

Mary J. Rathbun.

*With the compliments
of H. B. Stenzel*

**Middle Eocene and Oligocene Decapod
Crustaceans from Texas, Louisiana,
and Mississippi**



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MIDDLE EOCENE AND OLIGOCENE DECAPOD CRUSTACEANS FROM TEXAS, LOUISIANA, AND MISSISSIPPI*

H. B. STENZEL

I.—Introduction

Decapod crustaceans have in the past been much neglected by workers in the Tertiary of the Gulf Coastal Plain. This is due chiefly to an *embaras de richesse*, because mollusks are so abundant, so diversified, and so well preserved that they have occupied most of the attention of the paleontologists. Crustaceans, on the other hand, are not numerous, but for stratigraphic correlation they seem to be of great importance. With their aid long range correlation is possible.

A good example of the stratigraphic value of the crabs is the range of *Harpactocarcinus americanus* Rathbun. This species was used by the writer¹ in 1931 for zonation in the Crockett formation of the lower Claiborne of Brazos County, Texas, where hundreds of specimens occur. At that time it was believed that this crab zone was merely a local, restricted zone of no value outside of Brazos County. Further search to the eastward, along the outcrop of the Crockett formation, resulted in the finding of this species at many localities in Leon County and at the following three localities east of Leon County:

- A. At base of bluff on right bank of Hurricane or Threemile Bayou in the southeast corner of Young-Murchison 553.5-acre tract and H. F. Craddock 277.4-acre tract in southeast corner of Newell C. Hodge survey; 0.3 mile above the bridge over the bayou, which is 3.35 miles north-northeast of the Houston County court house on Crockett-Rusk road (mail route No. 1); Houston County, Texas. (Three specimens)
- B. Road cuts on each side of Provençal-Flora-Cypress road, 2.18 miles from Provençal depot or 4.48 miles from Flora railroad crossing; Natchitoches Parish, Louisiana. (Five specimens)
- C. Cut of Alabama & Vicksburg Railroad on Indian Mound in pasture of Mr. A. H. Edmonds, ± 3 miles east of Newton and south of Highway 80; Newton County, Mississippi. The Edmonds home is located at the entrance to this pasture, on south side of Highway 80, 2.81 miles east of the highway intersection on Newton main street. (One complete specimen and one separate right cheliped)

* Published by permission of the Director, Bureau of Economic Geology of The University of Texas.

¹ Renick, B. C., and Stenzel, H. B., The stratigraphy and paleontology of the lower Claiborne along the Brazos River, Texas. Univ. Texas Bull. 3101:78, 94-95, 1931.

Stenzel, H. B., Decapod crustaceans from the Middle Eocene of Texas. J. Paleont. 8:38-56, 1934.

In order to facilitate checking and finding of these fossils by others, detailed sections of the three localities are included below:

A. Combined section along Hurricane Bayou above the bridge:

| | Feet | Inches |
|---|------|--------|
| 5. Greenish, conchoidal, unctuous, fairly clean clay ----- | 5 | |
| 4. Limonite concretions in gray, glauconitic shale ----- | 2 | 1 |
| 3. Gray, non-glauconitic shale with buff, fine silty layers ----- | 8 | |
| 2. Glauconite marl with many <i>Plicatulae</i> and <i>Harpactocarcini</i> ----- | 1 | 6 |
| 1. Impure, limonitic limestone with <i>Plicatulae</i> , fucoids, pipes, and large ripple marks in its lower part. Total thickness not exposed ----- | 1 | |

B. Section in road ditch along Provencal-Flora road:

| | | |
|--|---|---|
| 5. Deeply weathered clay, reddish-brown on surface, yellowish-buff deeper inside, with many white marl nodules of about a quarter inch diameter: contains also white concretions with many <i>Harpactocarcini</i> . Weathers to reddish-brown loamy soil. To top of hill where exposure ends at a curve sign ----- | 5 | |
| 4. White to light yellow, marly limestone, weathering into boulders that strew the slopes on both sides of the road ----- | 1 | 6 |
| 3. Light buff clay, deeply weathered, with many white chalky lime nodules of about a quarter inch diameter. <i>Lobonutus</i> found here. Weathers to black, waxy soil ----- | 6 | |
| 2. Line of hard, white limestone concretions about 8 by 16 inches in size. These concretions are about 6 feet apart horizontally | | |
| 1. Thinly laminated shale with silt partings, dove-gray on weathered surface changing to brownish-gray on fresh surface. Toward the top this shale carries small lime nodules and weathers to black, waxy soil ----- | 6 | |

C. Section in railroad cut on Indian Mound:

| | | |
|--|----|---|
| 6. Light buff, massive, calcareous, indurated fossiliferous, weathered marl grading upward into brown soil ----- | 7 | |
| 5. Light greenish-gray, glauconite-speckled, massive, sandy, fossiliferous marl; forming a vertical wall. A two-inch oyster layer marks the top of this bed ----- | 4 | |
| 4. Line of concretions; light greenish gray, finely glauconite-speckled, massive, calcareous concretions. The largest measures 6 by 17 inches | | |
| 3. Poorly bedded, glauconitic, and a little marly sand with scattered fossils, light gray on weathered surface, light greenish-gray when fresh. This bed is darker grayish-green on its surface higher up on the slope | 18 | |
| 2. Coarse grained, finely glauconite-speckled, friable sand full of the young of <i>Ostrea sellaeformis</i> Conrad. <i>Harpactocarcinus</i> found in this bed -- | 1 | 8 |
| 1. Yellow to gray, massive, clean sand with few irregular limonite streaks and imprints of fossils. Fossil shells largely leached. Total thickness not exposed, to bottom of cut ----- | 9 | |

These localities are situated respectively 80, 200, and 400 miles air line distance east of the type locality of *Harpactocarcinus americanus* in Brazos County. The writer has had no opportunity to search the Crockett outcrops

southwest of the type locality. Therefore, no additional localities are known in Texas to the southwest. But in Mexico, *H. americanus* occurs on "Zardo Creek, about 100 meters downstream from No. 108; Eocene; 1920; Coll. No. M 115 V" according to M. J. Rathbun.² This is more than 300 miles air line distance southwest of the type locality in Brazos County. Therefore, the known horizontal range of *Harpactocarcinus americanus* is more than 750 miles measured along the outcrop of the beds. The vertical range of the species in Brazos and Leon Counties, Texas, where the range is known best and also probably greatest, is certainly less than 200 feet.

It is probable that the age of the beds is essentially the same at all localities in which *H. americanus* has been found. Through detailed mapping of the beds Dr. B. C. Renick and H. B. Stenzel proved this to be correct for Brazos and Leon County respectively.³ For the Hurricane Bayou locality it was proved by reconnaissance work done by the writer in 1932. It was checked for the localities in Louisiana and Mississippi by other paleontological correlations. The most notable of the latter are the correlations of Otto Meyer and T. H. Aldrich,⁴ G. D. Harris,⁵ A. C. Ellisor,⁶ E. A. Wendlandt and G. M. Knebel,⁷ H. K. Shearer,⁸ C. L. Moody,⁹ W. H. Monroe,¹⁰ and F. B. Plummer.¹¹ According to this correlation the beds near the level of the Little Brazos limestone in the Crockett marl in Brazos and Houston counties, Texas, and the Milams formation of the locality in Natchitoches Parish, Louisiana, and the Wautubbee formation of the locality in Newton County, Mississippi, are at about the same stratigraphic level. All these beds are uppermost lower Claiborne in age.

² Rathbun, Mary J., Fossil decapod crustaceans from Mexico. Proc. U. S. Nat. Mus. 78(8):1, 1930.

³ Renick, B. C., and Stenzel, H. B., op. cit., pp. 73-108. Stenzel, H. B., op. cit.

⁴ Meyer, Otto, and Aldrich, T. H., The Tertiary fauna of Newton and Wautubbee, Mississippi. J. Cincinnati Soc. Nat. Hist. 9(2):40-47, pl. 2, 1886.

⁵ Harris, G. D., Pelecypoda of the St. Maurice and Claiborne Stages. Bull. Amer. Pal. 6(31) 1919.

⁶ Ellisor, Alva C., Correlation of the Claiborne of East Texas with the Claiborne of Louisiana. Bull. Amer. Assoc. Petr. Geol. 13:1339-1341, 1929.

⁷ Wendlandt, E. A., and Knebel, G. M., Lower Claiborne of East Texas, with special reference to Mount Sylvan dome and salt movements. Bull. Amer. Assoc. Petr. Geol. 13:1351, 1929.

⁸ Shearer, H. K., Geology of Catahoula Parish, Louisiana. Bull. Amer. Assoc. Petr. Geol. 14:440, footnote, 1930.

⁹ Moody, C. L., Tertiary history of the region of the Sabine uplift, Louisiana. Bull. Amer. Assoc. Petr. Geol. 15: 535-537, 1931.

¹⁰ Monroe, W. H., The Jackson gas field, Hinds and Rankin counties, Mississippi. U. S. Geol. Surv. Bull. 831:4-5, 1931.

¹¹ Plummer, F. B., Cenozoic systems in Texas, in Geology of Texas, Vol I, Stratigraphy. Univ. Texas Bull. 3232:666, 1932 (1933).

II.—Description of Species

Order DECAPODA

Tribe BRACHYURA

Subtribe BRACHYGNATHA

Superfamily BRACHYRHYNCHA

Family *Xanthidae*

Genus *Lobonotus* A. Milne-Edwards 1863

A. Milne-Edwards, Monog. Crustac. Foss. de la Famille des Cancériens, 1:279-280, 1861-65.

Genotype.—*Lobonotus sculptus* A. Milne-Edwards from the Middle Tertiary of Santo Domingo; type by monotypy.

*Lobonotus natchitochensis*¹² sp. nov.

Description of monotype.—The type is an internal mold of the carapace preserved in a white to buff, friable lime nodule. Much of the corresponding external mold of the carapace is also extant.

Carapace broad, wider than long. Antero-lateral margins short, one-half the length of postero-lateral margins. Interorbital width one-third the width of the carapace. No spines on carapace margins.

Carapace divided into well defined areolations by broad, non-tuberculated grooves. The areolations are covered by crowded tubercles. On the internal mold the tubercles are saucer-shaped, with a low center and raised margin; on the external mold the same tubercles are convex with gently arched top and steeper sides.

Epigastric areolations small. A prominent, lone, warty tubercle is located at the inner frontal angle of each epigastric areolation. The median groove that extends to the frontal margin separates these two tubercles from each other and a narrow and deep groove separates each tubercle from the adjoining epigastric areolation. Protogastric areolation large and subtriangular. Mesogastric and metagastric region covered by an areolation that is pentagonal in outline and extends in front into a long narrow constriction, which ends 3 mm. behind the frontal margin. A shallow and inconspicuous groove separates the metagastric region from the urogastric areolation. Urogastric areolation small, transversely elongate, covered by few tubercles, and much lower than the surrounding areolations. Cardiac areolation large and broad, ending backward into three short extensions. The median extension is straight; the lateral ones curve toward the median. The elevation occupying the intestinal region is continued laterally over the branchial region and is narrow and transverse, widest at the outer ends. Metabranial areolations transversely elongate. Mesobranial areolations very small and triangular. Epibranial areolations obliquely elongate and with a short groove near the outer end. Hepatic areolations small and nearly circular. There is a very small areolation outside of the epibranial areolation and wedged in between the hepatic and epibranial areolations. This areolation is bluntly pointed forward and out-

¹² Specific name taken from the type locality in Natchitoches Parish, Louisiana.

ward at the margin of the carapace and occupies the lateral extremity of the carapace. The point projects barely beyond the carapace margin.

Interorbital front advanced, truncate, and roughly granulate at the frontal margin. The lower margins of the orbits project beyond the upper margins so that the orbits point obliquely forward, outward, and upward. Orbits only medium-sized and less than twice as long as broad. Orbital margins roughly granulate, similar to the interorbital margin. The granules are arranged in groups that are separated by smooth grooves. The upper orbital margins have the following granule groups and grooves listed in outward progressing order: small group of granules, shallow groove, small group, shallow groove, small group, deep groove, larger group, deep groove, larger group. The first larger group lies in front of the carapace groove that separates the protogastric from the hepatic region. The granules of the frontal and orbital margins are separated from the adjoining areolations of the carapace by a broad, non-tuberculate groove. Above the posterior margin of the carapace there is a row of fine bead granules.

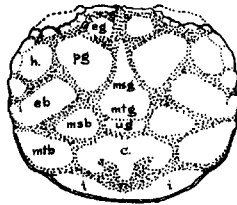


Fig. 1. Diagram of the carapace areolations of *Lobonotus natchitochensis*; eg = epigastric, pg = protogastric, msg = mesogastric, mtg = metagastric, ug = urogastric, c = cardiac, i = intestinal, h = hepatic, eb = epibranchial, mab = mesobranchial, mtb = metabranchial.

Dimensions.—Length of carapace in median line, 17 mm.; greatest width of carapace, 19.5 mm.

Type locality.—Near Provencal, Natchitoches Parish, Louisiana. (See above for more detailed description of the locality.)

Horizon.—Middle Eocene, lower Claiborne group, Cook Mountain division, Milams formation.

Types.—The two parts of the monotype are in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

Diagnosis.—Readily noticeable differences in the ornamentation of *Lobonotus sculptus* A. Milne-Edwards,¹³ *L. mexicanus* Rathbun,¹⁴ and *L. natchito-*

¹³ Milne-Edwards, A., Histoire des Crustacés Podophthalmes Fossiles, tome 1, Monog. d. crust. Foss. d. l. Famille des Cancériens, première partie, 1861-1865: 279-282, pl. 18, figs. 1, 1a, 1b.

Rathbun, Mary J., West Indian Tertiary decapod Crustaceans. Publ. Carneg. Inst. 291(5): 177-179, pl. 6, figs. 6, 7; pl. 7, figs. 10-13; pl. 8, figs. 4-7, 1919; as *Archaeopilumnus caelatus* spec. nov.

———, ———, Additions to West Indian decapod Crustaceans. Proc. U. S. Nat. Mus. 58: 384, 1920.

¹⁴ ———, ———, Fossil decapod Crustaceans from Mexico. Proc. U. S. Nat. Mus., 78(8): 2-3, pl. 1, figs. 1-3, 1930.

chensis are found along the antero-lateral margins, on the superior orbital margins, and in the epibranchial and intestinal areolations. Along the antero-lateral margin, *Lobonotus sculptus* has 5 sharp spines, *Lob. mexicanus* has 5 blunt and projecting teeth, *Lob. natchitochensis* has but 1 nonprojecting tooth at the lateral extremity of the carapace. The superior orbital margin in *L. sculptus* has 2 fissures, in *L. mexicanus* 2 furrows, in *L. natchitochensis* there are 2 shallow, smooth grooves separating tubercle groups. The epibranchial areole in *L. sculptus* is large, rounded, and well defined toward the carapace margin; in *L. mexicanus* it is large, oblique, and separated by a groove from the fifth tooth; in *L. natchitochensis* it is narrow, oblique, and separated only partially from the fifth "tooth," which in this species does not project. The intestinal areolation of *L. sculptus* is very long and of uniform width, in *L. mexicanus* and *L. natchitochensis* it is much shorter and at the ends wider than in the middle.

Lobonotus brazosensis¹⁵ sp. nov.

Description of monotype.—The type is a right manus and carpus. The carpus is short, stout, and densely covered with tubercles. Its proximal angle is rounded and rectangular. The inner angle is extended into a spine that carries some small tubercles and at its end a spinule. There are two shallow grooves on the carpus. One groove is largely free of tubercles and parallels the tuberculate distal edge of the carapace. It separates the outer surface of the carpus from the manus-carpus joint. The other groove is inconspicuous, shallow, and only partly free from tubercles. It extends longitudinally nearly through the middle of the outer or upper surface of the carpus and disappears proximally. The manus is inflated and increases in height distally. The surface of the manus is largely smooth. Tubercles are restricted to the upper margin and proximal end of the outer surface. The belt of tubercles along the upper margin stops abruptly toward the inner surface but grades off toward the outer surface. A raised and finely tuberculate lobe overlaps the manus-carpus joint at the proximal end of the upper margin. A finely tuberculate lobe overlaps the manus-carpus joint at the proximal end of the lower margin of the manus. Between these two lobes the outer surface of the manus forms a blunt, proximal angle that is emphasized by a group of 4 high tubercles. There is also a group of low, small tubercles at the extreme proximal edge of the manus near its articulation. This edge is separated by a broad smooth groove from the two lobes and the outer surface of the manus. The lower margin of the manus is smooth, polished, thick, and sinuous. The margin narrows very much as it goes over into the sinuous lower margin of the fixed finger which is deflexed by 16 degrees. This finger is slightly hooked at the end and carries a row of twelve closely-set small teeth on the occludent margin. The second, fifth, and ninth teeth are larger than the others. The eighth and tenth are very small: mere tubercles. From the tip of the fixed finger there runs a pitted groove on the outer and inner surface of the finger

¹⁵ Specific name taken from the type locality on Brazos River.

parallel with the lower margin. The grooves disappear proximally, on the finger. The groove on the inner surface is more marked than the other. The inner surface of the fixed finger carries a row of 6 pits near to and parallel with the occludent margin and between this margin and the pitted groove. Correspondingly, the outer surface of the fixed finger carries a row of 9 pits adjoining to and parallel with the occludent teeth. There are also some rows of widely scattered and shallow pits along and above the lower margin of the manus on inner and outer surface. These pits are so widely scattered that their arrangement in rows becomes obscure. The rows extend from the fixed finger out on the manus in longitudinal direction.

The dactylus is smooth except for a group of about 16 small tubercles and granules at the proximal end of its upper margin. Occludent teeth similar to those in the fixed finger. The inner surface of the dactylus carries a longitudinal pitted groove through its middle. The outer surface is smooth but for rows of widely separated and shallow pits. Tip is missing.

Dimensions.—Height of manus at distal end, 6.7 mm.; length of manus from interdigital sinus to proximal outer angle, 9.6 mm.; thickness in middle of manus, 4.2 mm.; length of fixed finger, 6.0 mm.; length of carpus, 5.5 mm.

Type locality.—Stone City, on right bank of Brazos River and below the bridges, Burleson County, Texas.

Horizon.—Middle Eocene, lower Claiborne group, Crockett formation, bed (ad) of Stone City section.

Type.—Holotype in writer's collection at the Bureau of Economic Geology, Austin, Texas.

Diagnosis.—A comparison with *Lobonotus natchitochensis* is not possible because the manus of the latter is unknown. It is possible that both belong to the same species. To assume this would be unsafe on account of the large distance between the two type localities. The manus of *L. sculptus* A. Milne-Edwards has 6 to 7 irregular rows of spines on the outer surface of the manus. *Lobonotus mexicanus* Rathbun has longitudinal rows of spines or tubercles on the outer surface of the manus, although it may be less rough than in *L. sculptus*. *Lobonotus brazosensis* has the outer surface of the manus smooth with the exception of the tubercles along the upper margin and the proximal end.

Genus *Harpactocarcinus* A. Milne-Edwards 1862

A. Milne-Edwards, Histoire des Crustacés Podophthalmaires Fossiles, 1862, tome 1, Ann. Sci. Nat., ser. 4, Zool. 18:46 and 64.

Genotype.—*H. punctulatus* (Desmarest).

Harpactocarcinus americanus Rathbun emend. Stenzel

Harpactocarcinus americanus Mary J. Rathbun (partim). Two new crabs from the Eocene of Texas, Proc. U. S. Nat. Mus. 73(6), 1928. Females, holotype and paratypes a and b; not paratypes c, d, and f.

Xanthopsis americana (Rathbun), in M. F. Glaessner, Crustacea decapoda, Fossilium Catalogus, I, Animalia, 41:395, 1929.

?*H. americanus* M. J. Rathbun, Fossil decapod crustaceans from Mexico, Proc. U. S. Nat. Mus. 78(8):1, 1930.

H. americanus Rathbun emend. Stenzel, in B. C. Renick and H. B. Stenzel, The lower Claiborne on the Brazos River, Texas, Univ. Texas Bull. 3101:94, 99, pl. 7, fig. 18, 1931.

H. americanus V. van Straelen, Sur des Crustacés décapodes cénozoïques du Venezuela, Mus. roy. Hist. nat. de Belgique Bull., 9(10):10-11, footnote 5, 1933.

H. americanus Rathbun emend. Stenzel, in H. B. Stenzel, Decapod crustaceans from the Middle Eocene of Texas, J. Paleont. 8(1):42-45, pl. 6, figs. 1a-e, 1934.

Description.—For detailed description see M. J. Rathbun, 1928, and H. B. Stenzel, 1934. Van Straelen, 1933, gives a critical discussion of the generic position of this species. The Mississippi specimen has more pronounced swellings on the carapace than the types.

Localities.—The type locality is along the banks of Little Brazos River, 0.1 to 0.3 mile above the new concrete bridge of State Highway No. 21 (Bryan-Caldwell road) and about 9.6 miles west of Bryan, Brazos County, Texas (about 100 specimens).

In bed of a branch of Campbell's Creek, directly adjoining the old San Antonio-Nacogdoches trail, 2.85 miles northeast of its junction with State Highway No. 6 (Bryan-Hearne road), at the northwest boundary of Brazos County, Texas (2 specimens).

In the north ditch of the old San Antonio-Nacogdoches trail, 2.7 miles northeast of its junction with State Highway No. 6 (Bryan-Hearne road), and in the Byer 65-acre tract, near the southeast corner of Skeagh Walker survey, on the southeast boundary of Robertson County, Texas (2 specimens).

Many localities in southern Leon County, Texas.

Hurricane Bayou, 3.35 miles north-northeast of Crockett, Houston County, Texas (3 specimens).

Near Flora, Natchitoches Parish, Louisiana (5 specimens).

Indian Mound, 3 miles east of Newton, Newton County, Mississippi (1 complete specimen and one right cheliped).

Horizon.—Middle Eocene, Claiborne group, uppermost part of the lower Claiborne; in Texas in the Crockett formation, near the level of the Little Brazos limestone; in Louisiana in the Milams formation; in Mississippi in the Wautubbee marls.

Types.—Holotype (No. 369607) and paratypes a and b of Rathbun in U. S. National Museum. Figured specimens of Stenzel and many additional topotypes in the writer's collection at the Bureau of Economic Geology, Austin, Texas. Topotypes in the Musée royal d'Histoire naturelle de Belgique, Brussels, Belgium, and in the Geology Departments of Cornell University, Ithaca, New York, University of Texas, Austin, and Agricultural and Mechanical College of Texas, College Station, Texas.

Family *Portunidae*
Genus *Portunus* Weber 1795

Weber, Nomenclator entomologicus, p. 93.

Genotype.—*P. pelagicus* (Linnaeus).

***Portunus* (?) *vicksburgensis* sp. nov.**

Description of holotype.—The specimen is a black carapace whose sides and rear are missing. The chelae are incomplete at proximal ends.

Frontal margin bears four teeth exclusive of the inner supraorbital teeth and is much advanced beyond the orbits. The frontal teeth are slender but end bluntly. The inner teeth point forward and slightly outward; the outer two teeth point forward and are less advanced. The interspaces between the teeth are broad and U-shaped. The orbits are small, only about one-third of the interorbital width. At the inner angle of the orbit there is a short, blunt tooth. The tooth at the outer angle of the orbit is missing in the specimen. The upper orbital margin recedes in semicircular outline between the inner orbital and a short, blunt supraorbital tooth and is interrupted by a fissure, which is near the supraorbital tooth. Fronto-lateral margins are incomplete in this specimen. At the left side there are four slender pointed teeth of equal size; a fifth tooth is indicated but largely broken off. Apparently there were more than five, possibly as many as eight, teeth on the fronto-lateral margins. The interspaces between the teeth are wide and U-shaped.

Carapace gently arched. The different regions are shown as low swellings. Proto-gastric regions are low, broad swellings separated from each other by a shallow groove that runs to the frontal margin. A transverse gastric ridge is barely indicated. Mesogastric and metagastric regions are covered by a more pronounced, well defined, and continuous swelling which is higher near the front. This swelling carries on the rear slope two small pits situated near the mid-line and only 2 mm. apart from each other. There is a low, ill-defined ridge that probably starts at the missing lateral tooth of the carapace, runs inward and forward, and becoming more pronounced, bends gradually backward to a point just behind the broadest part of the mesogastric region where it forms a large, broad tubercle. This tubercle is one of three blunt, conical tubercles which make an almost equilateral triangle. The second tubercle, the best defined of the three, is situated at the inner mesobranchial angle, and the third, the lowest, lies outward and forward of the second one in the mesobranchial region. Hepatic region occupied by a slight swelling. Epibranchial region is low and depressed. Branchio-cardiac grooves are deep near the mesogastric region, shallow and broad to the anterior.

Chelae unequal, stout, and finely granulate to smooth. Manus cylindrical to prismatic and swollen. There is a very low, medial, longitudinal ridge on the outer surface of the manus. This ridge disappears distally. Upper surface of manus flat and bounded by a low, longitudinal ridge on each side. These two ridges rise distally into elongate, low tubercles, of which the inner one is the higher. Lower margin of manus thick and rounded. Inner surface swollen and carrying a very low, medial, longitudinal ridge that flattens out distally. Fingers long and narrow.

Dactylus of left manus carries on its upper surface two rounded ridges that are separated by a rounded groove. A third rounded ridge is located on the outer surface. All these grooves and ridges extend only one-third of the length of the dactylus and disappear distally. Dactylus of right manus has the same ridges and grooves, but they are very broad and indistinct due to the larger size of the right dactylus. Prehensile edges of fingers armed with many small, unequal teeth. There is a large conical tooth near the base of the right dactylus. Imprint of part of the left carapace present in the rock matrix. It has a spine at the inner angle.

Description of paratype.—The specimen is a nearly complete interior mold of the carapace in limestone. Only the front of the original carapace is preserved.

Size smaller than the holotype. Lateral tooth of carapace extends outward and is much larger than the other marginal teeth. There are eight antero-lateral teeth including the postorbital and lateral teeth. Postorbital tooth very similar to the other antero-lateral teeth and separated from the adjoining supraorbital tooth by a fissure. Supraorbital tooth about one-half as long as the postorbital tooth.

Areolations of the carapace more pronounced than in the holotype. Proto-gastric regions carry a narrow and blunt transverse ridge. Cardiac region high, with two transverse tubercles lying near the frontal part of the cardiac region.

Dimensions.—Holotype: interorbital width, 15.5 mm.; width of orbits, 5 mm.?²; length from base of frontal teeth to urogastric region, 29 mm.; height of right manus at distal end, 17.6 mm.; height of left manus at distal end, 14 mm.; greatest known thickness of right manus, 12.7 mm.; length of left fixed finger, 18 mm. to broken tip, probably 19 mm. in complete state. Paratype: interorbital width, 10.4 mm.; width of orbits, ± 3 mm.; length from base of frontal teeth to urogastric region, 20.4 mm.; width of carapace to base of lateral spines, 48 mm.

Localities.—Banks of Mint Spring Bayou, just south of the wall of the National Military Cemetery, in Vicksburg, Warren, Mississippi, above the waterfall and about 100 feet below the lower street bridge over this creek (holotype). In cut of Illinois Central Railroad, 2 miles southeast of depot at Plain, Rankin County, Mississippi (paratype).

Horizon.—Lower Oligocene, Vicksburg group.

Types.—Holotype and paratype are in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

Diagnosis.—In some features of carapace ornamentation *Portunites triangulum* Rathbun¹⁷ is very similar to this species. These similarities are the low, ill-defined ridge that runs from the lateral tooth to near the mesogastric region, the three tubercles that form an almost equilateral triangle near the branchial angle, and the two pits on the meogastric swelling. However, *Portunus vicksburgensis* lacks other, small tubercles that are on the carapace of *P. triangulum*.

¹⁷ Rathbun, Mary J., The fossil stalk-eyed Crustacea of the Pacific slope of North America: U. S. Nat. Mus., Bull. 138:68-71, pl. 17, figs. 3-6, 1926.

These similarities to *Portunites triangulum* set the new species apart from all other American fossil *Portunus* species. The presence of only 8 anterolateral teeth is unusual for the genus. It is not certain whether this feature is constant in the species and it is best to await the finding of better preserved specimens before one may rely on this feature.

Tribe ANOMURA
Superfamily THALASSINIDEA
Family Callianassidae
Genus *Callianassa* Leach 1814

Leach, Edin. Encyc., 7:400, 1814.

Genotype.—*Callianassa subterranea* (Montagu).

Key to the species of *Callianassa*
from the Middle Eocene of Texas and Mississippi
based on the left manus

- A1. Lower margin of manus thick and rounded, no ridge or raised line; inner and outer surface of manus of equal convexity.....*C. burlesonensis* sp. nov.
Basal Crockett formation, Texas
- A2. Lower margin of manus sharp, with raised line or ridge; inner and outer surfaces of unequal convexities
- B1. Manus much longer than high
- C1. Sharp raised ridge extending from outer and upper edge of fixed finger onto outer surface of manus; proximal end slants obliquely upward and proximally; pits of row on inner surface below upper margin slit-like and ventral*C. brazosensis* Stenzel
Lower Crockett formation, Texas
- C2. No sharp raised ridge on fixed finger or outer surface of manus; proximal end vertical; pits of row on inner surface below upper margin round
- D1. Upper and lower margins converging distally; interdigital sinus narrow*C. wechesensis* Stenzel
Weches glauconite of Texas and Enterprise glauconite of Miss.
- D2. Upper and lower margins very nearly parallel; interdigital sinus wide*C. gamma* sp. nov.
Enterprise glauconite of Mississippi
- B2. Manus very nearly as high as it is long
- C1. Proximal end vertical; hair pits on inner surface along lower margin slit-like; granules between these pits obsolete; interdigital sinus without tubercles*C. beta* sp. nov.
Enterprise glauconite of Mississippi
- C2. Proximal end oblique upward and distally; hair pits on inner surface along lower margin round; granules between these pits prominent; interdigital sinus with tubercles on both sides.....*C. alpha* sp. nov.
Enterprise glauconite of Mississippi

Callianassa burlesonensis¹⁸ sp. nov.

Description of holotype.—The holotype is a large (male?) left manus whose proximal end is somewhat weathered. The manus is nearly twice as long as it is high. The proximal end seems to have an acute angle with the upper margin and an obtuse one with the lower margin. Except for the ends which are bent down, the upper margin is nearly straight in outline but with a slight concavity near the distal end. Lower margin conspicuously convex in longitudinal outline. Inner and outer surface equally inflated so that it is impossible to distinguish one from the other by their convexities. Cross section through the middle of manus evenly oval, because the upper and lower margins are both blunt to evenly rounded. Both surfaces are free of tubercles. But both surfaces have a zone of very subdued granulation parallel to the lower margin and about one-third of the height of the manus removed from the lower margin. Along the upper margin are two longitudinal rows of large pits; one containing 9 pits is located at the crest of the margin; another containing 11 pits is located one-half millimeter below the crest on the inner surface. This row bends down a little distally and becomes slightly irregular at the distal end. The inner surface has a solitary slit-like pit at the edge of the dactylus articulation one-third of the height removed from the upper distal point, and two pits in a short horizontal row in the middle of the distal third of the manus. There are four pits in a row through the middle of the inner surface of the fixed finger and the adjoining palm surface. The crest of the lower margin carries 21 tubercles, 16 on the palm and 5 on the fixed finger. The outer surface carries 12 pits in a longitudinal row about one millimeter above the lower margin, 10 on the palm and 2 on the fixed finger. A row of 8 pits extends through the entire length of the palm on the outer surface at about two-fifths of its height. There are two pits at the edge of the dactylus articulation. The occludent margin of the fixed finger has a ridge studded with crowded granules that is accompanied by a row of pits at each side. Each row has three pits on the preserved part of the finger. There is one more solitary pit on the outer surface of the fixed finger.

Description of paratype.—This is a small (female?) right manus, five-sevenths of the size of the holotype. The paratype is closely similar to the holotype even in the number of pits in each row as far as this is ascertainable. The well preserved proximal end of the manus slants as indicated for the holotype.

Dimensions.—Holotype: length of manus to interdigital sinus, 13 mm., greatest height, 8.2 mm.; height at distal end, 6.8 mm.; greatest thickness, 4.6 mm. Paratype: length of manus to interdigital sinus, 11.1 mm.; height at distal end, 5.1 mm.; greatest thickness, 3.2 mm.

Type locality.—Stone City, on right bank of Brazos River and below the bridges, Burleson County, Texas.

Horizon.—Middle Eocene, lower Claiborne group, Crockett formation, bed (ad) of Stone City section.

Types.—Holotype and paratype in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

¹⁸ Specific name taken from the type locality in Burleson County.

Callianassa alpha sp. nov.

Callianassa wechesensis Stenzel, Decapod crustaceans from the Middle Eocene of Texas. *J. Paleont.* 8(1):55, pl. 7, fig. 4b, 1934. Paratype 3 only.

Description of holotype, left manus.—The manus is approximately as long as it is high. Proximal end makes an obtuse angle with the upper margin and an acute angle with the lower margin. Upper margin nearly straight, descending very slightly at the distal end, and making a simple, inconspicuous, rounded lobe at the proximal end. This lobe is broken in the holotype. Lower margin is obliquely turned inward and sigmoidal in outline, in general ascending distally and making proximally a conspicuous, rounded lobe, which is produced backward beyond the line of the manus-carpus articulation. Outer surface evenly convex from top to bottom. Inner surface gently convex in the middle of the manus, concave below at a line about three-tenths of the total height removed from the lower margin, and very gently convex again within the lower three-tenths of the height of the manus. Both outer and inner surfaces equally little convex from end to end. Outer surface weathered in the middle. Therefore, no ornamentation is noted there. Outside of the weathered area there are no tubercles except near the interdigital sinus. Near the interdigital sinus there is a group of about 23 low rounded tubercles on the outside surface. Inner surface very well preserved and free of tubercles except at the interdigital sinus. This place is occupied by a crescentic group of about 36 elliptical to rounded tubercles. The prongs of the crescentic group ascend toward the fingers, the one prong merges with the granules at the edge of the aperture for articulation of the dactylus, the other prong ascends the fixed finger, which is broken off near its base. Lower margin of manus densely beaded to serrate. Between the beads are small, distally pointing hair pits. The average distance from bead to bead is 0.42 mm. One-half mm. above the lower margin and parallel to it on the outside surface there are 5 small hair pits. The average distance from pit to pit is 1.4 mm. Upper margin bears a fine, longitudinal ridge over its entire length. Immediately adjoining the ridge on the inner surface there are several, probably 9, fine, distally pointing hair pits. These pits are widely spaced, their average distance being 1.08 mm. Immediately adjoining the upper ridge on the outside surface there are several, probably 7, small pits or hair sockets. They are 1.3 mm. apart as an average. Fixed finger rather slender as far as it is preserved. Dactylus apparently rather bulky at its base to judge from the orifice of its joint. Interdigital sinus rounded and wide.

Description of paratype, left manus.—This rather weathered specimen is much larger than the holotype. It is very similar, differing only in the more pronounced inward flare of the lower margin especially at its proximal end. Therefore, the inner surface of the manus is strongly concave just above the lower margin.

Dimensions.—Holotype, left manus: length to the interdigital sinus, 10.7 mm.; height at proximal end, 10.5 mm.; height at distal end, 9.4 mm.; greatest thickness of manus, 4.2 mm. Paratype, left manus: length to interdigital sinus, 14.4 mm.; height at proximal end, 13.3 mm.; height at distal end, 12.8 mm.; greatest thickness, 5.3 mm.

Localities.—On right bank of Chickasawhay River, 0.2 mile below the steel bridge at Enterprise, Clarke County, Mississippi (type locality, holotype and paratype). On outlier of Weches formation in Mrs. Louisa Gamble 176-acre tract, Joshua Townsend Survey, on Marquez-Flynn mail route, 5.75 miles east of Marquez, Leon County, Texas.

Horizon.—Middle Eocene, lower Claiborne group; in Mississippi in the Enterprise glauconite marl of E. N. Lowe¹⁹ at the base of the Winona formation of C. W. Cooke;²⁰ in Texas in the Weches formation.

Types.—Holotypes and one paratype from the type locality in Mississippi and one paratype from the Texas locality in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

***Callianassa beta* sp. nov.**

Description of monotype, left manus.—The manus is approximately as long as it is high. Proximal end makes a right angle with both, upper and lower, margins. Upper margin gently convex, descending toward the distal end and making a simple, inconspicuous, rounded lobe at the proximal corner. Lower margin very slightly sigmoidal in outline, ascending toward the distal end and making proximally a simple, fair-sized, rounded lobe which is produced backward but a little beyond the line of the manus-carpus articulation. This lower lobe is produced backward not more than the upper lobe. Outer surface evenly convex from top to bottom. Inner surface gently convex in the upper two-thirds of the height of the manus and gently concave in the lower one-third of the manus. Both surfaces equally little convex from end to end. Outer and inner surfaces smooth and free of tubercles even at the interdigital sinus. Lower margin of manus sharp and broken by widely-spaced, much elongate to slit-like, hair pits. These pits are 1.02 mm. apart as an average and there are 13 pits on the preserved part of the margin. Between the pits the margin is only very slightly raised, not producing any serration or beading of note. One half mm. above the lower margin and parallel to it on the outer surface there are 7 small, irregularly spaced hair pits, average distance from pit to pit being 1.2 mm. Upper margin sharp over its entire length. Immediately adjoining the upper margin on the inner surface are several, probably 11, small, round hair pits, average distance from pit to pit 1.02 mm. Immediately adjoining the upper margin on the outer surface are 5 oblong pits that are as an average 2.33 mm. apart.

Dactylus missing and fixed finger broken near the base. Dactylus apparently was much heavier than the fixed finger. Interdigital sinus rounded and broad.

Dimensions.—Monotype, left manus: length up to interdigital sinus, 12

¹⁹ Lowe, E. N., Mississippi, its geology, geography, soil, and mineral resources: Miss. Geol. Surv., Bull. 12:76-78, 1915; and Bull. 14:77-79, 1919. The name Enterprise is preoccupied.

²⁰ Cooke, C. W., Correlation of the Eocene formations in Mississippi and Alabama: U. S. Geol. Surv., Prof. Pap. 140:135, 1926.

mm.; height at proximal end, 12.1 mm.; height at distal end, 10.4 mm.; greatest thickness, 4.7 mm.

Type locality.—On right bank of Chickasawhay River, 0.3 mile below the steel bridge at Enterprise, Clarke County, Mississippi.

Horizon.—Middle Eocene, lower Claiborne group, Enterprise glauconite marl at the base of the Winona formation.

Type.—Monotype in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

***Callianassa gamma* sp. nov.**

Description of holotype, left manus.—The manus is one-fourth longer than high. Proximal end makes a right angle with both, upper and lower, margins. Upper margin straight for the proximal half of length; farther on gently descending and rising again to form a slight hump at the distal end. This hump is very little lower than the proximal half of the upper margin. There is a small, inconspicuous, rounded lobe at the proximal upper corner. Lower margin slightly sigmoidal in outline, in general ascending distally, and making proximally a fair-sized rounded lobe which is produced backward very little more than the upper lobe. Outer surface evenly convex from top to bottom. Inner surface nearly as much convex as outer surface. Inner surface has a slight concavity in the distal part, one-fourth of the height of the manus removed from the lower margin. Both surfaces subparallel from front to back, the outer a little convex, the inner nearly straight. Inner surface smooth and free of tubercles. Outer surface smooth except for the low place near the interdigital sinus. This place is occupied by about 40 crowded, low, small, rounded tubercles. Lower margin of manus defined by a fine, sharply raised ridge that is smooth to the outer surface and serrate to the inner surface. The ridge disappears proximally at the lower proximal corner lobe. Serration of the ridge is produced by deeply set, round to slightly oblong, pits. There are 17 such pits and interposed serrae preserved, their average being 0.56 mm. In the groove that separates the marginal ridge from the outer surface there are some small, round hair pits. Their number is probably 7 and their average distance 1.2 mm. Upper margin sharp along the proximal half of its length, bluntly rounded along the distal end. Immediately adjoining the upper margin there are on the outer surface three small, round hair pits, as an average 4.1 mm. apart. Immediately adjoining the upper margin on the inner surface there are 10 small, round pits that are more narrowly spaced at the proximal end, their average distance from each other being 1.7 mm. at the distal end and .97 mm. at the proximal end. Aside from the pits mentioned above there are 5 pits arranged around the edge of the orifice for the insertion of the dactylus. Of these five, three are on the inner surface and two on the outer surface. Fixed finger broken below the base. Interdigital sinus rounded but incomplete, probably wide originally.

Description of paratype 2, left manus.—This specimen had a complete fixed finger whose tip broke off before the specimen was photographed. Fixed finger slender, evenly curved, and gently tapering, rounded triangular in cross

section. Occludent surface smooth and toothless. Lower margin of fixed finger is rounded and the ridge of the lower margin of the manus disappears toward the base of the fixed finger. There are 8 pits on the inner surface of the fixed finger above the lower margin. These pits are a continuation of the row on the manus but become very widely spaced at the distal end. There are 3 widely spaced pits in the outer surface of the fixed finger in continuation of the corresponding row on the manus. There are 4 pits on the rounded ridge that extends from the interdigital sinus to the tip and separates the occludent from the outer surface. There is a solitary pit near the tip on the ridge that extends from the interdigital sinus to the tip and separates the occludent from the inner surface. The orifice for insertion of the dactylus indicates a rather bulky base of the dactylus.

Dimensions.—Holotype, left manus: length up to interdigital sinus, 13 mm.; height at proximal end, 10.7 mm.; height at distal end, 10 mm.; greatest thickness, 4.6 mm. Paratype, left manus: height at proximal end, 11 mm.; height at distal end, 10.7 mm.; greatest thickness, 4.7 mm.; length of fixed finger, 6.5 mm (1 mm. for worn tip).

Type locality.—On right bank of Chickasawhay River, 0.3 mile below the steel bridge at Enterprise, Clarke County, Mississippi.

Horizon.—Middle Eocene, lower Claiborne group, Enterprise glauconite marl at the base of the Winona formation.

Types.—Holotype and two paratypes in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

Callianassa wechesensis Stenzel

Callianassa wechesensis, H. B. Stenzel, Decapod crustaceans from the Middle Eocene of Texas, J. Paleont. 8(1):55, pl. 6, fig. 4a, 1934.

Description of figured specimen (1), left manus.—The manus is one-eighth longer than wide. Proximal end makes a right angle with both, upper and lower, margins. Upper margin gently curved and descending distally and making a small, inconspicuous, simple, rounded lobe at its proximal end. Lower margin ascending distally in a gently convex curve as a whole more convex than in *Callianassa gamma*. Margin has a slight concavity below the base of the fixed finger. At the proximal end of the lower margin there is a small, simple, rounded lobe, that is produced backward. This lower lobe is only very slightly larger than the upper lobe. Outer surface convex from top to bottom. Inner surface gently convex, but with a gently concave longitudinal dell, one-fourth to one-third of the height of the manus removed from the lower margin. Both surfaces subparallel from front to back and nearly straight. Inner surface bears tubercles only in one belt. This belt extends from the interdigital sinus through the concave dell, on its upper slope, to within 1.5 mm. from the manus-carpus joint. The tubercles of this belt are low, rounded, and scattered. They number about from 50 to 60. Outer surface bears merely a few low, rounded tubercles at the interdigital sinus. Lower margin of manus defined by a fine, sharply raised ridge that is smooth

to the outer surface and merely slightly denticulate to the inner surface. The ridge disappears proximally at the lower proximal corner lobe and distally near the base of the fixed finger. Denticulation of the ridge is produced by oblong to slit-like, forward pointing hair pits. There are 13 such pits and interposed denticulations preserved; originally they were probably about 17 in number. They are as an average 0.63 mm. apart. In the groove that separates the lower marginal ridge from the outer surface there are 4 to 9 indistinct pits preserved, their average distance being .56 mm. Upper margin of manus sharp for the proximal two-thirds of its length, bluntly rounded beyond. Hair pits to both sides of this margin probably like in preceding species but very indistinct due to the preservation of this specimen. Pits around orifice for the insertion of the dactylus same as in the last described species. Fixed finger essentially like in last species.

Description of specimen (2), right manus.—The two right manus specimens (2) and (3) are very similar to specimen (1) in many of their features. The semblance is such that the writer does not hesitate to assign them to the same species.

The manus of specimen (2) has the same shape as in the first. The ornamentation differs only in the following feature: There are no tubercles on the inner surface of the manus. The tubercles on the outer surface are like in specimen (1). The arrangement of the hair pits is also the same in all essential features although the number of pits is possibly not exactly the same. There are 22 pits along the lower margin of the manus on the inner surface and 5 in direct prolongation of this row on the fixed finger. The 22 pits have an average distance of 0.46 mm. between them. There are 5 pits along the lower margin of the manus on its outer surface and 1 pit in the prolongation of this row on the fixed finger. The 5 pits have an average distance of 1.73 mm. between them. There are 15 pits along the upper margin of the manus on its inner surface and their distance is 0.66 mm. There are 4 pits along the upper margin of the manus on its outer surface and they are 2.2 mm. apart as an average. The 5 pits around the orifice for the insertion of the dactylus are the same as in all other *Callinassa* specimens described here.

The fixed finger of this paratype differs from the fixed finger of specimen (1). It is much shorter and therefore stouter for its length and bears a low ridge-like tooth near the point on its outer upper margin. Along this same margin on the outer surface of the fixed finger there are 4 pits. The other pits of the fixed finger have been mentioned already.

Dimensions.—Figured specimen (1), left manus: length of manus up to interdigital sinus, 11.7 mm.; height at proximal end, 10.4 mm.; height at distal end, 9 mm.; greatest thickness, 4.3 mm.; length of fixed finger, 6.5 mm. Specimen (2), right manus: length of manus up to interdigital sinus, 10.3 mm.; height at proximal end, 8.7 mm.; height at distal end, 8 mm.; greatest thickness, 3.6 mm.; length of fixed finger, 4 mm.

Localities.—On outlier of Weches formation in Mrs. Louisa Gamble 176-acre tract, Joshua Townsend Survey, on Marquez-Flynn mail route, 5.75 miles east of Marquez, Leon County, Texas (type locality). On right bank of

Chickasawhay River, 0.3 mile below the steel bridge at Enterprise, Clarke County, Mississippi.

Horizon.—Middle Eocene, lower Claiborne group; in Texas in the Weches formation; in Mississippi in the Enterprise glauconite marl at base of Winona formation.

Types.—Three specimens in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

Callianassa sp.

Description of monotype, right dactylus.—Axis of dactylus gently convex to the outside, tip turned down at a right angle. Cross section oval. Outer surface gently convex from base to tip, inner surface gently concave from base to tip and gently convex from top to bottom. There is an obscure, blunt, longitudinal ridge through the middle of the inner surface. Occludent edge bears three teeth or tubercles. The first is the largest. It is high with nearly vertical sides and elongate in the direction of the occludent edge. The second tooth is the smallest and adjoins the first distally; it is bluntly conical. The third is intermediate in size, oblong in direction of the occludent edge, and steep. From this third tooth extends a sharp ridge in distal direction disappearing toward the tip. On the outer surface and along the proximal half of upper margin there are 4 round pits. A solitary pit in the center and two near the upper distal margin of the inside surface. There are 11 pits along the upper margin.

Dimensions.—Length, 16.2 mm.; greatest thickness near base, 4.0 mm.; height at and including the large tooth, 6.6 mm.

Locality.—On right bank of Chickasawhay River, 0.3 mile below the steel bridge at Enterprise, Clarke County, Mississippi.

Horizon.—Middle Eocene, lower Claiborne group, Enterprise glauconite marl at base of Winona formation.

Type.—The figured specimen is in the writer's collection at the Bureau of Economic Geology, Austin, Texas.

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AUSTIN, TEXAS.

PLATE 14

FIGURES

- 1-2. *Lobonotus natchitochensis* sp. nov., internal mold of carapace, monotype, fig. 1 x1.88, fig. 2 x3.01 and illuminated from lower right to bring out the margin of the left eye.
- 3-4. *Lobonotus brazosensis* sp. nov., right manus and carpus, monotype, dorsal and frontal views, x3.06 and x3.15.
- 5-6. *Portunus(?) vicksburgensis* sp. nov., holotype, dorsal and frontal views, x1.09 and 1.03.

PLATE 15

FIGURES

- 1-2. *Callianassa alpha* sp. nov., left manus, holotype, inner and outer views.
- 3-3. *Callianassa beta* sp. nov., left manus, monotype, inner and outer views.
- 5-6. *Callianassa gamma* sp. nov., left manus, holotype, inner and outer views.
- 7-8. *Callianassa alpha* sp. nov., left manus, paratype, inner and outer views.
- 9-10. *Callianassa wechesensis* Stenzel, left manus, specimen 1, inner and outer views.
- 11-12. *Callianassa wechesensis* Stenzel, right manus, specimen 2, inner and outer views. All figures are x1.98.

PLATE 16

FIGURES

- 1-2. *Callianassa burlesonensis* sp. nov., right manus, paratype, outer and inner views, x 3.15 and 3.06.
- 3-4. *Callianassa burlesonensis* sp. nov., left manus, holotype, inner and outer views, x 3.15 and 3.06.
5. *Callianassa gamma* sp. nov., left manus, paratype 2, outer view, x 1.98.
- 6-7. *Callianassa* sp., right dactylus, outer and inner views, x 1.98.

PLATE 14

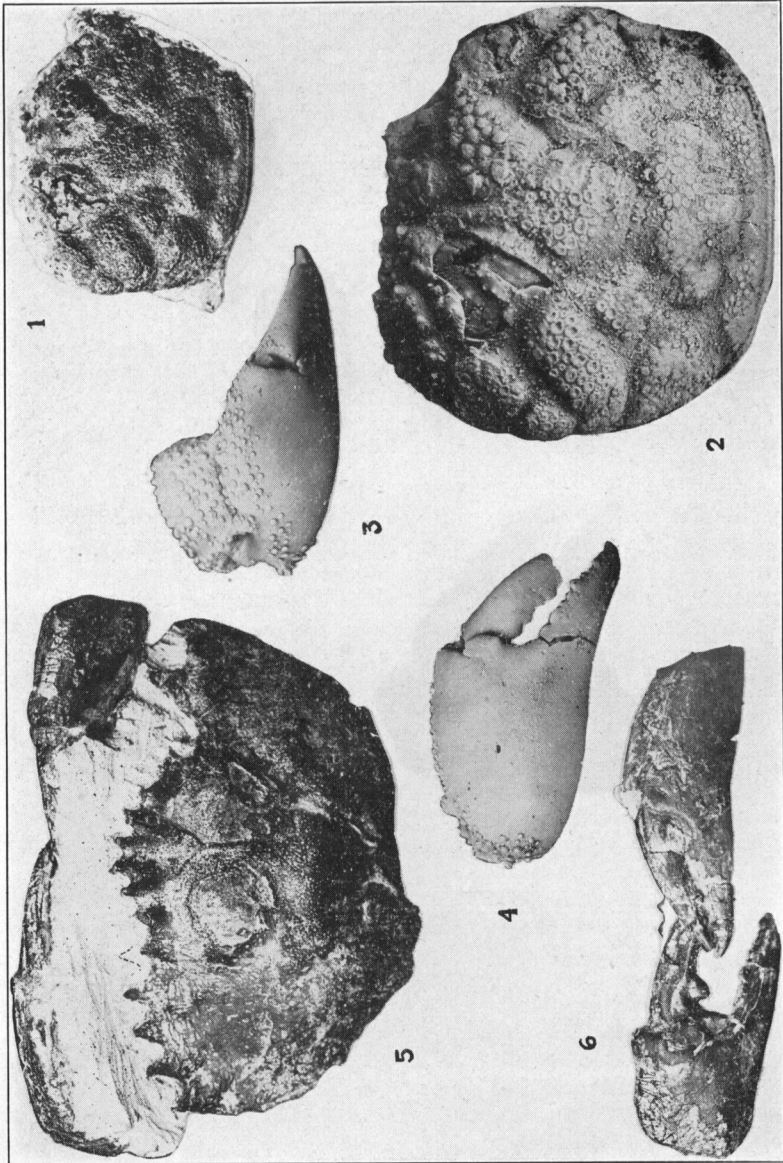


PLATE 15

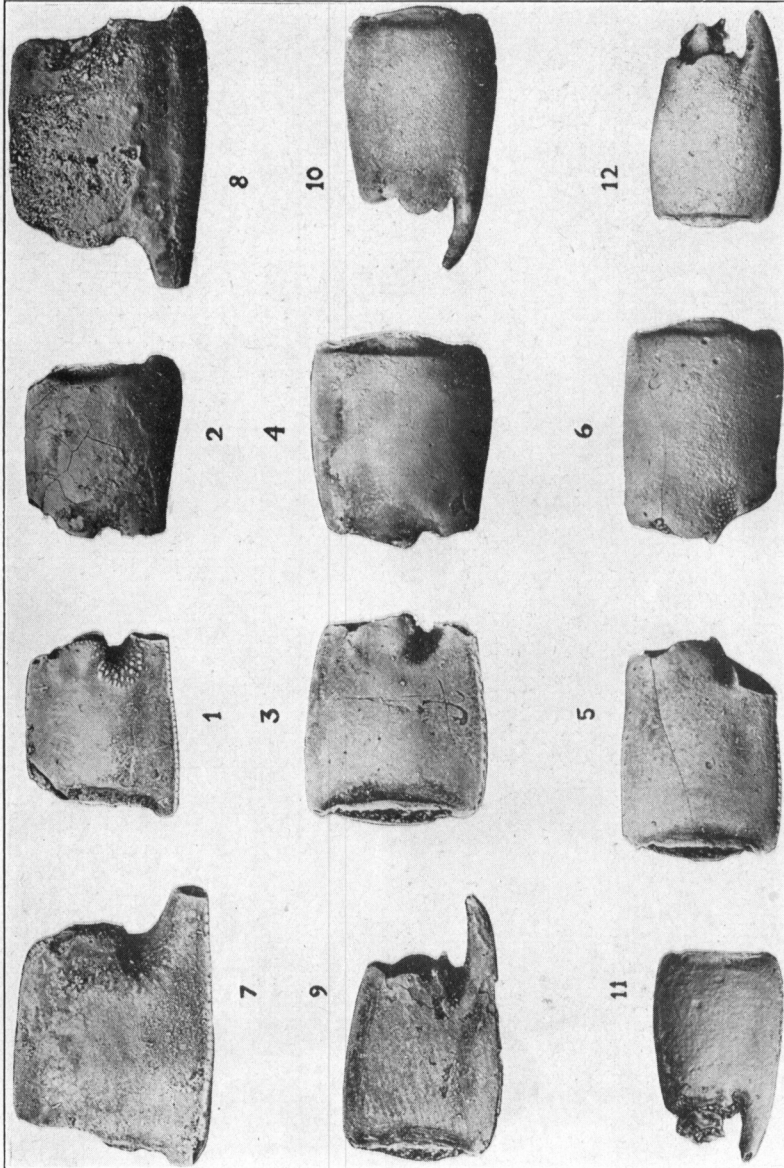


PLATE 16

