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2003, pp. 347-351. https://doi.org/10.56577/FFC-54.347

in:

Geology of the Zuni Plateau, Lucas, Spencer G.; Semken, Steven C.; Berglof, William; Ulmer-Scholle, Dana; [eds.], New Mexico Geological Society 54th Annual Fall Field Conference Guidebook, 425 p.
https://doi.org/10.56577/FFC-54

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New Mexico Geological Society Guidebook, 54th Field Conference, Geology of the Zuni Plateau, 2003, p. 347-351.

CRETACEOUS INVERTEBRATE AND SELACHIAN FOSSIL ASSEMBLAGE FROM THE JUANA LOPEZ MEMBER OF THE MANCOS SHALE NEAR HERRERA, WEST-CENTRAL NEW MEXICO

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Abstract.—An invertebrate fossil assemblage from the Juana Lopez Member of the Mancos Shale near Herrera in the Rio Puerco Valley of Sandoval County, New Mexico, includes the index bivalves *Lopha lugubris* (Conrad) and *Inoceramus dimidius* White and the index ammonites *Prionocyclus macombi* Meek, *Prionocyclus novimexicanus* (Marcou) and *Scaphites whitfieldi* Cobban. There is a meager selachian assemblage composed of *Ptychodus whipplei* Marcou, *Ptychodus anonymus* Williston, *Scapanorhynchus raphiodon* (Agassiz), *Cretolamna* sp. and *Squalicorax* sp., of which only *P. whipplei* is common. *P. whipplei* is a characteristic Turonian species of *Ptychodus* and is common in the Juana Lopez Member.

INTRODUCTION

Strata of the Juana Lopez Member of the Mancos Shale form one of the most distinctive Turonian stratigraphic units in the Upper Cretaceous section in New Mexico (e.g., Dane et al., 1966; Hook and Cobban, 1979, 1980a, b). These rocks are well exposed in west-central New Mexico in the Rio Puerco Valley (Fig. 1). Here, we describe a biostratigraphically significant invertebrate and selachian fossil assemblage from the Juana Lopez Member of the Mancos Shale near Herrera. NMMNH = New Mexico Museum of Natural History, Albuquerque.

HERRERA LOCALITIES

The fossils described here are from NMMNH localities 4705, 5315, 5316 and 5317 immediately east of Herrera Mesa in section 2, T11N, R3W, Sandoval County (Fig. 1). For the sake of brevity, we refer to these sites as the Herrera localities, all of which are in the Juana Lopez Member of the Mancos Shale. Earlier, we erroneously reported NMMNH locality 4705 as being in the Clay Mesa Member of the Mancos Shale (Johnson et al., 2002a, b).

At the Herrera localities, the Juana Lopez Member is ~ 25 m thick and mostly slope-forming, calcareous, pale yellowish brown to light olive-gray slightly sandy shale, split by thin (< 1 m thick) ledges of grayish orange fossiliferous calcarenite and concretionary ledges of nodular, light gray fossiliferous limestone (Fig. 1). All resistant beds in the section yield fossils, especially of the bivalves *Lopha lugubris* (Conrad) and *Inoceramus dimidius* White, but the ammonites and selachians only occur in the upper four calcarenite ledges (Fig. 1).

PALEONTOLOGY

Fossils from the Herrera localities are of bivalves, gastropods, ammonites and sharks (Figs. 2-3). Here, we document a few key index invertebrate fossils and discuss at greater length the characteristic Juana Lopez selachian taxon, *Ptychodus whipplei* Marcou.

Invertebrate Fossils

The most common bivalve at the Herrera localities is a small, inequivalve plicate oyster with a nearly round to subovate outline and large attachment area (Fig. 2D). The free areas of the valve have strong radial plicae, and valve heights are 15-20 mm. Numerous specimens are catalogued as NMMNH P-37052 and are readily assigned to *Lopha lugubris* (cf. Stanton, 1893, pl. 4, figs. 1, 3-6; Kauffman, 1977, pl. 9, figs. 3-5, 7; Hook and Cobban, 1980b, fig. 5H-I).

The next most common bivalve is an inoceramid characterized by its small, convex inaequivalve shell with coarse, concentric rugae (Fig. 2A-C). The early part of the shell well displays these rugae, whereas the later part of the shell is nearly smooth. This inoceramid is readily identified as *Inoceramus dimidius* White (cf. White, 1877, pl. 16, fig. 2a-d; Kauffman, 1977, pl. 8, figs. 7, 13; Hook and Cobban, 1980b, fig. 7).

Ammonites are found at two stratigraphic levels at the Herrera localities (Fig. 1): 4705 (*Prionocyclus macombi* Meek) and 5317 (*Prionocyclus novimexicanus* [Marcou] and *Scaphites whitfieldi* Cobban). Specimens of *P. macombi* (Fig. 2E-F, J-K) are moderately involute with a narrow whorl section, flattened flanks, gently arched venter and a distinct keel. Ornamentation consists of slightly flexuous, weak, prosiradiate primary and secondary ribs that have clavate ventrolateral tubercles. Early whorls are densely and finely ribbed, whereas late whorls have much weaker ornamentation (cf. Meek, 1876, pl. 2, fig. 3a-d; Hook and Cobban, 1980b, fig. 5A-G; Kennedy et al., 2001, figs. 63-73).

Specimens of *Prionocyclus novimexicanus* are poorly preserved steinkerns or impressions in calcarenite (Fig. 2I). They can be identified based on their large size, moderately evolute form and possession of distinct primary and secondary ribs. The primary ribs arise from elongate umbilical bullae and bear rounded to clavate inner ventrolateral tubercles (cf. Hook and Cobban, 1979, fig. 3E-L; Kennedy et al., 2001, figs. 88-100).

Specimens of *Scaphites whitfieldi* Cobban are also preserved as steinkerns or impressions on calcarenite slabs (Fig. 2G-H). They show the sculpture of dense, evenly spaced ribs that is char-

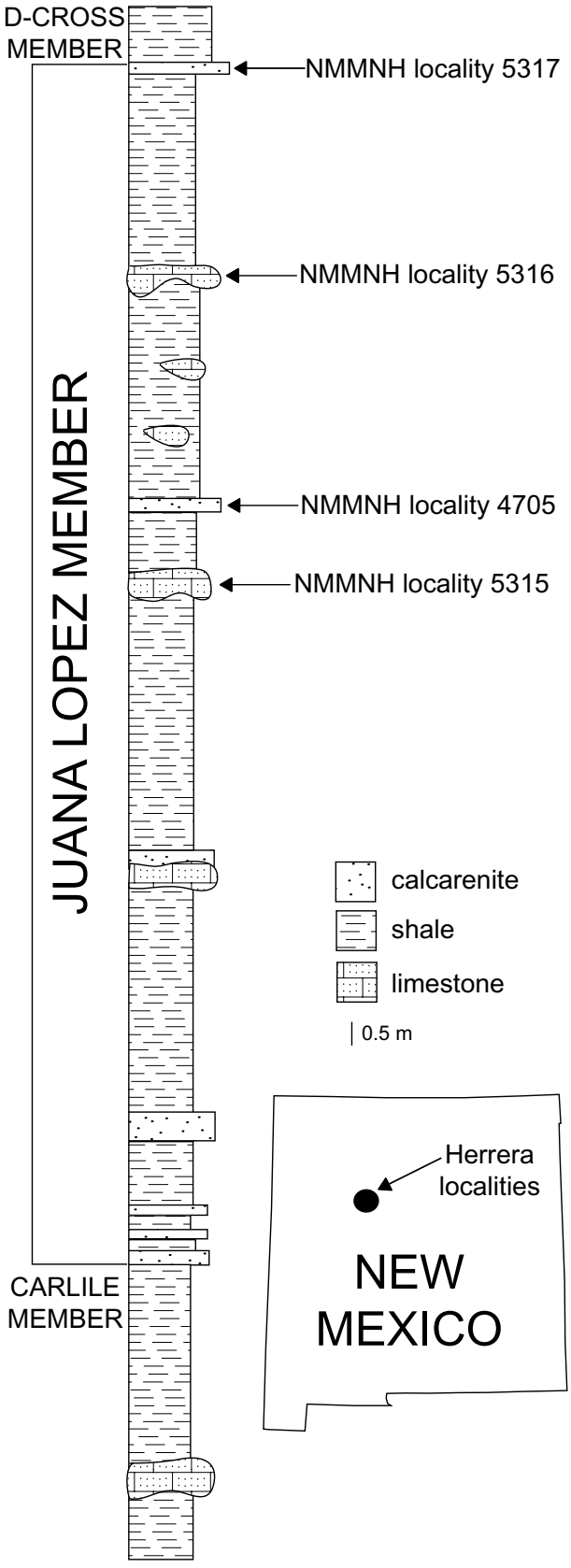

FIGURE 1. Measured stratigraphic section of the Juana Lopez Member of the Mancos Shale at the Herrera localities.

acteristic of the species (cf. Cobban, 1951, pl. 4, figs. 30-40, pl. 5, figs. 1-4; Hook and Cobban, 1979, fig. 3A-D).

Selachian Fossils

The selachian assemblage from the Herrera localities is of low diversity and consists of *Ptychodus whipplei* Marcou, *Ptychodus anonymus* Williston, *Cretolamna* sp., *Squalicorax* sp., and *Scapanorhynchus raphiodon* Agassiz (Johnson et al., 2002a, b). Fish centra and ctenoid teleost scales are also present. Here, we focus on *P. whipplei*, as it is the only abundant selachian fossil in the Juana Lopez Member.

The 39 teeth of *Ptychodus whipplei* from the Herrera localities come only from locality 4705 and range in size from 10 to 30 mm in width (Fig. 3). These teeth have a highly developed cusp on the occlusal surface, which is very tall compared to its diameter, giving the cusp a nipple-shaped appearance. The cusp is nearly cylindrical in cross section, unlike the teeth of other *Ptychodus* species, which have a lower, more oval and/or more conical cusp (Welton and Farish, 1993). Transverse ridges run across the tops of the cusps, and, on the majority of the teeth, these ridges do not extend to the tooth margin. However, on a few teeth the transverse ridges do extend to the margins of the teeth.

The only two species of *Ptychodus* that these teeth could represent are *P. whipplei* (Fig. 3D-F) or *P. anonymus,* but there are several characteristics of the teeth from the Herrera localities that preclude their assignment to *P. anonymus*. There is a difference between *P. whipplei* and *P. anonymus* in the shape of the cusp. The cusp of *P. anonymus* is more conical, whereas that of *P. whipplei* is more cylindrical. Thus, the teeth of *P. whipplei* have a much higher ratio of the height of the cusp to its diameter. The range of ratios is between 1.67 and 2.5 for *P. whipplei* and between 1.55 and 2.47 for the specimens from NMMNH locality 4705; it is between 0.55 and 1.45 for *P*. *anonymus*. Furthermore, the width of the cusp at midsection in the labial-lingual direction can be divided by the width at the midsection in the anterior-posterior direction. The range of this ratio for *P. whipplei* is 0.7 to 0.9, whereas *P. anonymus* has a range of 0.7 to 1.4. The teeth from locality 4705 are closest to *P. whipplei* in having a range from 0.7 to 1.08

In *P. anonymus,* there is a gentle slope transition between the cusp and the crown margin. The teeth of *P. whipplei* have an angular transition between the side of the cusp and the marginal surface. For the anterior teeth, the transition for *P. whipplei* is about 85˚,whereas it is about 55-70˚ for *P. anonymus*. The teeth from NMMNH locality 4705 have a transition angle that is about 80-85º, so this also supports their identification as *P. whipplei*.

The teeth from NMMNH locality 4705 are a characteristic Juana Lopez Member (Turonian) record of *P. whipplei*. There is a report of *P. whipplei* from the upper Cenomanian of Texas, in the lower part of the Eagle Ford Group (V. Friedman, written commun., 2001). But, we have examined these teeth, and they are morphologically more similar to *P. anonymus* than *P. whipplei*. Similarly, Shimada (1993) reported an isolated tooth he assigned to *P. whipplei* from the upper Cenomanian portion of the Greenhorn Limestone in Kansas. This tooth is morphologically identi-

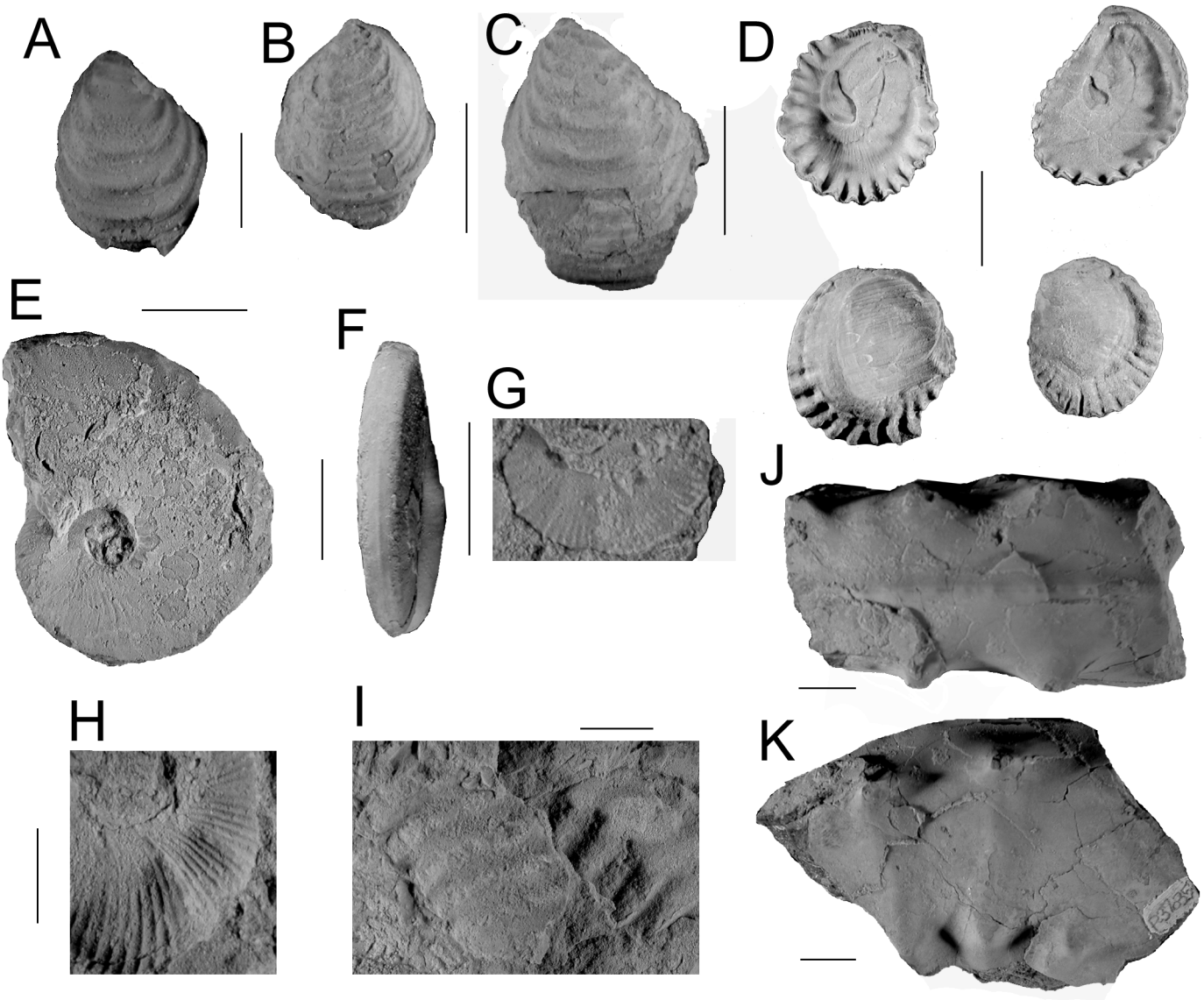

FIGURE 2. Invertebrate fossils from the Juana Lopez Member of the Mancos Shale at the Herrera localities. All fossils are from NMMNH locality 4705 except G-I, which are from locality 5317. A-C. *Inoceramus dimidius*, NMMNH P-37044. D. *Lopha lugubris*, NMMNH P-37052. E-F. *Prionocyclus macombi*, NMMNH P-37039. G-H. *Scaphites whitfieldi*, NMMNH P-39162. I. *Prionocyclus novimexicanus*, NMMNH P-39161. J-K. *Prionocyclus macombi*, NMMNH P-37035.

cal to those from the Eagle Ford Group and therefore is closer to *P. anonymus* than *P. whipplei*.

Otherwise, *P. whipplei* has previously been recorded only in Turonian and lower Coniacian age sediments North America, with records in Texas (Meyer, 1974; Welton and Farish, 1993; Cicimurri and Bell, 1996; Cappetta and Case, 1999), New Mexico (Marcou, 1858; Wolberg, 1985; Lucas and Johnson, 2002), Arizona (Williamson et al., 1993), Colorado (Edwards, 1976) South Dakota (Cappetta, 1973; Evetts, 1979; Stewart and Martin, 1993; Cicimurri, 1998) and Kansas (Williston, 1900).

ACKNOWLEDGMENTS

Ron Peterson found NMMNH locality 4705, L. Rinehart and G. Johnson helped in the field, and R. Zakrzewski of Fort Hays State University loaned us the fossil described by Shimada. Virginia Friedman and Barry Kues provided helpful comments on an earlier version of this paper, and Kate Zeigler reviewed this version.

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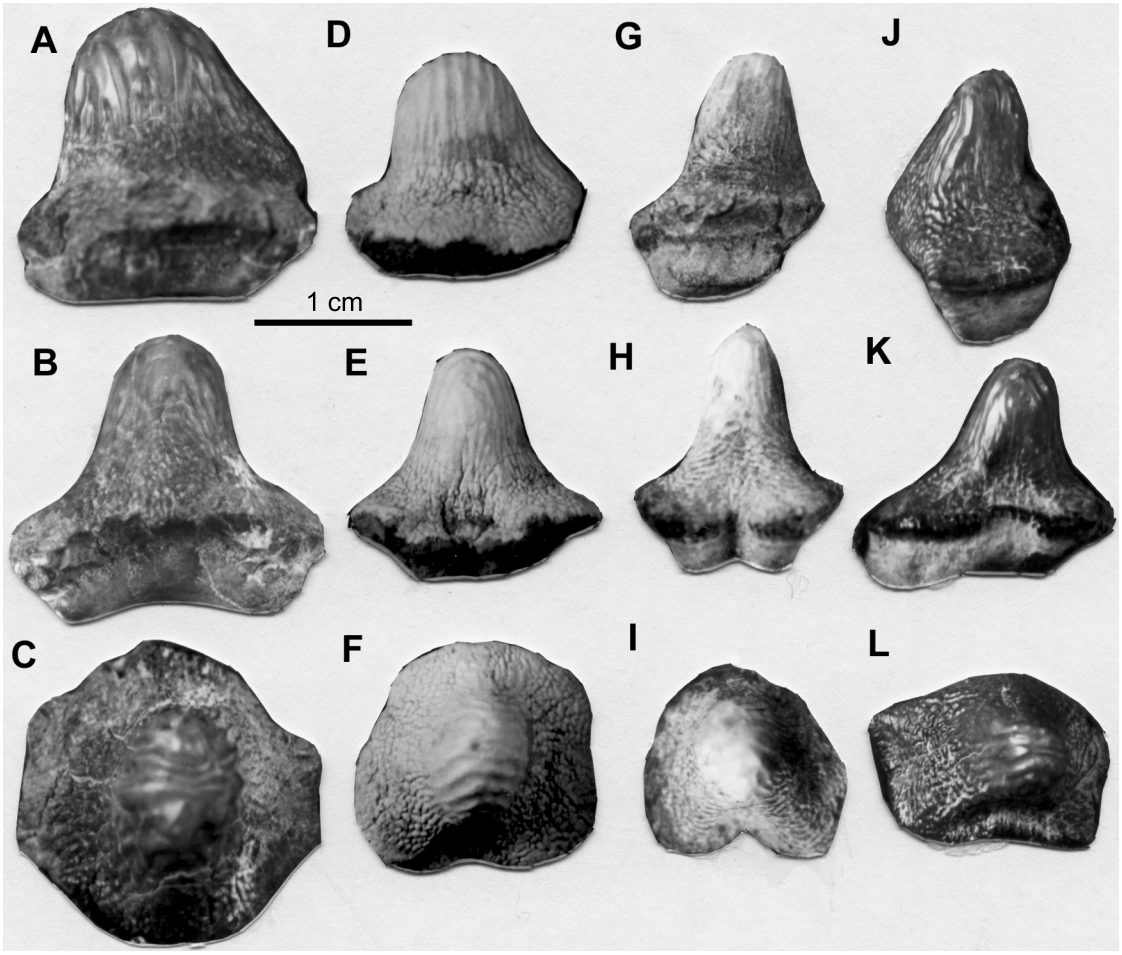

FIGURE 3. Selected teeth of *Ptychodus whipplei*. The teeth illustrated are from the Juana Lopez Member at NMMNH locality 4705, except D-F, which is a tooth from Coniacian strata for comparision. A-C, NMMNH P-3593 from locality 4705, A. labial view, B. posterior view, C. occlusal view; D-F. NMMNH P-28990, from locality 3271 in the Mulatto Tongue of the Mancos Shale, D. labial view, E. posterior view, F. occlusal view; G-I. NMMNH P-35952 from locality 4705, G. labial view, H. posterior view, I. occlusal view; J-L, NMMNH P-35954 from locality 4705, L. lingual view, K. posterior view, L. occlusal view.

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