



## *Upper Cretaceous macruran decapods (lobsters) from the southeastern San Juan Basin, Sandoval County, New Mexico*

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# UPPER CRETACEOUS MACRURAN DECAPODS (LOBSTERS) FROM THE SOUTHEASTERN SAN JUAN BASIN, SANDOVAL COUNTY, NEW MEXICO

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**ABSTRACT**—Recent fieldwork has recovered fossils of clawed lobsters of the genus *Hoploparia* from the Upper Cretaceous (Cenomanian and middle Turonian) strata in the southeastern San Juan Basin near San Ysidro, Sandoval County, New Mexico. *Hoploparia* is a well-known, extinct clawed lobster genus that persisted from the Early Cretaceous to the Early Miocene, with 60 recognized species from around the world. The fossils documented here are the first records of *Hoploparia* from New Mexico.

## INTRODUCTION

Over a decade of fieldwork in the Upper Cretaceous marine strata near San Ysidro, New Mexico, has recovered five fossils of clawed lobsters, which are macruran decapods of the family Nephropidea. These fossils can be assigned to *Hoploparia* McCoy (1849), a well-known, widespread, and very diverse clawed lobster genus, with a fossil record of 60 species extending from the Lower Cretaceous (Valanginian) to the lower Miocene (Tshudy, 1993, 2003; Tshudy et al., 2018; Fraaije et al., 2020; Feldmann and Schweitzer, 2021). Other fossil decapods (crabs) have been reported from Upper Cretaceous strata in New Mexico, in the Semilla Sandstone of the Carlile Shale (Toolson and Kues, 1996) as well as the Fite Ranch Sandstone Member of the Tres Hermanos Formation (Schweitzer et al., 2017), both of middle Turonian age. Those specimens consist of disarticulated chelea and a few carapaces. This is the first report of a fossil lobster from New Mexico. In this paper, NMMNH refers to the New Mexico Museum of Natural History in Albuquerque. All dimensions are given in millimeters.

## GEOLOGIC SETTING

In the southeastern San Juan Basin, the Dakota Formation is interbedded with the Mancos Shale in well-defined layers near the western margin of the Western Interior Seaway in New Mexico (e. g., Owen, 1966; Molenaar, 1983; Woodward, 1987; Sealey and Lucas, 2019). The specimens reported here were collected from the Paguate Member of the Dakota Formation and the younger Semilla Member of the Carlile Shale of the Mancos Formation (Fig. 1). Both units are bioturbated, medium-grained quartzose marine sandstone bodies that were deposited in shallow, nearshore sand sheets, shoals, and bars in the San Juan Basin (Owen, 1966; La Fon, 1981; Molenaar, 1983; Woodward, 1987; Fleming, 1989; Sealey and Lucas, 2019). The Paguate Member outcrops are present throughout western and central New Mexico and are quite fossiliferous where exposed (Cobban, 1977; Sealey and Lucas, 2003, 2019). The Cenomanian-age *Acanthoceras amphibolum* Morrow (1935) and *Plesiacanthoceras* aff. *wyomingensis* Reagan

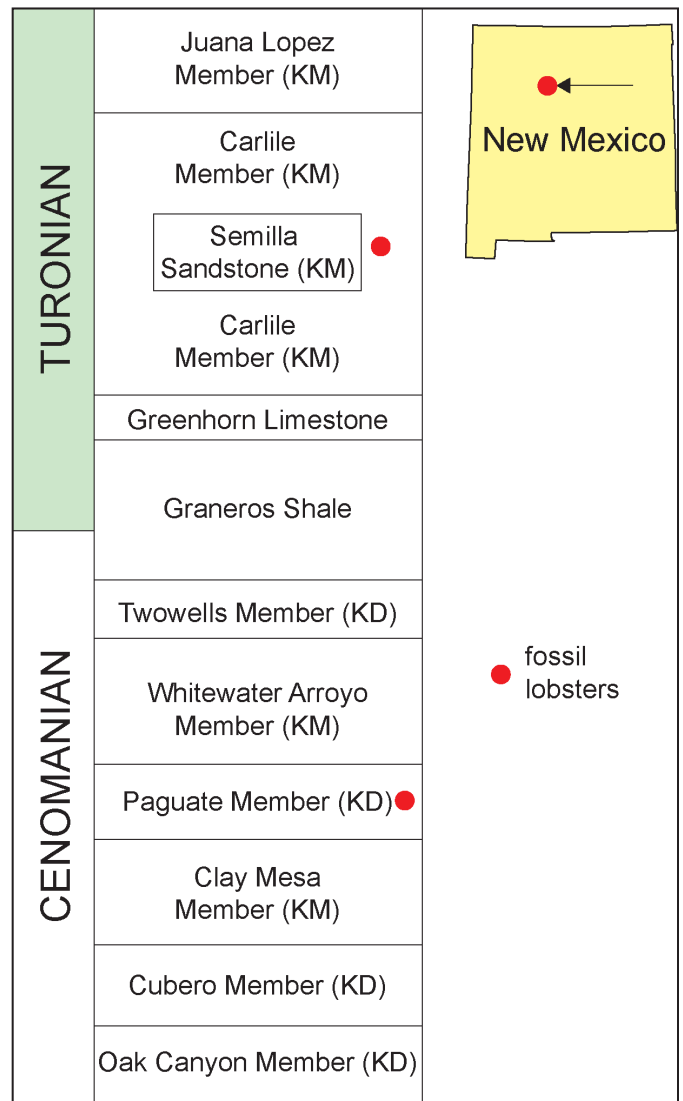


FIGURE 1. Location map of the study area in Sandoval County, New Mexico, and a generalized stratigraphic section of the Cretaceous strata that produced the fossil lobsters described here. Members of the Dakota Formation (KD) and Mancos Formation (KM) are labeled.

(1924) (*Cunningtoniceras arizonensis* [Kirkland and Cobban, 1986]) ammonite zones are reported from the main body and top of the Paguate Member, respectively (Cobban, 1984; Sealey and Lucas, 2019; May and Lucas, 2023). The younger, Turonian-age, Semilla Member outcrops are present in west-central New Mexico (La Fon, 1981; Fleming, 1989), are also fossiliferous and produce ammonites of the *Prionocyclus hyatti* (Stanton, 1894) zone (Cobban, 1984; Estep and Lucas, 2000; Sealey and Lucas, 2019).

## LOCALITIES

All fossils described here were collected from five localities in the southeastern San Juan Basin near San Ysidro, northwest of Albuquerque, Sandoval County, New Mexico. Four localities (NMMNH L-9592, L-9593, L-13238a, and L-13238b) are in the Paguate Member of the Dakota Formation. NMMNH L-9589 is in the Semilla Member of the Carlile Shale of the Mancos Shale Formation (precise map coordinates for these localities are in the NMMNH database and are available to qualified researchers).

## SYSTEMATIC PALEONTOLOGY

Phylum ARTHROPODA Von Siebold, 1845  
 Class Crustacea Latreille, 1796  
 Order Decapoda Latreille, 1802  
 Infraorder Astacidea Latreille, 1802  
 Section Homarida Scholtz and Richter, 1995  
 Superfamily Nephropoidea Dana, 1852  
 Family Nephropidea Dana, 1852  
 Subfamily Homarinae Huxley, 1880  
 Genus *Hoploparia* McCoy, 1849  
*Hoploparia* sp. indet.

## Characteristics

McCoy (1849) described the genus *Hoploparia* as minutely granulose, oblong, tumid, slightly compressed, with a little deeper than wide carapace, and with a sharp, strong carinate rostrum at the front. It attains a sheath-like prolongation of strongly ridged and spinose cheeks with a smooth-sided rostrum (El-Shazly, 2015). The rostrum is thin, long, smooth or denticulate, the cervical groove clearly developed above and below the gastro-orbital groove, the postcervical groove distinct, connecting with the cervical groove through a semicircular arc, and the chelae strong, long, and heterochelous (Moore, 1969). Tshudy (1993) described the well-defined cervical and hepatic grooves, the deeply impressed postcervical groove, and the extent of the brachiocardiac groove to intersect the hepatic groove (also see El-Shazly, 2015).

## Referred Specimens

NMMNH P-71507 from NMMNH locality L-9592 is a poorly preserved part and counterpart of a portion of the unornamented dorsal carapace of the posterior cephalothorax and

anterior abdomen with outstretched chelipeds. P-71508 from NMMNH locality L-9593 (Fig. 2A, B) is a well-preserved, three-dimensional, mostly complete dorsolateral carapace of the cephalothorax and abdomen. P-71512 from NMMNH locality L-9589 (Fig. 2E, F) is a marginally preserved disarticulated cephalothorax and abdomen. P-94502 from NMMNH locality L-13238a (Fig. 2C-D) is three-dimensional, marginally preserved, and slightly crushed, with an articulated cephalothorax and abdomen as well as three disarticulated cheliped fragments. P-945093 from NMMNH locality L-13238b is a poorly preserved three-dimensional posterior cephalothorax and abdomen.

## Description

P-71507 from NMMNH locality L-9592 is a poorly preserved part and counterpart of a limestone concretion containing a portion of the unornamented dorsal carapace that is tubular, broken at the bisecting postcervical groove, exposing the smooth posterior cephalothorax and anterior abdomen, and with outstretched chelipeds anterior to the exposed cephalothorax. The left carpus is preserved and an impression of the inferior portion of both chelae, with what appear to be slender elements.

P-71508 from NMMNH locality L-9593 (Fig. 2A, B) is a well preserved, three-dimensional, mostly complete dorsolateral cephalothorax and abdomen. The preservation retains the cylindrical shape of the carapace. The cephalothorax is 20 mm long and is mostly complete except for the most anterior features (rostrum and supraorbital spine). The antennar, cervical, postcervical, and hepatic grooves are well defined and incised with the postcervical groove bisecting the dorsal carapace. Other than the well-defined grooves, the carapace is devoid of ornamentation or lineae. The regions bordered by the grooves are inflated. The carapace of the cardiac region is smooth and unornamented. There is a possible drill hole in the dorsomedial portion of the cervical region. There is also minor damage to the lateral thoracic carapace; however, the smooth unornamented character of the overall carapace is maintained. The carapace and the abdomen are slightly disarticulated. The abdomen is 25 mm long and 10 mm wide, consisting of the most posterior aspect of the carapace, five articulated somites with concave terga ornamented bilaterally with blunt ridges where the tergum meets the pleurae, and two-thirds of the tail fan with the telson, with accentuations of the margins, and the superior portion of one pair of uropods. The superior aspect of the first uropod is bisected by a ridge. The ventral portion of the abdomen is obscured by matrix.

P-94502 from NMMNH locality L-13238a (Fig. 2C, D), which is less than 1 m from the top of the Paguate Member, is mostly complete, three-dimensional, laterally compressed, marginally preserved, and slightly crushed, with an articulated cephalothorax and abdomen as well as three disarticulated cheliped fragments. The specimen was found loose, with the fragments in association. The cephalothorax is 22 mm long. The left dorsolateral side of the carapace is more crushed and distorted than the right lateral side; however, the antennar, cervical, postcervical, and hepatic grooves are discernable. On

the right lateral side, the antennar, cervical, postcervical, and hepatic grooves as well as the orbit are well defined. The carapace is smooth and unornamented. There is an 8-mm-by-1-mm indentation in the right lateral branchiocardiac region. The abdomen is complete, with five articulated somites with concave unornamented terga extending laterally into blunt pleura and a tail fan, which is poorly preserved. One walking leg is partially exposed. The slender cheliped fragments have maximum lengths of 12 mm merus, 10 mm carpus, and a 15 mm chelea, consisting of a propodus with the base of the dactylus (the propodus is absent).

P-94503 from NMMNH locality 13238b is a poorly preserved, flattened, three-dimensional carapace of the left lateral side of a cephalothorax. The antennar, cervical, postcervical, and hepatic grooves are shallow though discernable. A fragment of the left merus is just anterior to the carapace.

P-71512 from NMMNH locality 9589 in the Semilla Member (Fig. 2E) is a marginally preserved, disarticulated cephalothorax and abdomen. The ventrolateral carapace of the cephalothorax is 28 mm long, flattened, smooth, unornamented except for the antennar ridge, which is comprised of a row of fine carina, and mostly complete, except for the most ante-

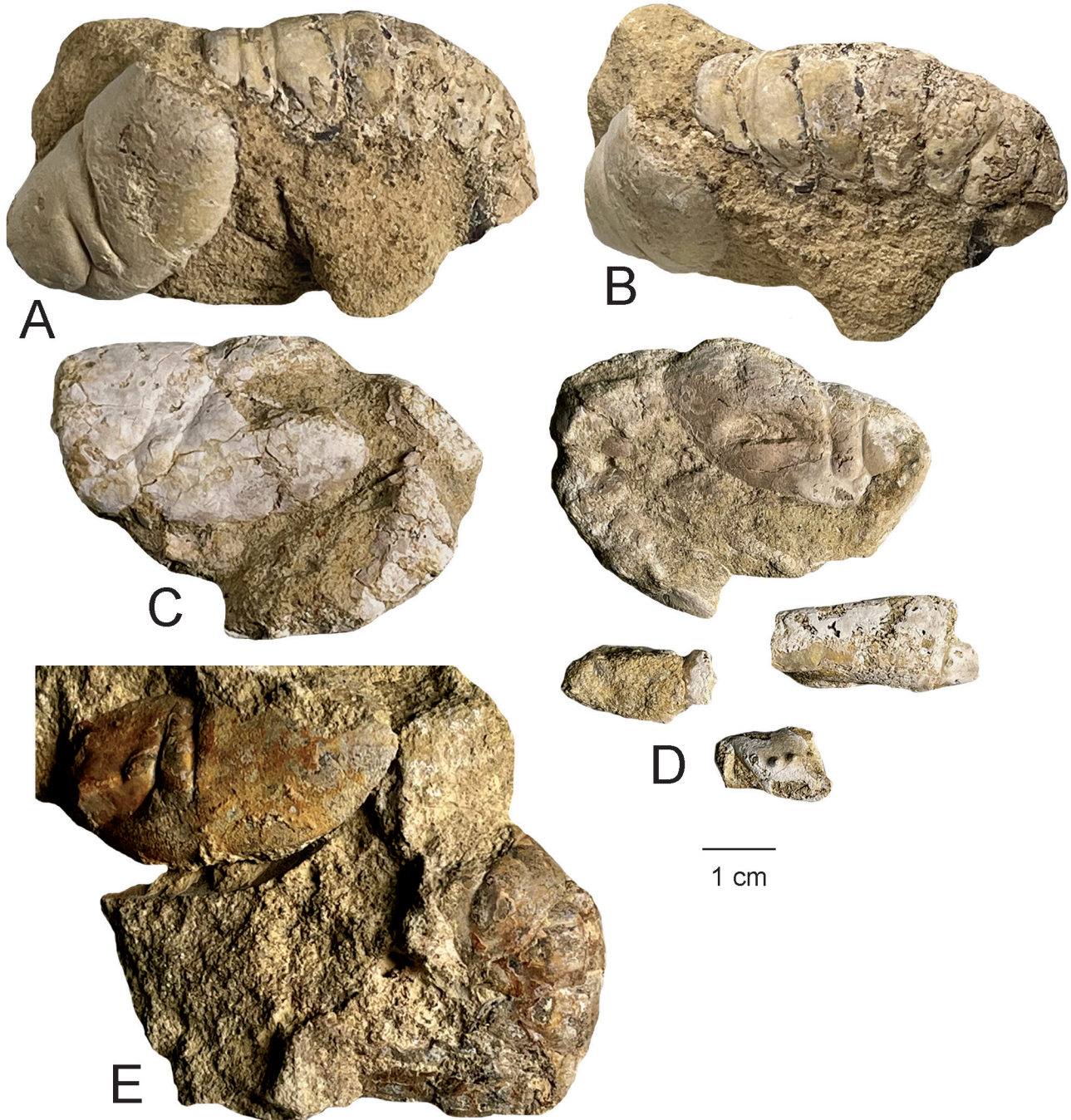


FIGURE 2. *Hoploparia* sp. from the Paguate Member of the Dakota Formation (A–D) and from the Semilla Sandstone Member of the Carlile Shale. (A) lateral view and (B) dorsal view, NMMNH P-71508; (C) left lateral view and (D) right lateral view, P- 94502; (E) lateral view of P-71512.

rior features. The orbit is just visible. The antennar, cervical, postcervical, and hepatic grooves are well defined. The overall shape of the cephalothorax is more elongated and tunicate than in many *Hoploparia* species, and an overall granular appearance is perceptible under oblique lighting. This may be a distortion from initial fossilization. The abdomen is separated from the cephalothorax by 5 mm, is three-dimensional and 20 mm long, and is mostly complete. It consists of five articulated somites with concave unornamented terga and pleurae, a telson, and uropods. The ventral portion of the abdomen is obscured by matrix.

## DISCUSSION

All five lobster fossils from the southeastern San Juan Basin are moderately large nephroids. Assignment to the genus *Hoploparia* is made with confidence. The carapaces of all specimens described here are tubular, smooth, and unornamented. The spinous rostrums and supraorbital spines are not preserved. Four specimens have the antennar, cervical, postcervical, and hepatic grooves that are connected and well defined. This groove pattern is diagnostic of the genus *Hoploparia* McCoy and serves to separate it from *Homarus* Weber (1795) (Schweitzer and Feldmann, 2001). The antennar, cephalic, hepatic, and cardiac regions are well defined and locally inflated and lack conspicuous carinas and lineae. The presence of antennar and hepatic grooves precludes assignment to the family Astacoidea Latreille (1802), the fresh-water crayfish, a sister group to Nephroidea (Rode and Babcock, 2003).

The carapace of P-71508 matches well the carapace of the holotype of *Hoploparia tshudyi* (Schweitzer and Feldmann, 2001, p. 181, fig. 5). P-94502 strongly resembles the carapace and minor cheliped of the holotype of *H. dentonensis* (Rathbun, 1935; Frăntescu, 2013, p. 344, fig. 2), with the other specimens falling between the two due to marginal preservation and variation. We document two instances of predation (El-Shazly, 2015). P-71508 appears to have a drill hole within the cephalic region. This appears to have been a failed attempt, as the hole does not penetrate the molted carapace. And P-94502 appears to have tooth damage, an 8-mm indentation on the right lateral carapace of the branchiocardiac region and a matching crushed area on the left lateral carapace of the cephalothorax, indicative of a possible bite mark.

Specimens P-71508, P-71512, P-94502, and P-94503 are examples of exuviae or molted individuals (Moore, 1969, p. R432, fig. 245, 2; Tshudy, 2003). Many examples of the fossil *Hoploparia* or any lobster are exuviae, shed exoskeletons or fragments thereof, due to the way invertebrates grow—molting, more often early in their ontogeny, out of necessity and decreasing greatly in frequency by maturity. The fact that all but one specimen were found mostly intact, with carapace and abdomen in association, points to an autochthonous source of deposition in a shallow, low-energy, sublittoral marine environment. The presence of associated abdomens runs counter to Tshudy's (2003, p. 178) taphonomic bias hypothesis against the preservation of abdomens of exuviae due to disarticulation by scavenging or decomposition.

Since its inception, the genus *Hoploparia* has accumulated 60 species of lobsters with this aforementioned pattern of connected cephalothoracic grooves of varying degrees of embossment and inflation, with a range of ornamentation from smooth to spiny (Tshudy, 1993, 2003; Tshudy et al., 2018; Fraaije et al., 2020; Pinherio et al., 2020; Feldmann and Schweitzer, 2021), and more are on the way (personal communication with Tshudy, 2024). At the species level, most specimens of the family Nephropidea, including the genus *Hoploparia*, are singletons, single-interval taxa (Foote, 2000; Tshudy, 2003). It is not within the scope of this paper to evaluate the extensive record of the genus *Hoploparia* over its 110-million-year existence (Tshudy, 1993, 2003; El-Shazly, 2015), nor to delve into a highly nuanced discussion of the phylogeny of Nephroidea. However, several smooth, unornamented *Hoploparia* sp. are reported through the later Cretaceous. Simply separating/lumping? the truly smooth carapace from the more ornamented seems an easy step toward sorting out the current “wastebasket” status of the genus (Tshudy and Sorhannus, 2003). Indeed, the moniker “Hoploparia” given by McCoy in 1849 refers to the “spiny cheeks” of *H. longimanus* Sowerby (1826) (Tshudy and Sorhannus, 2003). The specimens examined herein have smooth cheeks and no obvious ornamentation of any kind, as do other Cretaceous *Hoploparia* species. We also note that the holotype of *H. echinata* (Pinherio et al., 2020, p. 5, fig. C) from the Late Cretaceous of Antarctica does not share the same pattern of cephalothoracic grooves as the New Mexico *Hoploparia*.

*Hoploparia*, a well-known cosmopolitan, extinct clawed lobster genus persisted from the Early Cretaceous to the Early Miocene mostly in the Northern Hemisphere, with the greatest diversity occurring during the Late Cretaceous (Tshudy, 1993, 2003; El-Shazly, 2015). No species collected from the Interior Seaway is also known from the East and West coast deposits or globally, which suggests a notable degree of endemism (Tshudy et al., 2005; El-Shazly, 2015). This is the first report of the genus *Hoploparia* from New Mexico.

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Eastward view across the Rio Puerco. The southern Nacimiento Mountains form the skyline. In the middle ground are three volcanic necks (from left to right): Cerro Cuate, Cabezon Peak, and Cerro de Santa Clara.