the Sandia-Manzanita-Manzano Mountains area.

Pennsylvanian Fossils of the Jemez-Nacimiento Mountains Area

Unless otherwise indicated, these are from Northrop and Wood (1946), which included microfossils by Henbest, Read, and others (1944). Other citations are indicated by key numbers in parentheses, as follows:

1. Bisbee (1932)
2. Needham (1937)
3. Moore and Dudley (1944)
4. Northrop and Wood (1945)
FORAMINIFERA

1. Thompson (1948)
2. Armstrong (1955)
3. Lovejoy (1958)

FORAMINIFERA

Bradyina 2 sp.
B.? sp.
Climacodina sp.
Endothyra sp.
E.? sp.
Fusulina of F. cylindrica group
F. leei
F.? sp. aff. F. leei
F. tregoensis?
F.? sp.
Fusulinella carmani?
F. sp. aff. F. iowensis
F. cf. juncea (3)
F. stout'
F.? sp.
Millerella sp.
Spiroplectammina sp.
Tetrataxis sp.
Textulariidae

TRILLICITES irregularis
T. irregularis var.
T. jemazensis [synotypes] (2)
T. kellyensis [synotypes] (2)
T. kellyensis?
T. nebraskensis
T. sp. aff. T. nebraskensis
T. sp. aff. T. plummeri
T. cf. rhodesi (7)
T. ventricosus (7)
T. ventricosus var.
T.? sp.
Wedekindellina euthysepta
W. excentrica
W. excentrica?
W. minuta
W. sp.

PORIFERA

New genus, new species (red siliceous sponge)
Spicules (7)
Sponge (?) borings

ANTHOZOA

Auloporina cf. prosseri
A.? sp. (4)
Axophyllina? sp.
Chaetetes milleporaceus
C. sp.
Cyathaxonia distorta?
Lophophyllidium proliferum (1)
L. proliferum?
Neozaphrentis? sp.
Phleodorithum? sp.
Undet. horn corals

BRYOZOA

Boscomella sp. (7)
Batostomellid
Cyclotrypa pelagia [holotype and paratypes] (3)
Heteronemus? sp. (7)
Prismopora sp.
Rhomboptera cf. Lapidodendroides
Septopora biseriata
Undet. genera of massive, encrusting, and foliaceous forms

BRACHIOPODA

Antiquatonia coloradoensis
A.? cf. hermosana
A. portlockiana
A. portlockiana crossicosta (7)
A.? sp.
Becheeria bovidens
Cancrinella boonensis
Chonetes granulifer

C. granulifer meekanus (7)
C. sp.
Chonetinella flamingi alata (7)
C.? sp.
Cleothyrina orbicularis (7)
Composita cf. elongata (7)
C. cf. gibbsa
C. cf. magna (7)
C. ovata (7)
C. subtilia
C. trilobata (7)
C. cf. trilobata
C. sp.
Crustithyris planoconvexa
Derbyia bennettii
D. cf. bennetti
D. cressa
D. cressa texana
D. cressa cf. texana
D. cymATALa?
D. cf. hoestans
D. sp. aff. D. hoestans
Plattsmouthensis (7)
D. sp.
Desmainella cf. missouriensis
Echinaria moorei
E. cf. moorei (7)
E. semipunctata
E. cf. semipunctata
E. sp.
Hustedia cf. nisieri
H. mormoni
H. sp. (4)
Hystriculina wabashensis
Juresania nebrascensis
Kazlowskaia splendens (1)
Lingula sp.
Linealocystinula cf. oklahomae
L. platyumbonous
L. sp. aff. L. platyumbonous
L. protentianus
L. cf. protentianus
L. sp.
"Marginifera" sp. [probably most = Kazlowskaia]
Meekella striatocesta
M. cf. striatocesta
M. sp.
Neospirifer alatus
N. dunbari
N. cf. dunbari
N. gibbusa (7)
N. sp.
Orbiculidea? sp. (7)
Petrocesta modesta
Phricodothyris perplexa
Pelcithysia cf. ovalis
P. symmetrica? (7)
Punctospirifer kentuckiensis
P. kentuckiensis?
Schizophrenia oklahomae (6)
S. cf. oklahomae
Schuchertella? sp. (7)
Spirifer occidentalis [formerly Spirifer occiduus]
S. cf. occiduus
S. opimus
S. rockymontanus
S. cf. rockymontanus
S. sp. A (7)
S. spp. (6)
Wellerella immatura
W. orioensis
Genus undet. (7)

PELECYPODA

Acanthopecten carboniferus
Allorisma terminale
A.? sp.
Anthracosella? sp.
Astartella vera (1)
Aviculopecten occidentalis (1)
A.? sp.
A.? sp.
Pennsylvanian Fossils of the Sandia-Manzanita-Manzano Mountains Area

Citations are indicated by key numbers in parentheses, as follows:

1. Marcou (1858)
2. White (1877)
3. Herrick (1900)
4. Herrick and Bendrat (1900)
5. Herrick and Johnson (1900)
6. Bisbee (1932)
7. Dunbar and Condra (1932)
8. Needham (1937)
9. Szabo (1953)
10. Toomey (1953)
12. Read, C. B. (personal communication)
Beecheria bovidens (6, 9, 10)
Cancrinella baenensis (4, 9)
Chonetes granulifer (3, 6, 9, 10)
Chonetes dehiscens (9)
Chonetes granulifer (3, 6, 9, 10)
Chonetinella flemingi (9)
Cleiothyridina orbicularis (9)
Cryptacanthia compacta (7)
Derbyia crassa (4, 9, 10)
Desmoinesia missouriensis (9)
D. mesolobus (4, 9, 10)
D. mesolobus decipiens (10)
D. madrestrum (6, 9, 10)
D. mother (7, 9)
D. rockymontanus (1, 9, 10)
D. parvula? (4, 9, 10)
D. prattenianus (1, 4, 6, 9, 10)
Dentition (9, 10)
Echinaria semipunctata (6, 9, 10)
E. punctatus (1) [see Echinaria]
E. semipunctata knighti (9)
E. semipunctata knighti (9)
Edmondia aspinwallensis (9)
E. gibbosa (9)
E. nebrascensis (9)
E. nebrascensis? (9, 10)
E. sp. (3)
Eucyclophora spinata (9)
E. sp. (10)
Euomphalus plummeri (9)
E. reeds) (9)
Euphytus carbonarius (9)
E. turbiniformis (9)
E. ? nitida (4) [an English species]
F. punctatus (1) [see Echinaria]
F. postulatus (1) [English Mississippian]
F. pyxidiformis (1) [English Mississippian]
G. punctatula (1) [English Permian; Juresania]
G. semireticulata (1, 4, 6) [see Antiquatonia]
Punctospirifer kentuckiensis (6, 9, 10)
Rotaia laevis (9, 10)
Rhipidocyclinae carbonaria (6) [formerly P. pecasi]
Rhinocyclus sp. (4) [probably Rhynchaphora]
Schizophragma cf. oklahomae (10)
S. resupinatae (9)
Schuchertella pratteni (10)
Spiroplectamnia (9) [not recognizable]
S. matheri (7, 9)
S. occidentalis (9, 10) [formerly S. occidentalis]
S. occidentalis, var. (9, 10)
S. opimus (4, 9, 10)
S. rockymontanus types (1, 9, 10)
Terebratula plana-sulcata (1) [Cleiothyridina]
Wallereilia immutata (10)
W. exogena (6, 9, 10)
Acanthopecten carbonarius (3, 6, 9, 10)
A. carboniferus (9, 10)
Allorisma terminalis (9, 10)
Ammonitella interlineata (9)
Antartella concentrica (9)
A. newberryi (4)
A. varica (4)
Aviculapex basilica (10)
A. occidentalis (9)
A. occidentalis? (4)
Aviculapexina nebrascensis (9)
A. peracuta (9)
Bakewellia parva (3)
Cryptacanthia carbonaria (4)
Dunburrella knighti (9)
Edmondia aspinwallensis (9)
E. gibbosa (9)
E. nebrascensis (9)
E. nebrascensis? (9, 10)
E. sp. (3)
Ficuicia carbonaria (4)
Gastropoda (9)
H. mormoni (6, 9, 10)
Hystriculina wabashensis (9, 10)
Jurandia nebrascensis (6, 9, 10)
Kaziskia splendidus (6, 9, 10)
Lingula tigit (4)
Linaptychus insinuates (9)
L. oklahomae (9)
L. platyburyanus (9)
L. cf. platyburyanus (10)
L. prattitania (1, 2, 4, 6, 9, 10)
Meekella striatocostata (6, 9, 10)
Mesolobus mesolobus (4, 9, 10)
M. mesolobus decipiens (10)
M. nebrascensis (4, 6, 9, 10)
N. cameratus (6, 9, 10)
N. dunbari (1, 9)
N. gibbosa (9, 10)
N. lotus (9)
O. missouriensis (9)
O. ? nitida (4) [an English species]
P. punctatus (1) [see Echinaria]
P. postulatus (1) [English Mississippian]
P. pyxidiformis (1) [English Mississippian]
P. scabriculus (1) [English Permian; Juresania]
P. semireticulata (1, 4, 6) [see Antiquatonia]
Punctospirifer kentuckiensis (6, 9, 10)
Rotaia laevis (9, 10)
Rhipidocyclinae carbonaria (6) [formerly P. pecasi]
Rhinocyclus sp. (4) [probably Rhynchaphora]
Schizophragma cf. oklahomae (10)
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Spiroplectamnia (9) [not recognizable]
S. matheri (7, 9)
S. occidentalis (9, 10) [formerly S. occidentalis]
S. occidentalis, var. (9, 10)
S. opimus (4, 9, 10)
S. rockymontanus types (1, 9, 10)
Terebratula plana-sulcata (1) [Cleiothyridina]
Wallereilia immutata (10)
W. exogena (6, 9, 10)
B. sp. (11)
Cythereella sp. aff. C. foael (11)
C. sp. (11)
Kellettina binata, 2 var. (11)
Kirkbya sp. aff. C. kanoyensis (11)
K. sp. (11)
Paraparchites claytonensis (11)
Silletes sp. (11)

CRINOIDEA
Cibolocrinus punctatus (9)
C. tumidus (9)
Delocrinus cf. versus
D. n. sp.
Ulorocrinus sp. (10)
Crinoids, gen. and sp. undet. (9)

ECHINOIDEA
Eochinocrinus sp. (6, 10)

PLANTS

Asterophyllites equisetiformis (12)
Calamites sp. aff. C. suckowii (12)
Cardiocarpus sp. (9, 10)
Cordaites sp. (9, 10)
Labachin sp. (9)
Neuropteris ovata (12)
N. tenuifolia (9, 10)
N. scheuchzeri (9, 10)
Peccopteris vestita (9)
Sigillaria sp. (9)

In conclusion, it seems likely that the Pennsylvanian sequence in the Jemez country ranges from Morrowan to Virgilian, whereas the sequence in the Sandia country may lack representatives of Morrowan and Lampasan (Atokan) time.

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