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LOWER PIERRE SHALE, SOUTHEASTERN MONTANA

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A NEW CRAB, *ZYGASTROCARCINUS CARDSMITHI*
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ABSTRACT—The third species belonging to *Zygartrocarcinus* from the Cretaceous of the Western Interior is represented by a single carapace collected from below the Groat Sandstone Bed, Gammon Ferruginous Member, Pierre Shale of Carter County, Montana. Comparison of *Zygartrocarcinus cardsmithi* n. sp. with the other North American congeners, *Z. mendryki* (Bishop, 1982) and *Z. griesi* Bishop, 1983, and with the Pacific Slope species *Z. richardsoni* (Woodward, 1896) suggests early separation of the Pacific Slope and Western Interior lineage having *Z. cardsmithi* as a possible ancestor to *Z. mendryki* and *Z. griesi*.

INTRODUCTION

ON NOVEMBER 17, 1968, Eugene Richardson of the Chicago Field Museum of Natural History informed me of a "lost" Cretaceous Pierre Shale lobster locality at "Twelve Mile Crossing" somewhere in southeastern Montana. The "Twelve Mile Crossing" locality had been collected about 1904, yielding some 40–50 specimens of the lobster *Linuparus*. A search of topographic maps of the region located a "Twelve Mile Creek" near Albion, Carter County, Montana, a likely place to look for the lost locality because of the creek's name and its proximity to the town of Albion and its transportation network, which must have crossed the nearby Little Missouri River. Self-sponsored fieldwork in 1971 resulted in the rediscovery of the "Twelve Mile Crossing" locality. Collecting in 1976, sponsored by the National Geographic Society (NGS Grant 1629), allowed further collecting that led to the discovery of a new crab species by my field assistant, H. C. Smith.

The Twelve Mile Crossing Locality (Bishop locality 23, hereafter GAB 23) is situated (Figure 1.2) in a small badlands on the south bank of the Little Missouri River on the section line between sections 30 and 31, T57N, R61E, about 1.2 km (0.75 miles) due west of Albion, Carter County, Montana (Cook, Collins, and Davidson, 1949). Fossil decapods preserved in apatite or ironstone concretions occur in the silty claystones of the Gammon Ferruginous Member (Figure 1.3) of the Pierre Shale approximately 9 m (30 ft) below the

Groat Sandstone bed (Mapel, Robinson, and Theobald, 1959).

The fauna, dominated by decapods (Figure 2, Table 1), consists of the lobster *Linuparus* cf. *L. canadensis* (Whiteaves, 1885) (76 specimens); the crabs *Necrocarcinus davisi* Bishop, 1985 (2 specimens), *Zygartrocarcinus cardsmithi* n. sp. (1 specimen), and *Notopocorystes* sp. (2 specimens); and a few molluscs including *Baculites aquilaensis* (late form), which places this locality in the Zone of *Scaaphites hippocrepsis* III, Campanian (W. A. Cobban, personal commun.).

SYSTEMATIC PALEONTOLOGY

Section PODOTREMATA Guinot, 1977
Subsection DROMIACEA de Haan, 1833
Superfamily HOMOLODROMIOIDEA
Alcock, 1899

Family HOMOLIDAE White, 1847
Genus ZYGASTROCARCINUS Bishop, 1983

Type species.—The type species of *Zygartrocarcinus* is *Z. griesi* Bishop, 1983, from the Bearpaw Shale of north-central Montana.

Diagnosis.—"Carapace rectangular or slightly ovate, longer than wide, widest in posterior half. Upper surface nearly level, laterally rounded, lateral margins nearly vertical, rostrum downturned. Carapace well differentiated by deep furrows, regions often developed into bosses or spines, surface ornamented with coarse tubercles. *Linea homolica* well developed, dorsal, parallel to lateral margins. Chelipeds long (palm as long as

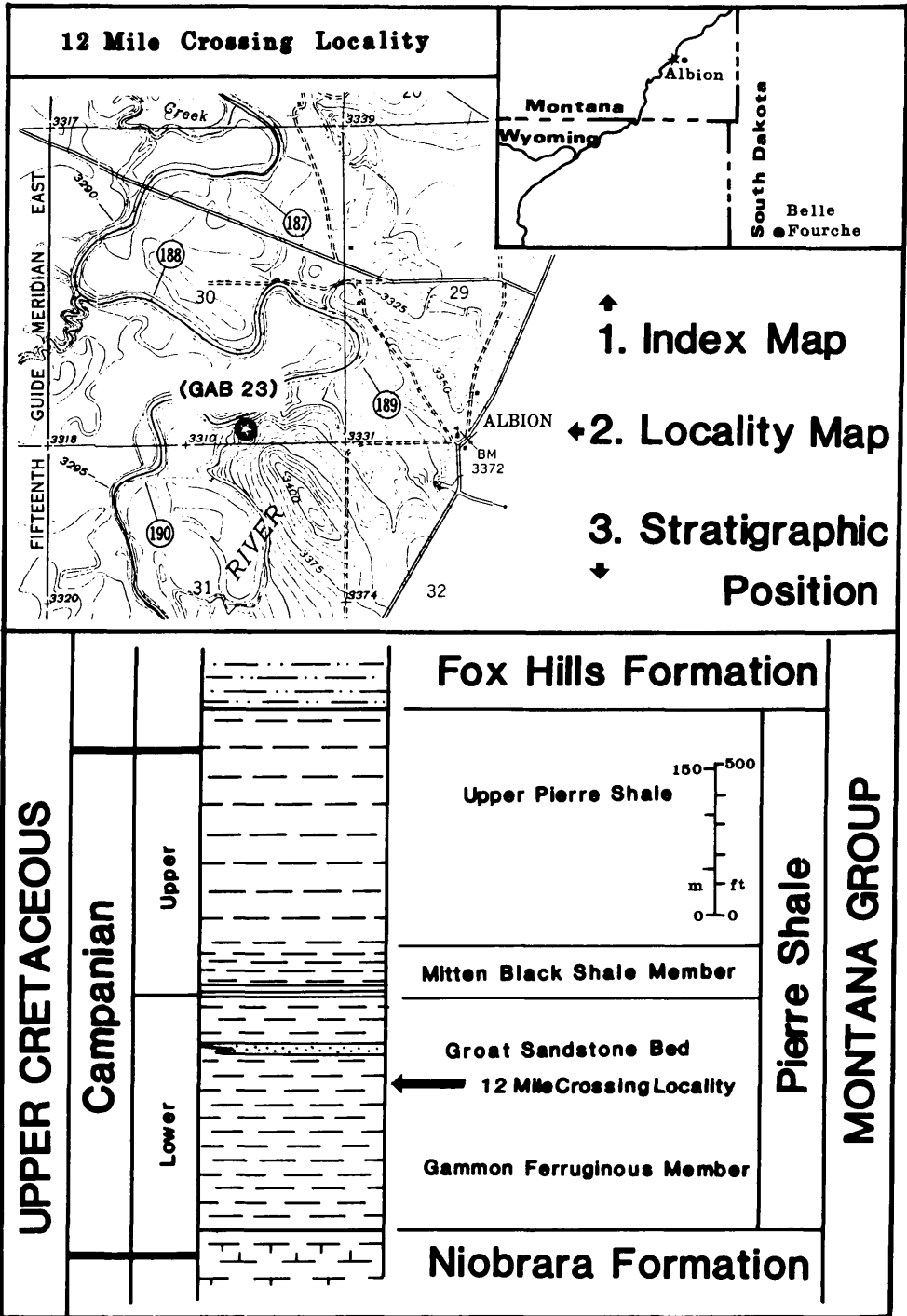


FIGURE 1—The Twelve Mile Crossing Locality. 1, index map. 2, topographic map of locality (star in circle) (gridded by section lines, one mile on a side). 3, stratigraphic position of locality.

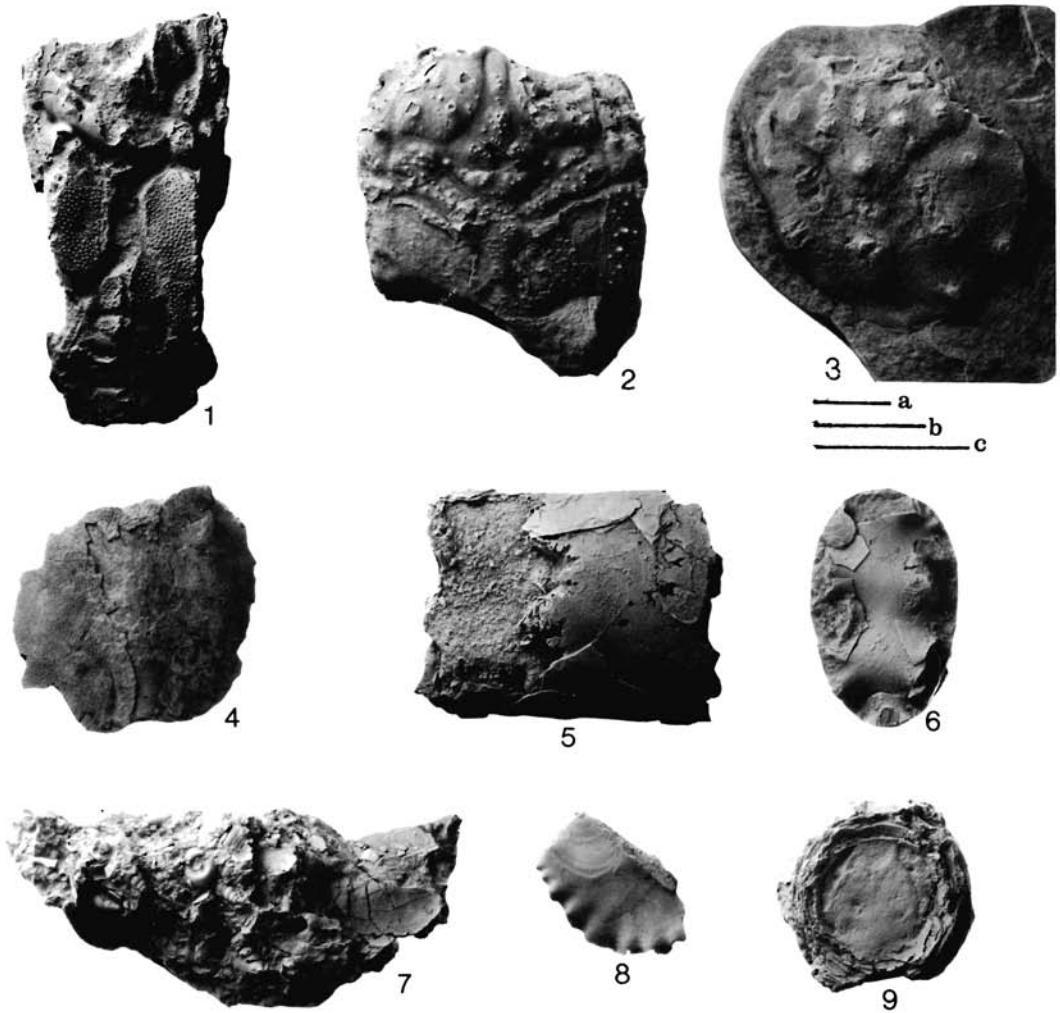


FIGURE 2—Twelve Mile Crossing decapod-dominated assemblage. 1, *Linuparus* sp., GAB 23-4. 2, *Zygastracarcinus cardsmithi* n. sp., SDMG10,038. 3, *Necrocarcinus davisii* Bishop, 1985, GAB 23-30. 4, *Notopocorystes* sp. 23-33. 5, 6, *Baculites aquilaensis* Reeside, 1927, GAB 23-36. 7, Molluscs in concretion fragment, GAB 23-38. 8, *Ostrea* sp., GAB 23-39. 9, fish vertebra, GAB 23-37. Scales 1 cm; 1, 5-9, $\times 1.0$; 2 and 4, $\times 1.5$; 3, $\times 2$.

carapace), slim and tuberculate. Pereiopods 2-4 long, slim, somewhat flattened with longitudinal dorsal and ventral grooves" (Bishop, 1983, p. 901).

ZYGASTROCARCINUS CARDSMITHI n. sp.

Figures 2.2, 3, 4.2

Etymology.—*Zygastracarcinus cardsmithi* is named in honor of my 1976 field assistant, H. C. "Card" Smith, who discovered the holotype.

Holotype.—The holotype of *Zygastracarcinus cardsmithi* (SDMG 10,038) is depos-

ited in the collection of the Museum of Geology, South Dakota School of Mines and Technology, Rapid City, SD 57701.

Occurrence.—The apatite concretion containing the single specimen of *Zygastracarcinus cardsmithi* was collected approximately 30 feet (9.2 m) below the Groat Sandstone Bed, Gammon Ferruginous Member, Pierre Shale at the Twelve Mile Crossing Locality (Bishop Locality designation GAB 23) on the Oliver Ranch, on the section line between sections 30 and 31, T57N, R61E, Carter County, Montana.

TABLE 1—The Cretaceous Twelve Mile Crossing decapod assemblage, from Oliver Ranch, Albion, Carter Co., Montana.

Bottom dwellers		Swimmers	
Infauna			
<i>Notopocorystes</i> sp.	(2)	crab	<i>Baculites aquilaensis</i> (4) fish vertebra (1)
Epifauna			
<i>Linuparus</i> sp.	(76)	lobster	
<i>Zyagstrocarcinus cardsmithi</i>	(1)	} crabs	
<i>Necrocarcinus davisii</i>	(2)		
<i>Drepanochilus</i> sp.	(~30)	gastropod	
<i>Pteria</i> sp.	(1)	bivalve	
<i>Ostrea</i> sp.	(1)	oyster	

Distribution, 0.16 km², through 4.6 m of rock.

Diagnosis.—Carapace slightly wider than long; well-defined gastric groove; mesogastric lobe triangular behind with narrow anterior tongue, three granulate bosses at apexes and one on posterior of tongue; protogastric lobe with four granulate bosses forming rhombus; cardiac lobe posteriorly placed, fairly triangular with fine transverse granules; branchial lobe separated into narrow epibranchial, very narrow mesobranchial, and large metabranchial lobes. Carapace well differentiated by grooves, regions fairly tumid and granulate.

Description.—Carapace rectangular, slightly wider than long, widest across epibranchial, rostrum unknown. Orbits occupy 25% of carapace width, laterally notched at anterior one-third; level transversely, arched longitudinally. Grooves fairly well marked; cervical groove obsolete distally; groove defining metagastric well marked, anterior tongue narrow; antennar grooves moderately de-

finied; branchiocardiac groove broad and shallow, groove between epibranchial and mesobranchial and metabranchial lobes broad and shallow. Regions tumid and granulate. Mesogastric lobe triangular posteriorly, three low granulate bosses at apexes, anterior tongue narrow with granulate bars near posterior. Protogastric lobe with four granulate bosses arranged in rhombus, bases transverse, sides slanting inward and forward. Hepatic lobe nearly all of vertical and underturned side of carapace; broad, smooth ocular depression surrounded by a row of granules above and small spines below. Urogastric lobe crescentic, bilobed, granulate. Cardiac lobe triangular, covered with fine transverse granules. Intestinal lobe poorly delimited. Branchial lobe separated into narrow epibranchial ridge, very narrow mesobranchial ridge, and large metabranchial lobe. *Linea homolica* runs longitudinally well inside dorsal margin.



FIGURE 3—Holotype, SDMG 10,038, of *Zyagstrocarcinus cardsmithi* n. sp. in 1, dorsal; 2, anterior; 3, ventral; 4, right lateral views. Scale = 1 cm.

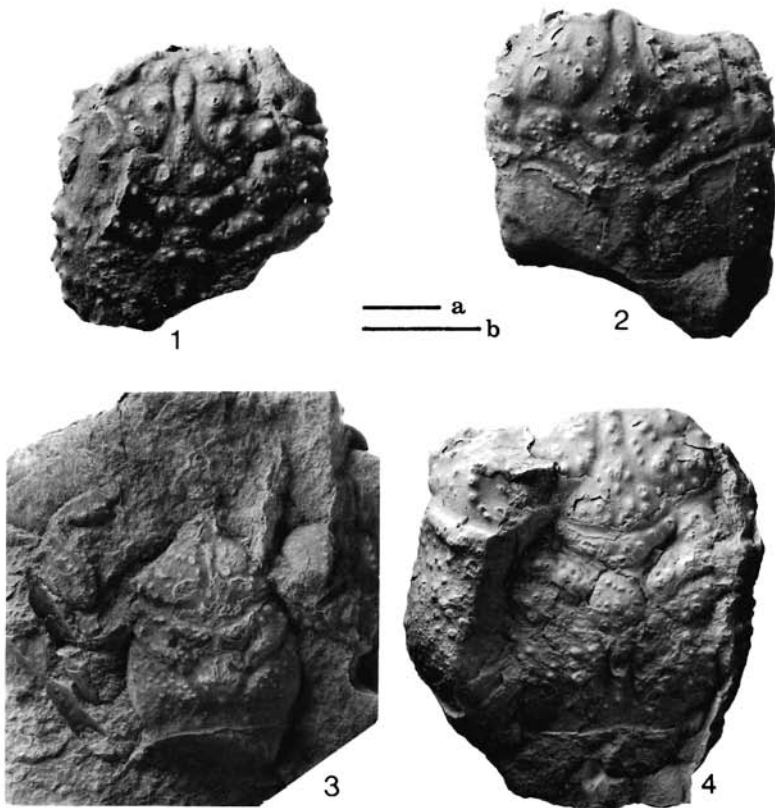


FIGURE 4—Comparative photographs of dorsal views. 1, *Zygastrocarcinus mendryki* Bishop, 1982, holotype, SDMG 10,001. 2, *Zygastrocarcinus cardsmithi* n. sp., holotype, SDMG 10,038. 3, *Zygastrocarcinus richardsoni* (Woodward), 1896, holotype, GSC 5995. 4, *Zygastrocarcinus griesi* Bishop, 1983, GAB 31-38. Scales 1 cm; 1-3, $\times 1.0$; 4, $\times 1.5$.

Comparison.—The carapace outlines of *Zygastrocarcinus cardsmithi*, *Z. griesi* Bishop, 1983, and *Z. mendryki* (Bishop, 1982) (see also Bishop, 1981, fig. 13-4G) are rectangular or square, whereas *Z. richardsoni* (Woodward, 1896) is triangular. *Zygastrocarcinus cardsmithi* and *Z. griesi* are relatively equidimensional, whereas *Z. mendryki* (Bishop) is much longer than wide ($L/W = 1.16$). *Zygastrocarcinus cardsmithi* can be distinguished from the similarly ornamented *Z. mendryki* because it is relatively shorter; it has less tumid, more subtly ornamented regions; and it has more parallel sides and is widest at the anterior one-third rather than its midpoint. *Zygastrocarcinus cardsmithi* can be distinguished from the similarly proportioned *Z. griesi* by its possession of granulate bosses on the mesogastric and protogastric lobes, its more posteriorly placed triangular

cardiac lobe, and its better differentiated branchial lobes. *Zygastrocarcinus cardsmithi* can be differentiated from *Z. richardsoni* by its quadrangular shape.

Remarks.—Of the four species of *Zygastrocarcinus* now known from North America, the oldest is *Z. richardsoni* (Woodward, 1896), which is least similar to the other species and geographically isolated from them, being from British Columbia (Queen Charlotte Island). Rathbun (1926, p. 86) described *Palehomola gorrelli* from the Oligocene of Oregon, a species quite similar (as far as one can discern from the photographs) to *Z. richardsoni*.

The other three species are *Z. mendryki*, Pierre Shale, Zone of *Baculites grandis* (Maastrichtian), Mobridge, South Dakota; *Z. griesi*, Bearpaw Shale, Zone of *Didymoceras nebrascense* (late Campanian) of north-central

Montana; and *Z. cardsmithi*, Pierre Shale, Zone of *Scaphites hippicrepis* III (middle Campanian), southeastern Montana. These limited data suggest two evolutionary lineages, one with a triangular carapace (*Z. richardsoni*, *Z. gorrelli*) on the Pacific Slope and one with a rectangular carapace (*Z. cardsmithi*, *Z. griesi*, and *Z. mendryki*) in the Western Interior. *Zygastrocarcinus cardsmithi*, being oldest, could have given rise to the two younger species: *Z. mendryki*, similar in ornamentation but having become relatively longer, and *Z. griesi*, similar in carapace proportions but differently ornamented.

ACKNOWLEDGMENTS

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