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wise not a probable candidate. *Glyptosaurus* sensu stricto (Sullivan, 1979) seems the most reasonable taxonomic assignment based on tubercular arrangement and osteoderm size.

Biostratigraphic and biogeographic significance

The discovery of cf. *Glyptosaurus* in the Baca Formation of south-central New Mexico is significant in three ways: 1) *Glyptosaurus* is a late Wasatchian–Uintan genus known from Colorado, Utah, and Wyoming (Sullivan, 1979); its occurrence in the Baca Formation near Carthage is consistent with, though not conclusive proof of, the Bridgerian-age assignment made by Lucas and others (1982). 2) Other glyptosaurs known from New Mexico are from the San Juan Basin and are of Paleocene and early Eocene age (Sullivan, 1981); therefore, UNM BE–012 is the youngest glyptosaur known from New Mexico. 3) To our knowledge, UNM BE–012 also represents the most southerly occurrence of a specimen that apparently pertains to *Glyptosaurus*.

ACKNOWLEDGMENTS—We thank Adrian Hunt and Donald Wolberg for field assistance in the Baca Formation, W. D. Turnbull (Field Museum of Natural History) for the subloan of the Carnegie Museum *Glyptosaurus* specimen, and Richard Estes and Jiri Zidek for reading an earlier version of this paper.

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Cephalopod aptychi from Los Moyos Limestone, Madera Group (Middle Pennsylvanian), near Albuquerque, New Mexico

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Introduction

Aptychi are bivalved structures that probably functioned as opercula on some cephalopods (see Yochelson, 1983), although they have also been interpreted as cephalopod lower jaws (Morton, 1981). Aptychi are known from many genera of Mesozoic ammonoids (Arkell, 1957, p. L82) but are extremely rare in the Paleozoic. Only two finds of aptychi from the late Paleozoic have been reported. Closs and others (1964) noted aptychi in a unit containing the ammonoid *Pseudogastrioceras* from the Permian of Utah, and Thompson and others (1980) described aptychi that, in life, were probably associated with the nautiloid *Liroceras* from the Bishop Cap Member, Magdalena Formation (Desmoinesian), in Vinton Canyon, El Paso County, Texas. The latter report is also important because it provides the first good circumstantial evidence that some late Paleozoic nautiloids may have possessed aptychi. Recently, well-preserved aptychi have been discovered in the Middle Pennsylvanian of central New Mexico, in an assemblage that contains both ammonoid and nautiloid phragmocones.

The purpose of this paper is to document a new occurrence of these rare Paleozoic fossils, to discuss their relationships with the cephalopod conchs in the fauna, and to provide a brief summary of the fauna itself, which includes some taxa not previously reported from the Pennsylvanian of New Mexico. Specimens mentioned and illustrated here are in the University of New Mexico Department of Geology paleontology collections and have been assigned UNM numbers.

Location and geologic setting

The assemblage reported herein was collected by the author, Kenneth Kietzke, and members of a paleontology class from a roadcut on the east side of NM–14, 5.6 mi (9.1 km) south of the intersection of I–40 and NM–14 at Tijeras (Fig. 1). This locality is just north of the village of Cedro in the Manzano Mountains east of Albuquerque. The roadcut consists primarily of light-brown to grayish-brown, sparsely fossiliferous, fissile mudstones. Collections totalling approximately 30 kg were made from several levels within a 2-m-thick interval near the top of the roadcut, immediately below a massive limestone bed. These units are in the upper part of the Los Moyos Limestone (Madera Group) and are late Desmoinesian in age, based on fusulinid

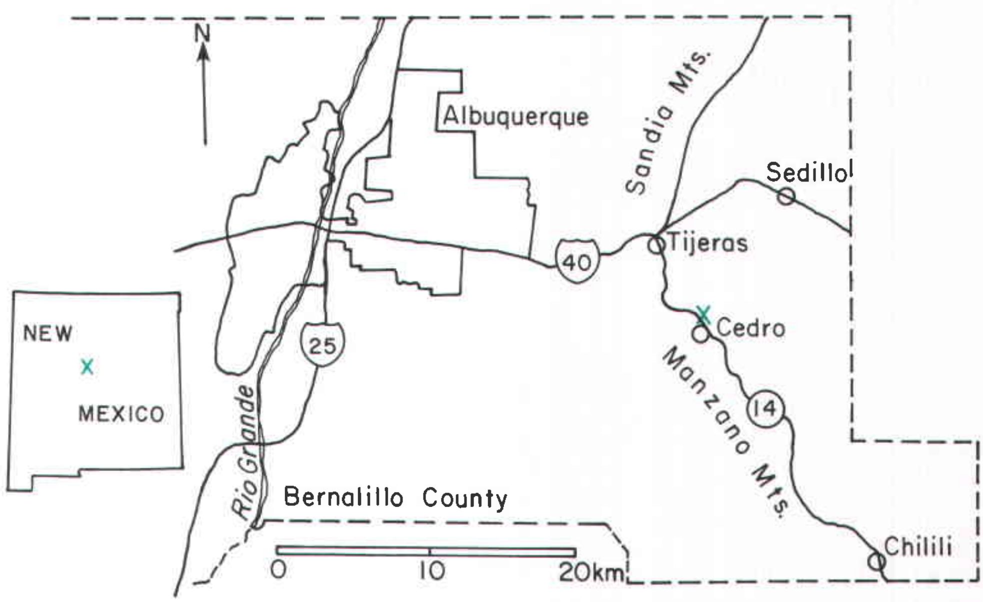

FIGURE 1—Map showing aptychi locality (x) in Cedro Canyon, south of Tijeras.

evidence at other localities (Myers and McKay, 1976).

Marine invertebrates are sparsely but relatively evenly distributed through the aptychi horizon, and the invertebrate fossils within the samples were examined and identified to provide a general view of the fauna associated with the aptychi.

Aptychi and cephalopods

Five aptychi and 24 partial phragmocones comprise the remains of several different species of cephalopods in the assemblage. Complete aptychi are paired structures consisting of right and left halves attached at a symphysis, but the specimens at hand are disarticulated halves. One specimen (UNM 5991), however, does include both halves of an aptychus still partially appressed (Fig. 2). Each half of an aptychus is roughly oval, very thin shelled, has fine concentric growth lines on the external surface, and has its apex displaced about two-thirds of the distance along the symphysis. As noted by Thompson and others (1980), aptychi of this type superficially resemble bivalve mollusk shells. The three best preserved aptychi have the following dimensions: 1) UNM 5991—length, 17 mm; width, 9 mm; width/length, 0.53; 2) UNM 5996—length, 40 mm (est.); width, 19 mm (est.), width/length, 0.48; 3) UNM 6005—length, 18 mm; width, 11 mm; width/length, 0.61.

No significant differences are found between these specimens and those described and illustrated by Thompson and others (1980), and the descriptive comments of these authors, for the most part, are equally applicable to the Cedro specimens. The smallest of the Vinton Canyon aptychi is 20 mm long, slightly larger than two of the three measured Cedro specimens, but the largest Cedro specimen (Fig. 3) is slightly longer than the largest Vinton Canyon specimen. Following the reasoning of Thompson and others (1980, pp. 907–908), the Cedro aptychi are assigned to the form genus *Cornaptychus* sp.

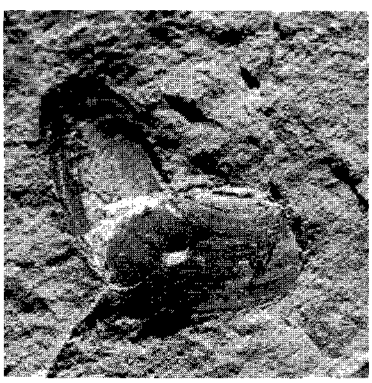

FIGURE 2—Slightly disarticulated halves of a single aptychus (UNM 5991), x 1.5.

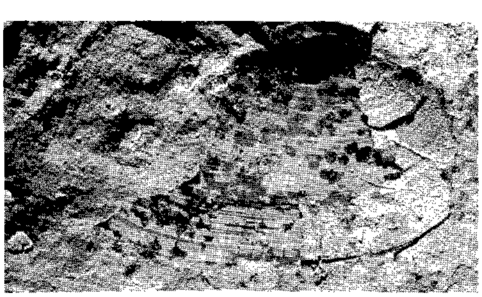

FIGURE 3—Fragment of a large aptychus (UNM 5996), x 1.5.

A moderate number of cephalopod phragmocones were collected from the aptychi horizon, but most were incomplete and many are poorly preserved. In all examples, the shells were flattened on bedding planes, making it impossible to accurately determine cross-sectional shape or apertural proportions. Two ammonoid genera and at least three nautiloid genera are present in the assemblage. Definite evidence of the association, in life, of the aptychi with a particular cephalopod (for example, a shell preserved with the aptychus covering its aperture) is lacking; however, some species may be dismissed as the possible bearers of the aptychi on size considerations alone. Both ammonoids are far too small to have borne the aptychi. Most of the ammonoids are *Anthracoceras*?, a small goniatitid having a maximum shell diameter in the Cedro assemblage of approximately 18 mm. One fragmentary ammonoid specimen is quite different from *Anthracoceras*? in that it has fine, closely spaced, transverse lirae covering the initial half of the last whorl, fading to obscurity toward the aperture. Suture marks are not preserved in this specimen, but its external ornamentation resembles that of *Reticuloceras*. The shell diameter is approximately 13 mm, much smaller than the aptychi specimens.

Several fragments of orthoconic nautiloids, probably representing both *Pseudorthoceras* and *Mooreoceras*, are present in the assemblage. The largest fragment possesses six chambers, is approximately 28 mm long, and has a maximum diameter of 13 mm. Estimating the complete size of the phragmocone or of its aperture is difficult, as only a small portion of the apical end of the shell is preserved. However, circular aptychi composed of three, rather than two, elements are known from some European Silurian orthoconic nautiloids (Thompson and others, 1980), and thus it is unlikely that the elliptical Cedro aptychi belonged to the orthoconic nautiloids in the assemblage.

Specimens of the nautiloid *Metacoceras* cf. *M. cornutum* in the Cedro collections range up to approximately 30 mm in diameter—too small for the aptychi. However, shells of *M. cornutum* more than twice this size have been reported from Desmoinesian and early Missourian units in other areas (Girty, 1915, from the Wewoka Shale; and Unklesbay, 1962, from the Coffeyville Formation, both in Oklahoma), and it is certainly possible that the few available Cedro specimens do not represent the maximum size attained by this species in the Los Moyos Limestone. Thompson and others (1980) noted node fragments of *Metacoceras* at Vinton Canyon that indicated a shell too large to be closed by an aptychus, but no evidence exists for such large specimens of *Metacoceras* in the Cedro assemblage. A full-sized specimen of *M. cornutum* having a diameter of 70–90 mm would have had an apertural diameter of approximately 30–40 mm, about the size that could have been covered by a large aptychus.

One other cephalopod in the Cedro assemblage deserves mention. It is the outer shell layer, without evidence of sutures or ornamentation, of one side of a moderately large shell (UNM 5998) having a diameter of 45 mm and an estimated apertural diameter of about 25 mm (Fig. 4). The umbilicus is small and moderately deep, and the shell appears to be involute. On the basis of general shell morphology, this specimen is very likely a nautiloid rather than an ammonoid, and no observable features occur that preclude it from belonging to the Liroceratidae. Conceivably, the aptychi in the Cedro assemblage could have come from specimens of this cephalopod that were about the same size or somewhat larger than the specimen at hand.

FIGURE 4—Largest nautiloid found in aptychi horizon, a specimen tentatively assigned to the Liroceratidae (UNM 5998), x 1.

In summary, several different types of cephalopods, including both ammonoids and nautiloids, are present in an assemblage containing aptychi in the Los Moyos Limestone. Only the nautiloids *Metacoceras* cf. *M. cornutum* and Liroceratidae? are large enough to be plausible as possible bearers of the aptychi. Because the aptychi reported by Thompson and others (1980) from Vinton Canyon probably belonged to *Liroceras*, a liroceratid, possibly the same association existed in the contemporaneous Los Moyos Limestone of central New Mexico. Definite identification of the nautiloid involved, however, must await the fortuitous discovery of a shell preserved with an aptychus at its aperture.

Associated fauna

The shale unit that yielded the aptychi and cephalopod conchs described above contains

TABLE 1—INVERTEBRATES FROM THE APTYCHI HORIZON, UPPER LOS MOYOS LIMESTONE, NEAR CEDRO. Numbers are percentage of entire assemblage represented by each taxon, based on approximately 500 specimens examined. Asterisks indicate taxa not previously reported from New Mexico.

ANNELIDA (?)	
Clavulites sp.	< 1
BRYOZOA	
Fenestella sp.	3
BRACHIOPODA	
**Mesolobus* aff. *M. lioderma*	42
Chonetinella aff. *C. plebeia*	1
**Eolissochonetes* sp.	9
Derbyia sp.	< 1
Cancrinella sp.	1
Antiquatonia sp.	< 1
Phricodothyris? sp.	< 1
GASTROPODA	
Glabrocingulum sp.	1
Phymatopleura sp.	< 1
unidentified gastropods	1
SCAPHOPODA (?)	1
BIVALVIA	
Phestia bellistriata	5
Solemya (Janeia) radiata	< 1
S. (J.) aff. *S. (J.) radiata*	< 1
Parallelodon sp.	< 1
Pteronites? sp.	< 1
**Leptodesma (Leptodesma)* aff. *L. (L.) ohioense*	< 1
**Monopteria*? *subalata*	1
**Modiolus (Modiolus)* aff. *M. (M.) radiata*	< 1
Aviculopecten sp.	< 1
Limipecten? sp.	1
Paleolima retifera	3
Streblochondria tenuilineata	2
**Sanguinolites*? sp.	< 1
**Solenomorpha*? sp.	< 1
Edmondia aff. *E. ovata*	< 1
**E.* aff. *E. meekiana*	1
Astartella sp.	1
**Schizodus affinis*	< 1
*New genus (?)	1
unidentified bivalves	11
CEPHALOPODA (AMMONOIDEA)	
Anthracoceras? sp.	3
*aff. *Reticuloceras*	< 1
CEPHALOPODA (NAUTILOIDEA)	
Pseudorthoceras and/or *Mooreoceras*	1
Metacoceras cf. *M. cornutum*	1
Liroceratidae?	< 1
**Cornaptychus* sp. (aptychi)	1
ECHINODERMATA	
crinoid stem and cirri fragments	3
echinoid spines and plates	1

a sparse, but moderately diverse, marine invertebrate fauna. Although this fauna was not studied in detail, each specimen encountered in the samples was identified and counted, and the relative abundance of each species determined. Several species not previously reported from the Pennsylvanian of New Mexico occur (Table 1).

The fauna is dominated by chonetid brachiopods (*Mesolobus, Chonetinella,* and *Eolissochonetes*). Pelecypods are surprisingly diverse and collectively are about half as abundant as brachiopods. Non-chonetid brachiopods, as well as such typical Madera invertebrates as bryozoans, crinoids, and echinoids, are uncommon. The shells of most of the fossils were originally unbroken, but they are thin and to some extent decalcified and tend to break off of bedding planes or crumble when exposed, making retrieval of complete specimens difficult. Some taxa are preserved primarily as molds. Large, meandering grazing trails and undulating, elongate fecal casts are characteristic trace fossils that probably indicate a significant density of soft-bodied organisms. The unbroken nature of most of the skeletons, along with the preservation of delicate chonetid spines still attached to the shells, long articulated crinoid cirri, and complete fenestrate bryozoan zoaria, suggests that deposition occurred in a quiet environment. The low diversity of brachiopods, absence of corals and fusulinids, and paucity of crinoids and bryozoans may indicate high sedimentation rates or a slightly fluctuating salinity that made it difficult for large populations of stenohaline suspension feeders to colonize the seafloor for long periods of time.

The chonetid brachiopods and many of the bivalves are similar or identical to contemporaneous forms that have been reported from the midcontinent and eastern regions of the United States. Eight of the bivalve taxa have not previously been reported from the Pennsylvanian of New Mexico—a consequence more of the lack of study of this group in the state than of their rarity.

ACKNOWLEDGMENTS—I thank Kenneth Kietzke for helping with the collecting and for originally bringing the specimens later identified as aptychi to my attention. I also thank the Spring 1983 invertebrate paleontology class at the University of New Mexico for their enthusiastic aid in sampling the fauna of the aptychi locality. Ellis Yochelson, Smithsonian Institute, and Rousseau Flower, New Mexico Bureau of Mines and Mineral Resources, reviewed the manuscript and offered helpful suggestions for its improvement.

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Geographic names

U.S. Board on Geographic Names

Capitan Mountains—mountains, 34 km (21 mi) long, highest elevation 3,073 m (10,083 ft) at Capitan Peak, northeast of the Sierra Blanca and 35 km (22 mi) east of Carrizozo; Lincoln County, New Mexico; 33°35′ N., 105°12° W. (east end), 33°39′ N., 105°33′ W. (west end); 1907 decision revised; *not:* Sacramento Mountains (BGN 1907).

Carrizo Mountain—mountain, highest elevation 2,928 m (9,605 ft) at Carrizo Peak in the Sacramento Mountains 14 km (9 mi) northeast of Carrizozo and 33 km (20 mi) north of Ruidoso; Lincoln County, New Mexico; T. 7 S., Rgs. 12 and 13 E., NMPM; 33°42′ N., 105°46′20″ W. (west end), 33°42′ N., 105°41′ W. (east end); *not:* Carrizo Mountains, Carrizozo Mountain.

Davenport Canyon—canyon, 5.1 km (3.2 mi) long, heads in the Datil Mountains east of Davenport Spring at 34°16′43″ N., 107°54′50″ W., trends west 1.5 km (0.9 mi) then south-southwest 3.7 km (2.3 mi) to White House Canyon 15.6 km (9.7 mi) northwest of Datil; Catron County, New Mexico; sec. 1, T. 1 S., R. 11 W., NMPM; 34°15′ N., 107°56′25″ W.

Jicarilla Mountains—mountains, 29 km (18 mi) long, north of Carrizo and Patos Mountains 29 km (18 mi) northeast of Carrizozo; extend north from White Oaks Draw and Reventon Draw to Ancho Valley and Hasparos Canyon between the Tularosa Valley on the west and the Pecos River valley on the east; Lincoln County, New Mexico; 33°57′ N., 105°40′ W. (north end), 33°45′ N., 105°45′ W., (south end); 1907 decision revised; *not:* Sacramento Mountains (BGN 1907).

Kid Spring—spring, in the Datil Mountains, between Blue Canyon and Main Canyon 13.4 km (8.3 mi) north-northeast of Datil and 5 km (3.1 mi) west-northwest of Madre Mountain; Catron County, New Mexico; 34°16′37″ N., 107°49′22″ W.; *not:* Hidden Spring.

Patos Mountain—mountain, elevation 2,588 m (8,490 ft), 6.4 km (4 mi) across, northeast of Carrizo Mountain and south of the Jicarilla Mountains 23 km (14.3 mi) northeast of Carrizozo; Lincoln County, New Mexico; T. 6 and 7 S., R. 12 E., NMPM; 33°44′11″ N., 105°39′44″ W.; *not:* Patos Mountains.

Rancheria Canyon—canyon, 12.9 km (8 mi) long, heads in the Sacramento Mountains at Rancheria Spring at 33°05′26″ N., 105°53′ W., trends west-southwest to open out 3.2 km (2 mi) southeast of Tularosa; reportedly, groups of Indians once lived here in brush camps, locally called "rancherias"; Otero County, New Mexico; sec 28, T. 14 S., R. 10 E., NMPM; 33°03′55″ N., 105°59′31″ W.

Rinconada Canyon—canyon, 16.9 km (10.5 mi) long, in the Sacramento Mountains, heads at 33°19′41″ N., 105°51′35″ W., trends southwest along the course of Rinconada Creek to open out 14.5 km (9 mi) northwest of Mescalero; rinconada is a Spanish word meaning "little box canyon"; Otero County, New Mexico; sec. 6, T. 13 S., R. 11 E., NMPM; 33°12′36″ N., 105°54′24″ W.

Rinconada Creek—stream, 16.9 km (10.5 mi) long, in the Sacramento Mountains, heads at 33°19′41″ N., 105°51′35″ W., flows southwest through Rinconada Canyon to join an unnamed creek to form Temporal Creek 14.5 km (9 mi) northwest of Mescalero; Otero County, New Mexico; sec. 6, T. 13 S., R. 11 E., NMPM; 33°12′36″ N., 105°54′24″ W.

(continued on page 82)