

Within the last few years, it has been proved that the occurrence of the remains of fishes in many of the western groups of rocks, is by no means rare. In the Clinton group at the base of the Upper Silurian, as developed in the Lake Superior district, we have detected markings similar to those in the same group in New York, made by some vertebrated animal, probably a fish. Mr. Joseph Sullivant has observed the remains of fishes consisting of teeth, scales and fins in numerous instances in the Cliff limestone of Columbus, (Upper Silurian,) and Prof. Agassiz, in a recent visit to the quarries, was enabled to collect numerous specimens, and we may hope, ere long, to receive exact information as to the character of these ancient species.

Dr. Norwood found a well-preserved jaw in the same group, at Madison, Ia. Messrs. Whittlesey and Brainard of Cleveland have brought to light well-preserved specimens from the Devonian, or perhaps sub-carboniferous system of Northern Ohio; while at Zanesville and Cambridge, we have indisputable evidence of their occurrence in the true carboniferous.

4. *Sulphate and Carbonate of Copper of Bristol, Conn.*—On page 222 we failed to state that the copper ore contains both sulphuric and carbonic acids, but the fact of their chemical combination remains in doubt.

III. ZOOLOGY.

1. *On the Classification of the Crustacea Grapsoidea*; by JAMES D. DANA.—The GRAPSOIDEA, in the system here explained, correspond to the Cyclometopa of Edwards, excepting that we separate the Telphusa, group and place it with the Cancroidea.*

A few of the species have the fourth joint of the outer maxillipeds articulated by the inner angle with the third, as in the Cancroidea: of these we make the family GONOPLACIDÆ, or the GRAPSOIDEA CANCRIDICA.

In all the other species, this articulation is remote from the inner angle, being either near the middle of the apical margin or at the outer angle. The near universality of this character among the Grapsoidea is proof of its importance, and sustains us in removing from along side of the Gonoplacidae the Macrophthalmi.

The Macrophthalmus and Ocypod groups are closely related, and with Doto make our *second* family the MACROPHTHALMIDÆ,—characterized by the great length of the eye-peduncles, the very narrow front, and the 2nd joint of the male abdomen narrower than the corresponding part of the sternum.

The GRAPSUS family—the third has the same limits as in the system of Milne Edwards. The form is subquadrate, with the lateral margin anteriorly more or less acute; the front broad; the eyes of moderate length or short; the second joint of the male abdomen usually not narrower than the corresponding part of the sternum. We give more importance than has hitherto been done to the fact of the outer maxillipeds having an oblique piliferous crest on the surface or not; and we make this characteristic the basis of a subdivision of the Grapsidæ (exclusive of the Plagusinæ) into the subfamilies *Grapsinæ* and *Sesarminæ*,

* This volume, p. 130.

the former characterized by the absence of this crest. A survey of the groups will at once show, we believe, that we follow natural lines in this subdivision. The *Plagusinae* are distinguished by longitudinal sinuses in the front of the carapax for the inner antennæ.

The family GECARCINIDÆ—the fourth—is the same in limits as the “Gecarciniens” of Edwards,—the species are remarkable for their thick obese forms, high rounded front and antero-lateral margin, and for having the second joint of the male abdomen but slightly narrower than the corresponding part of the sternum.

The family PINNOTHERIDÆ—the fifth—differs from the “Pinnotheriens” of Edwards in the removal of the genus *Doto*, closely related to *Ocypod*, and also the genus *Myctiris*, an aberrant form between *Pinnothera*, *Doto* and *Helæcius*, but very peculiar in being narrow anteriorly, and having no distinct orbits for the retraction of the eyes. The genus *Myctiris* constitutes the last or sixth family MYCTIRIDÆ. In the *Pinnotheridæ*, the male abdomen is much narrower than the sternum behind, which character separates them from the *Gecarcinidæ*.

We do not believe in a properly lineal order in classification; yet the succession we have given to the families is a natural succession, as nearly as can be made. The *first*, *Gonoplacidæ*, link the *Grapsoidea* with the *Cancroidea*, and the genus *Eucrate* is very near *Eriphia* and *Panopæus* in form. The *second*, *Macrophthalmidæ*, is closely allied to the first, so much so that *Macrophthalmus* and *Gonoplax* have been arranged in the same group. The *third*, *Grapsidæ*, are again very near the *Macrophthalmidæ*, and the genus *Helice* is almost as correctly placed with one as the other. Thence the transition is as gradual also to the *fourth* or *Gecarcinidæ*, and from the fourth to the *fifth* or *Pinnotheridæ*, and from the fifth to the *sixth* or *Myctiridæ*. Still, there are other relations of somewhat less prominence which this order does not exhibit. That of *Elamena* to *Inachus* has long been recognized.

The *Gonoplacidæ* are placed in the *Cancer* group by DeHaan, who neglected the important distinction based on the male verges. The other genera, exclusive of *Pinnothera* and the species related, he divides into two groups, the *Ocypus* and *Grapsus* groups, the former having the fourth joint of the outer maxillipeds articulated with the outer angle of the third, and the latter, articulated with the middle of the apical margin;—a distinction difficult to carry out and dividing natural groups, as the *Gecarcinidæ*, *Grapsidæ*, &c. His genera of the *Ocypus* group, are, *Doto*, *Scopimera*, *Myctiris*, *Gelasimus*, *Macrophthalmus*, *Cleistostoma*, *Cardisoma*, *Chasmagnathus*, *Helice*, *Uca*, *Ocypoda*, *Acanthopus* (a division of *Plagusia*); those of the *GRAPSUS* group, are, *Gecarcinus*, *Philyra* (division of *Plagusia*), *Plagusia* (another division), *Grapsus*, *Trichopus*, *Eriocheir*, *Pachysoma*, *Goniopsis*, *Platynotus*, *Brachynotus*, *Nautilograpsus*, *Cyclograpsus*, and in his “*Decas Septima*,” published in 1849, he unites with the group, *Pinnotheres* and *Hymenosoma*.

We add a few words on the genera of GRAPSIDÆ. Both De Haan* and Randall† have divided the *Grapsus* of authors into two genera, according to the *short* or *oblong* form of the third joint of the outer max-

* Faun. Japon., p. 33, 1833.

† Jour. Acad. Nat. Sci., Philad., viii, 124, 126.

illipeds. The former are De Haan's *Grapsi*, and Randall's *Pachygrapsi*; the latter De Haan's *Goniopses* and Randall's *Grapsi*. But the length of this joint, as we have shown in many other cases, is a characteristic of small importance, and such a basis for subdivision is therefore wrong. There are two natural groups; one with arcuate sides, like *G. pictus*, and the other with straight sides like *G. cruentatus* and *G. messor*; and in each, this joint may be short or oblong. *G. variegatus*, like *G. pictus*, has the joint oblong; yet a species every way similar and hitherto referred to the *variegatus* has the same joint not longer than broad.* We hence reject this subdivision and adopt two others, viz: *Grapsus*, having arcuate sides, and *Goniograpsus*, having straight sides. The latter forms the transition to *Sesarma* and *G. cruentatus* is like the *Sesarmæ* in habit.

The genus *Cyclograpsus* of Edwards is characterized by its author as having a piliferous crest on the outer maxillipeds, though exceptions are admitted. Subsequently, M'Leay made his genus *Gnathochasmus* on the same type. Some recent authors have taken M'Leay's name for these typical species and restricted *Cyclograpsus* to the exceptions. We find no authority in the rules laid down by the British Association, or in the nature of the case, for thus perverting *Cyclograpsus* from its true type as first established, and we therefore make *Gnathochasmus* a synonym of it, and adopt a new name for the species without the piliferous crest. This we believe is due to M. Edwards.

The following is a synopsis of the Families, Subfamilies and Genera of Grapsoidea:—

CRUSTACEA GRAPSOIDEA.

1. ARTICULUS MAXILLIPEDIS EXTERNI 4TUS ANGULO 3TII INTERNO ARTICULATUS.

FAM. I. GONOPLACIDÆ.

Carapax transversus. Frons quartâ parte latitudinis carapacis longior, paulo deflexus, lamellatus. Antennæ internæ transversæ. Articulus abdominis maris 2dus sterno contiguo angustior.

G. 1. EUCRATE, *De Haan*.†—Carapax antice arcuatus, parce declivis, *Panopæo* formâ antennisque affinis. Appendices maris sexuales e sterno ortæ abdomineque tectæ. Pedes maris antiqui breves, crassi. Oculi breves. Abdomen maris 5-articulatum, versus basin sterno contiguo vix angustius.

G. 2. CURTONOTUS, *De Haan*.‡—Carapax antice arcuatus, parce declivis, margine antero-laterali rotundato. Appendices maris sexuales e basi pedum ortæ, in canaliculo sterni ductæ, deinde abdomine tectæ. Oculi breves. Pedes maris antiqui prælongi.

* The species referred to is one from Valparaiso. The *G. variegatus*, according to its description by Edwards, and the figure by Guérin, has the joint quite oblong. The Valparaiso species, which we name the *Grapsus planifrons*, has this joint no longer than broad.

† Crust. Faun. Japon., p. 36. *Geryon*, Krøyer, Tidskrift, i, (1837,) p. 15, pl. 1.

‡ De Haan, Crust. Faun. Japon., p. 20. *Pseudorhombila*, Edwards, Crust. ii, 58.

G. 3. GONOPLAX, *Leach*.—Carapax latus, trapezoidalis, antice elongatè transversus, angulis anticis acutis. Appendicibus *maris* sexualibus *Curtonoto* affinis. Oculi longi. Pedes *maris* antici prælongi.

2. ARTICULUS MAXILLIPEDIS EXTERNI 4TUS ANGULO 3TII INTERNO NON ARTICULATUS.

FAM. II. MACROPHTHALMIDÆ.

Oculi tertiâ parte latitudinis carapacis non breviores. Carapax subquadratus, sæpissimè transversus, antice latissimus, angulis anticis acutis, lateribus non arcuatis. Antennæ internæ sive transversæ sive longitudinales. Articulus abdominis *maris* 2dus sterno contiguo angustior. Articulus maxillipedis 3tius costâ obliquâ piliferâ nunquam ornatus.

1. MACROPHTHALMINÆ.—Antennæ internæ transversæ, sub fronte insitæ. Antennæ externæ basi frontem appressæ. Articulus maxillipedis externi 4tus apertus.

G. 1. CLEISTOSTOMA, *DeH.**—Carapax subquadratus, paulo transversus. Frons quartâ parte latitudinis carapacis vix brevior. Oculi longiusculi. Pedes antici *maris* *feminæ* breves. Articulus maxillipedis externi 3tius 2do vix minor, quadratus.

G. 2. MACROPHTHALMUS, *Latr.*—Carapax latus, transversim rectangularis. Frons angustissimus. Oculi longissimi. Articulus maxillipedis externi 3tius 2do multo minor.

2. OCYPODINÆ.—Antennæ internæ longitudinales, juxta frontem utrinque insitæ. Antennæ externæ fronte paulum remotæ. Articulus maxillipedis externi 4tus apertus, 3tius 2do minor.

1. Articulus maxillipedis externi 2dus 3tio valde major.

G. 1. GELASIMUS, *Latr.*—Oculi graciles, corneâ parvulâ, parce oblongâ. Pedes *maris* antici portentose inæqui. Manus minor debilis, digitis sæpissimè instar cochlearis excavatis aut spatulatis.

G. 2. HELÆCIUS, *Dana.†*—Oculis habituque *Gelasimo* affinis. Pedes antici subæqui. Abdomen versus basin sterno contiguo vix angustius. Maxillipedes externi sulco lineari fere longitudinali superficie notati.

G. 3. OCYPODA, *Fabr.*—Oculi crassi, corneâ longâ, fere ad pedunculi basin productâ. Pedes *maris* antici inæqui, minoris digitis acuminatis. Abdomen basi angustum. Carapax transversus.

2. Articulus maxillipedis externi 2dus 3tio parce major, non oblongus.

G. 4. SCOPIMERA, *† DeH.*—Corpus globoso-cubicum. Pedes *maris* antici subæqui, non crassi. Habitu *Gelasimo* affinis.

3. DOTINÆ.—Articuli maxillipedis externi 4tus et sequentes 3tio celati.

Genus Doto, *DeH.§*—Corpus subquadratum.

* Crust. Faun. Japon., p. 26.—From κλειστός, *shut*, and στόμα, *mouth*—not *Cleistotoma*.

† Includes *Gelasimus cordiformis*.

‡ Crust. Faun. Japon., p. 24.

§ Crust. Faun. Japon., p. 24.

FAM. III. GRAPSIDÆ.

Oculi tertiâ parte latitudinis carapacis breviores. Carapax subquadratus, sæpius depressus, lateribus aut rectis aut arcuatis. Antennæ internæ transversæ. Articulus abdominis *maris* 2dus sterno postico sæpius vix angustior. Articulus maxillipedis externi 3tius sive inornatus sive costâ obliquâ ornatus. Palatum lineâ elevatâ viæ efferentis limite instructum.

1. GRAPSINÆ.—Antennæ internæ fronte tectæ. Articulus maxillipedis externi 3tius costâ obliquâ in 2dum productâ non notatus.

1. *Maxillipedes externi vix hiantes.*

G 1. PSEUDOGRAPsus, *Edw.*—Articulus maxillipedis externi 3tius orbiculato-cordatus, aut subquadratus, 2do brevior. Frons dimidio latitudinis carapacis vix brevior. Carapax lateribus arcuatus.

G. 2. ERIOCHEIR, *DeH.**—Articulus maxillipedis externi 3tius uti in *Pseudograpso*. Frons dimidio latitudinis carapacis multo brevior. Carapax subpolygonatus.

G. 3. PLATYNOTUS, *De H.†*—Articulus maxillipedis externi 3tius 2do longior, margine postico valde obliquo.

G. 4. TRICHOPUS, *De H.‡*—Articulus maxillipedis externi 3tius latior quam longior, extus dilatatus. Pedum articuli 5tus 6tusque posticorum compressi denseque ciliati.

2. *Maxillipedes externi rhomboidicè hiantes.*

G. 5. GRAPSUS, *Lamk.*—Carapax transversim lineolatus, lateribus plus minusve arcuatis. Frons dimidio latitudinis carapacis brevior. Antennæ externæ juxta frontis latera oblique exsertæ. Tarsi spinulis armati.

G. 6. GONIOGRAPsus, *Dana.§*—Carapax transversim lineolatus. lateribus rectis, postice sæpe convergentibus. Frons dimidio latitudinis carapacis longior. Antennæ externæ sub frontis margine sæpius exsertæ. Tarsi spinulis armati.

* Faun. Japon., p. 32, 59.—The genus *Utica* of White, (*Ann. Mag. Nat. Hist.*, xx, 206, and *Crust. Voy. Samarang*, 52, pl. 13, fig. 6,) appears to have the essential characteristics of *Eriocheir*, and like *Eriocheir* differs but little from *Pseudograpsus*. The front is narrow, the form subpolygonal, and it lives like *E. Japonicus*, in fresh-water. The bushy hair on the hand of the Japan species is not necessarily a generic character. The name *Eriocheir* is therefore unfortunate, and it would be better for the science to substitute the name given by White.

The *E. penicillatus* of De Haan, (p. 60, pl. 11, f. 6,) appears to be a true *Pseudograpsus*.

† Faun. Jap., p. 34.

BRACHYNOTUS is the name of another genus by De Haan based on a Mediterranean species described by Risso, *Hist. Nat. de l'Eur. Merid.*, v, 13. The male abdomen is but 4-jointed, the female 7-jointed; 2d and 3d joints of the outer maxillipeds of equal length, and the 3d truncate at either extremity.

‡ Faun. Jap., p. 32.—*Varuna* of Edwards, *Crust.* ii, 94.

§ In part, *Goniopsis* of De Haan, *F. Jap.*, p. 33, and *Pachygrapsus* of Randall, *J. Acad. Nat. Sci., Philad.*, viii, 126.

G. 7. PLANES, *Leach*.*—Carapax non lineolatus, lævis, fere quadratus, parce oblongus. Frons rectus. Articulus maxillipedis externi 3tius latior quam longior, cordatus. Tarsi spinulis armati.

G. 8. HEMIGRAPsus, *Dana*.†—Carapax non lineolatus, fere lævis, lateribus plus minusve arcuatis. Frons rectus aut rectiusculus, antennis internis transversis. Articulus maxillipedis externi 3tius fere orbiculato-cordatus. Tarsi inermes.

G. 9. CYRTOGRAPsus, *Dana*.—Carapax gibbosus, subhexagonus non lineolatus. Frons sursum sinuosus, antennis internis obliquis, implicis frontis insitis. Articulus maxillipedis externi 3tius suborbiculato-cordatus. Tarsi inermes.

2. SESARMINÆ.—Antennæ internæ fronte tectæ. Articulus maxillipedis externi 3tius costâ obliquâ in 2dum productâ notatus.

1. *Articulus maxillipedis externi 3tius apice rotundatus.*

G. 1. SESARMA, *Say*.‡—Carapax quadratus, sæpe partim lineolatus, lateribus rectis, fronte rectè prærupto. Abdomen *maris* versus basin sterno contiguo vix angustius. Tarsi sæpe armati.

G. 2. SARMATIUM, *Dana*.—Carapax subquadratus, lateribus arcuatis, fronte curvatim declivi. Abdomen *maris* versus basin sterno contiguo vix angustius. Tarsi inermes.

2. *Articulus maxillipedis externi 3tius apice truncatus et sæpe excavatus.*

G. 3. CYCLOGRAPsus, *Edw*.§—Carapax lævis, medio planus, ad margines anteriores declivis, lateribus arcuatis, integris. Abdomen *maris* versus basin sterno contiguo vix angustius.

G. 4. CHASMAGNATHUS, *De H*.||—Carapax convexus, subquadratus, lateribus arcuatis et antice emarginatis, fronte curvatim declivi. Oculi breves. Abdomen *maris* versus basin sterno contiguo parce angustius.

G. 5. HELICE, *De H*.¶—Carapax quadratus, lateribus parallelis, rectis. Oculi longiusculi. Abdomen *maris* versus basin sterno contiguo multo angustius.

3. PLAGUSINÆ. Antennæ internæ sinubus frontis longitudinalibus apertæ.

G. 1. ACANTHOPUS, *De H*.**—Corpus valde depressum. Articulus maxillipedis externi 3tius oblongus, parvus, apice 2di multo angustior. Ramus maxillipedis 1mi internus apice angustus et not transversus.

* Mss. Mus. Brit.; the genus is recognized in Bowdich's "Madeira and Porto Santo," p. 151; and more lately in Bell's Brit. Crust., p. 133.—*Nautilograpsus* of Edwards, Crust. ii, 89.

† *Grapsus* (subgenus) of De Haan, F. Jap., p. 31; *Cyclograpsus*, in part, of Edwards, Crust. ii, 77.

‡ Jour. Acad. Nat. Sci., i, 76, 1817. *Pachysoma*, of De Haan, Faun. Japon., p. 33.

§ Crust. ii, 77.—*Gnathochasmus*, of M'Leay, Smith's Illust. Zool. S. Africa, and Cat. Crust. Brit. Mus. by A. White, 1847, 40.

¶ Faun. Japon., p. 27.

¶ Faun. Japon., p. 28.

** Faun. Japon., p. 29. Corresponds to *Plagusia clavimana*.

- G. 2. *PLAGUSIA*, Latr.*—Corpus minus depressum, crassius. Articulus maxillipedis externi 3tius apice 2di vix angustius, raro longior quam lator. Ramus maxillipedis 1mi internus apice transversus.

FAM. IV. GECARCINIDÆ.

Oculi breves. Carapax obesus, paulo transversus, antice latus, curvatim declivis, lateribus arcuatis poneque oculos large rotundatis, vix dentatis. Antennæ internæ transversæ. Articulus abdominis maris 2dus sterno contiguo vix angustior. Articulus maxillipedis externi 3tius costâ obliquâ piliferâ non ornatus. Palatum lineâ elevatâ viæ efferentis limite non instructum.

1. *UCAINÆ*. Articulus maxillipedis externi 4tus apertus.

1. *Maxillipedes externi non hiantes.*

- G. 1. *UCA*, Leach.—Articulus maxillipedis externi 4tus angulo 3tii externo insitus.

- G. 4. *GECARCINUCUS*, Edw.†—Articulus maxillipedis externi 4tus marginis medio apicalis 3tii insitus.

2. *Maxillipedes externi rhomboidicè hiantes.*

- G. 3. *CARDISOMA*, Latr.—Articulus maxillipedis externi 4tus apice 3tii externo insitus.

- G. 4. *GECARCOIDEA*, Edw.—Articulus maxillipedis externi 4tus marginis medio excavato apicalis 3tii insitus.

2. *GECARCININÆ*. Articuli maxillipedis externi 4tus et sequentes 3tio celatus.

- G. 1. *GECARCINUS*.

FAM. V. PINNOTHERIDÆ.

Oculi breves, orbitis insiti, raro non retractiles. Carapax sive obesus sive depressus, raro paulo oblongus et interdum parce rostratus, lateribus valde rotundatis. Antennæ internæ aut transversæ aut obliquæ. Abdomen maris angustum, versus basin sterno contiguo valde angustius. [Species omnes parvæ.]

2. *PINNOTHERINÆ*. Articulus maxillipedis externi 2dus parvulus aut obsoletus. Corpus sive obesum sive depressum.

* *Plagusia* and *Philyra* of De Haan, Faun. Japon., p. 31; the latter genus in his system including *Plagusia depressa* of authors, and the former the *P. squamosa*. The distinction between his two genera consists in this; the palpus of the outer maxillipeds in *Plagusia* has a flagellum, and that of *Philyra*, none. The name *Philyra* belongs to another genus of earlier date, instituted by Leach; moreover, the resemblance between the species of these groups is so close in other characters, that we hardly consider the distinction important as a generic character.

† Jacquemont's Voy. dans l'Inde, plate 1.



Dana, James Dwight. 1851. "On the classification of the Crustacea Grapsoidea." *The American journal of science and arts* 12, 283–290.

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