

*Hab.* 360 miles North-East of Sydney, New South Wales. Taken in the towing net on a calm day. The surface of the ocean appeared to be covered with them.

The appendix by Mr. Ralph Tate to Woodward's Manual of the Mollusca, 1875, 3rd edition, says that *Sinusigera*, D'Arbigny, *Cheletropis*, Forbes, is the fry of species belonging to the *Muricidæ*. He also states that the *Macgillivrayia* only comprises the larva forms of several species of *Dolium*; the fact is, that it is like a good many more things in Zoology not thoroughly worked out at the present time. There is one thing certain that the *Macgillivrayia* is operculated. I don't see that it can be placed with *Dolium*, a genus without operculum.

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#### THE ECHINI OF AUSTRALIA

(including those of the Chevert Expedition.)

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Ever since the publication of Prof. A. Agassiz's great work, "Revision of the Echini,\*" the determination of species has been a comparatively easy task. These singularly interesting organisms, whose forms vary as far as it is possible, while retaining a uniform type, have been but little understood until very lately. Even now much remains obscure about them, and their classification consequently is hardly a natural one. In past times this has led to misconception of characteristic features, and consequently a host of genera. Their different aspects at various stages of growth has also been little known, and this has led to an almost endless multiplication of species, and consequently a most disheartening amount of synonyms. Prof. Agassiz has remedied much of this. Carefully studying each species within his reach, especially in its various stages of growth, he has made himself thoroughly acquainted with the limits within which

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\*Printed for the American Government in 1873.



Echini vary in their progression from the ova to the adult state. Thus he has come to understand to a certain extent, the structure, homologies, anatomy, and physiology of the order. He has, with extraordinary industry and care, watched their habits as far as he could, from those within the range of his observation. He subsequently visited every museum in Europe where type specimens were preserved, and was even fortunate enough to discover the types of some of the oldest authors. The result has been an exhaustive monograph. It is a treatise on all that has been done in the matter. It is also a history of the synonymy, and, as a matter of course, its rectification. It contains besides, a judicious arrangement of the genera, from a careful study of the relations of each species. It is finally a descriptive catalogue, as perfect as such a catalogue can be made in the present state of our knowledge of all the known species. The amount of work thus done is easily seen to be enormous. Dealing with the bibliography and synonymy alone would seem almost a labour of years.

The subject is one of especial interest and value just now, and deserves all the attention it has received. A very small acquaintance with Palæontology will tell what an important element the order is in estimating the earth's past history; and now that deep sea dredging has brought so many new friends and old relations of Echini to light, the order may be said to be of the utmost importance. Urchins are generally better preserved than most shells in strata, and being denizens of great depth, they often remain to tell a tale when all else has disappeared.

It will very likely be thought that very little is as yet known of the Echini of Australia, but this would be a mistake. It is true that no special study has been made of them, but many of its species have a very wide range, and the coast has been pretty well explored.

A very extensive list of Australian species is contained in Prof. Agassiz's volume, yet it is true to say, that beyond the fact that such species exist on the coast, nothing beyond has been ascertained. Now, Australia being a very large country, it is not



much more information to say a species is found in it, than to say it is found in Europe or America. I venture to say that there is as much difference between the marine fauna of North and South Australia, as there is between that of East and West America. Specimens have been sent to museums from various parts of Australia, and as far as I am aware, with but little satisfactorily recorded as to the precise habitat, habits, or bathymetry of any species. It is therefore with considerable pleasure that I accepted the request of Mr. Macleay to describe the ECHINI collected by him in the Chevert Expedition, together with those contained in his extensive museum at Elizabeth Bay. It will scarcely surprise any one to learn that only three new species have come under my notice, as the order has been so very exhaustively treated by Professor Agassiz. The new species are 1st, a small *Echinus*, *E. Darnleyensis*, which was found rather abundantly at Darnley Island and which is very near to a South American species, *E. magellanicus*, which is known to occur at New Zealand; 2nd, a new *Evechinus*, *E. australis*; 3rd, a new *Echinanthus*. But while finding but three new species, I have been able, from this collection, and from my notes made at the various Australian museums, and my own observations on the coast during many years, very much to increase the list of the Australian Echini fauna. I think I may say also that I have added some information as to habits and habitats. Unfortunately, no Australian collection that I am acquainted with is well supplied with our common Australian genera and species, and none have series to illustrate the modes of growth, so that I am unable to add anything to our knowledge in this direction, and that knowledge is very meagre indeed.

I find from my investigations into the matter, that Australia may be divided into three provinces:—1. The N. Eastern. 2. The Eastern. 3. The Southern. I do not deal with the Western fauna, for I know so little of it, that my remarks would possess no value. The Southern has a peculiar fauna which possesses what are called the truly Australian genera, such as *Amblypneustes*, *Holopneustes*, *Microcyphus*, and *Linthia*. The



Eastern has a few peculiar forms, such as *Centrostephanus Rodgersii*, *Phyllacanthus imperialis*, together with Pacific species, such as *Metalia sternalis*, *Mespilia globulus*, and *Hipponoë variegata*, &c. The North-Eastern province seems entirely a derived fauna, in which the E. Australian, Indian, and Pacific species meet. The *Echinus* mentioned above is the only peculiar species. The N. Eastern province includes the species of Darnley Island and Torres Straits, with say Rockhampton for its centre. The Eastern province would include the East coast from Cape Byron to Cape Howe, including E. Tasmania. The Northern provinces would extend from Cape Howe to Port Lincoln, west of Spencer's Gulf. These provinces are only meant to be somewhat roughly estimated, but they correspond with what I have noticed as to the Mollusca fauna.

I cannot find that there is much connection between our tertiary fossil fauna, and what we see in the present Australian seas. Some few—three in all—are common to both, while not only are Australian genera remarkably absent, but even a whole sub-order—the Desmosticha—is scarcely represented at all in our fossil formations. In fact, the separation between our tertiary and recent Echini is almost complete. A very few species and a small number of genera are common to the Tertiary and recent period, but our commonest forms, *Strongylocentrotus erythrogrammus*, *Amblypneustes ovum*, *Hipponoë variegata*, *Echinocardium australe*, *Linthia australis*, &c., are not even generically represented.

I now proceed to describe the Australian recent fauna. In doing so, I have given a brief diagnosis of the sub-orders, families, genera and species. I have strictly followed the arrangement of Prof. Agassiz in this, though I have summarized his details, and re-arranged the most of them, so as to facilitate reference. The notices of habits, depths, habitat, &c., are always from my own observations, unless otherwise stated. The following explanation of terms will be found useful :—

Actinal surface.—The under side.



**Actinosome.**—The central orifice, or mouth, in life covered with a membrane, plates, or spines.

**Abactinal surface.**—The upper side.

**Ambulacra.**—The space included between the two poriferous zones.

**Interambulacra.**—The five areas between the ambulacra.

**Ambitus.**—The rounded edge of the base on which the test rests.

Genital plates and ocular plates are sets of five each, with pores at their edge or centre. They are referred to here as the G. and O. plates. The O. plates are sometimes without pores. Within these is the anal system, which is composed of one or many plates, and has one anal slit or pore.

The madreporiform body is a spongy tissue on one of the G. plates.

To abbreviate references, the ambulacral and interambulacral areas are always referred to as the A. and I. areas.

#### Sub-Order 1.—DESMOSTICHA. Hæckel, 1866.

##### (The ENDOCYCLA of Wright.)

Echini, more or less circular in outline. Anal system completely surrounded and enclosed by reproductive and ocular plates. *Actinosome central.* Zones of pores extending from anal system to actinosome in simple vertical rows or disconnected arcs. Jaws highly developed, supported upon prolongations (auricles) of the edge of the actinosome either as arches or disconnected supports. Five rows of ambulacral and five interambulacral plates only. If the *test* is elongated in form, the longitudinal axis is indicated by the position of the madreporic body. Actinal system covered by a flexible membrane attached to the jaws, either bare, or more or less covered with plates. Gills extending through openings in the edge of membrane, corresponding to cuts more or less marked on the edge of the actinosome. Tubercles carrying the spines form vertical or



horizontal rows, or sometimes both, on the A. and I. plates. Spines large, compared to the size of test, and less numerous than in the other sub-orders.

Family 1.—GONIOCIDARIDÆ. Hæckel, 1866.

Actinal and abactinal system large, and of nearly equal size. Pores composed of single pairs in a narrow vertical zone (except *Diplocidaris*—fossil) extending to buccal membrane, A. area narrow with many small plates, I. area wide with few large coronal plates, each surmounted with a single primary perforate tubercle surrounded by a large scrobicular circle. The primary I. spines are large, while those of the actinal system are small flattened papillæ, and never ornamented, extending also over the imbricated buccal membrane. Teeth less complicated than *Echinidæ* or *Diadematidæ*. Auricles, independent arches originating from the I. spaces. Actinal cuts not in coronal plates, but near the actinosome in the edge of the buccal membrane. Teeth like a gouge; the jaws have not the large triangular foramen of the *Echinidæ*, nor are the sides of the jaws connected over their central part.

Genus 1.—PHYLLACANTHUS. Brandt, 1835.

Test swollen *circular, turban shaped*, thin, ambulacra almost straight or very slightly undulating. Poriferous zone, broad pairs of pores connected by a slight horizontal furrow. Primary spines variable, cylindrical, triangular, flattened club-shaped, elongate, fluted, or with highly developed lamellæ or rows of secondary spines. Tubercles perforate, mammary boss smaller than on *Cidaris*; scrobicular circle large, with very prominent granules. Areola deeply sunken.

This genus must not be confounded with the large "Pencil fish" (*Hetrocentrotus mammillatus*) so commonly preserved as an ornament, with its long club-shaped spines, brown, tipped with red, and ringed with yellow. In that species it will easily be seen that the test is *oblong*, and the anal system very small.



**PHYLLACANTHUS ANNULIFERA**, Lamarck. Scrobicular circle very distinct, formed by a double row of secondary tubercles. Secondary spines and papillæ elongate, tapering, yellowish with greenish longitudinal stripe in the middle. Primary spines, nearly twice the diameter of the test, gradually tapering towards the extremity, often fluted, cupuliform, granulation in irregular rows with scattered larger spines along the body of the shaft.

Not very common. Found in shallow water at low tide, generally sandy bottom. Specimens from Tasmania and N. S. Wales coast. MacLeay's Museum. Endeavour River—"Chevert Expedition." It seems to have a wide range in Eastern Australia.

**PHYLLACANTHUS DUBIA**, Brandt. Closely allied to *P. imperialis*, but smaller. Granulation of abactinal system coarse. O. plates smaller, and plates of anal system longer and less numerous than *P. imperialis*. Six primary tubercles on each row. The primary spines are nearly cylindrical, sometimes swelling near base, or gently tapering towards extremity, and deeply grooved.

Common in Tasmania, E. coast, Botany Heads, Port Jackson, Apollo Bay; Victoria, King's Island, Bass Straits. Sandy bottom, 10 to 20 fathoms.

**PHYLLACANTHUS IMPERIALIS**, Lamarck. The primary spines of this species are like the Pacific "Pencil fish" (*Heterocentrotus mammillatus*), but much fewer in number. Primary tubercles, six in each row, even in the largest specimens (75 millim. in diam.) Scrobicular circle, well defined circular, limited by one row of rather prominent secondaries.

Rare, Port Jackson, Port Denison, Port Molle. Station unknown, as the specimens seen by me have all been cast up on the beach after storms. There is no specimen in the MacLeay museum.

**PHYLLACANTHUS VERTICILLATA**, Lamarck. This species is distinguished by its peculiar spines, which have circles of lamellæ at intervals along the shaft. The primary tubercles are small, not prominent. I have never seen a specimen which I could rely upon as coming from Australia. Though it is given as Australian on the authority of the Pourtales. It is probably tropical.



## Genus 2.—STEPHANOCIDARIS, A. Agassiz, 1863.

Test exceedingly thin, abactinal system large, thin, packed with milliares, moveable; primary tubercles more numerous than last genus.

STEPHANOCIDARIS BISPINOSA, Lamarck. Primary spines flattened, tapering with very marked serrated edges, and smaller spines along medium line of shaft. Primary tubercles small, mammary boss little prominent, auricles very high and thin.

Said to occur in Australia, on very good authority, but I have never met with a specimen.

## Genus 3.—GONIOCIDARIS, Desor, 1846

Test frequently higher than broad, coronal plates more numerous than in any other genus of the family. Tubercles perforate, with a smooth base. A. narrowest of the family. Poriferous zone almost as broad as the medium A. region. Medium A. and I. areas bare, sutures of plates sunk, forming deep zigzag vertical sutures, with pits at the angle of two plates. Spines cylindrical, covered with thorny spines pointing irregularly outwards, spreading out, frequently cupped at the extremity.

GONIOCIDARIS GERANIOIDES, Lamarck. Test high, thick, as many as ten primary tubercles. Scrobicular circle small, circular, well defined by a close row of secondary tubercles. Poriferous zones narrow, with high ridge separating the pairs of pores. Primary spines fluted, swelling near base, cupped at the top; near upper part of spine, fluting often broken up into disconnected lamellæ, or irregular rugose projections.

Common. Darnley Island, New Guinea, Endeavour River, "Chevert Expedition."

GONIOCIDARIS TUBARIA, Lamarck. Test somewhat flattened. Eight primary tubercles. Scrobicular circle elliptical, mammary boss small, not prominent. Differs strikingly from the preceding species in the structure of the primary spines, which are somewhat swelling at the base, tapering, cupuliform. Shaft ornamented by irregular longitudinal rows of small flattened disconnected pointed lamellæ, forming diminutive spines.



Port Jackson, Swansea, Tasmania, King's Island, Hobson's Bay, Sealers' Cove, Portland Bay, Guichen Bay, Encounter Bay, and generally on South Australian coasts.

The family ARBACIADÆ is not represented on the Australian coasts.

Family DIADEMATIDÆ, Peters, 1853.

Test thin, with a bare forking I. space. A. narrow. Is depressed near abactinal system. Spines long, exceeding test, hollow, verticillate. Tubercles of both areas similar. Actinal cuts, moderate.

Genus I.—DIADEMA, Schynvoet, 1711.

Test slightly pentagonal, flattened at both poles, thin. Tubercles in two vertical rows, those of A. smaller than I. perforate and crenulate. Porif. zones narrow. A. narrow compared to I. and often rising considerably above them. Pores in simple pairs, forming arcs round adjacent tubercles. Actinal system large, cuts 10, broad, but not very deep. Membrane strengthened by small limestone plates. Anal system *covered by a thin naked membrane*, anal openings at end of a tube, extending like a proboscis beyond anal system.

DIADEMA SETOSUM, Gray. Easily distinguished by its long slender needle-like hollow spines, extending three or four times the diameter of test. Dusky in colour, but banded with darker spaces. The colour of the test is blackish, on which the white tubercles are very conspicuous. Many specimens were obtained by Mr. Macleay, from Darnley Island, 10 to 20 fathoms, on sandy mud bottom. It had been found hitherto in almost every tropical sea, except the Australian.

Genus II.—CENTROSTEPHANUS, Peters, 1855.

Test globular, buccal plates 10, all carrying spines, no bare forking interambulacral space. Abact. syst. nearly circular, and *covered by distinct plates*. Tubercles of both areas similar, crenulate, perforate, and arranged in two vertical rows in the I. zone. Spines stouter in shape than last genus, but more hollow, being mere shells. Actinal openings slight. Pores in arcs of three.



CENTROSTEPHANUS RODGERSII, A. Agas. Thin, very spiny, urchin with long stout but very brittle spines of deep reddish purple colour. It is not uncommon about Botany Heads, at low tides in a few feet of water.

Genus 3.—ASTROPYGA. Gray, 1825.

Test so thin that it is more or less flexible, greatly depressed. I. sunken frequently far below the bulging A. Bare median I. space forking, and each plate having a colored pit. Tubercles uniform, perforate crenulate, two vertical rows on the I., many on the A. Spines rarely attaining half diam. of test, uniform, slender. Porif. zone, rather broad, pores, in four irregular vertical rows. Anal system plated, but not otherwise different from *Diadema*.

ASTROPYGA RADIATA. Leske. A large depressed test of dull whitish green and reddish brown. The anal system and bare median I. space are reddish with spots of violet. The spine slender, generally red. This species has been known to naturalists for more than a century, but has never before been found in Australia. Four large specimens were dredged by Mr. MacLeay, in the Chevert, off Darnley Island, at 10 to 20 fathoms in sandy mud.

Family ECHINOMETRIDÆ. Gray, 1855.

Test with an oblique axis, elongated or oblong, with more than three pairs of pores to each arc.

Genus 1.—HETEROCENTROTUS. Brandt, 1835.

Test very thick, elongated; tubercles few, massive, smooth and *imperforate*. Porif. zone very narrow above the ambitus, pores on long narrow arcs of numerous pairs round the tubercles; below the zone widens much more than in *Echinometra*, becoming broader than the I. space. Actinosome, very large, cuts slight. Primary spines large, club-shaped, angular, twice the diam. of test. Round the actinosome they are flattened; auricles tall, slender, with large opening, and connected by a low ridge.



## HETEROCENTROTUS MAMMILLATUS. Klein.

The large "pencil fish," well known to collectors. It is found throughout the Pacific, and four or five specimens were dredged by the "Chevert" off Darnley Island. This is the first time an Australian habitat has been ascertained. Ten to twenty fathoms on sandy mud.

This species must not be confused with one very like it from the Mauritius. "The secondary spines of *H. mammillatus*," says Mr. A. Agassiz,\* form a sort of loose pavement, somewhat similar to that covering *Colobocentrotus*; they cover the whole test, are small, short, usually flaring and truncated at the extremity; while in *H. trigonarius* they are bevelled.

## Genus 2.—ECHINOMETRA, Rondel, 1554.

Test thin, elongate, tubercles large imperforate, not crenulate, slightly smaller in the A. area. Poriferous zone moderately broad pores in very prominent arcs of many pairs. Actinosome large, cuts shallow, often broad. Jaws very powerful (they are comparatively small in *Heterocentrotus*) auricles very massive. Actinal membrane with 10 buccal plates, on which there are usually clusters of spines. Spines quite stout, somewhat long, and longitudinally striated.

## ECHINOMETRA LACUNTER, Leske.

A very variable species, found abundantly under stones in all tropical Eastern Australia. It is not mentioned as Australian in Mr. Agassiz very extensive lists. Mr. Macleay brought specimens from Cape Grenville, Endeavour River, Darnley Island, and New Guinea. The largest specimens were scarcely two inches in the longest diameter. The colour of the spines varied from purple to straw colour, but the most were banded, and the whole appearance of the test is very much like a small porcupine. The spines are swollen, generally falling off when the test is dry, and the ground color of the shell is dull violet.

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\* *Revision of the Echini*, p. 429.



## Genus 3.—PARASALENIA, A. Agassiz, 1863.

Arcs of pores of three pairs only, anal system very small, closed by only four plates. Buccal membrane carrying minute spines.

## PARASALENIA GRATIOSA, A. Ag.

Very like *E. lacunter*, and generally associated with it. The spines are often extremely alike. I have met with no well authenticated case of its occurrence in Australia.

## Genus 4.—STOMOPNEUSTES, Agas, 1841.

Test nearly circular, axis very slightly oblique. Actinal surface *flat*; actinosome small, cuts scarcely marked, pores in *three irregular vertical lines*. Two principal rows of tubercles in both areas, but the I. area almost filled up with somewhat smaller ones. Spines long, stout, and finely striated.

## STOMOPNEUSTES VARIOLARIS, Lamk.

This species (the only one of the genus) is easily known by the continuous groove extending along the vertical suture in median I. space. The specimen in the Sydney Museum is very much larger than any of the dimensions given by Agassiz, as the following dimensions will show:—Diam. 102, alt. 52, abactinal system 15, actinosome 25 (exclusive of cuts), spines from 45 to 62, and about 4 mil. at base. It is probable that this specimen comes from North Australia, but the precise locality is unknown.

## Genus 5.—STRONGYLOCENTROTUS, Brandt, 1835.

This includes all species having a somewhat circular or sub-pentagonal, regularly arched, or slightly depressed test, with smooth, imperforate, not crenulate tubercles of unequal sizes, forming primary and secondary vertical rows. Pores arranged in arcs of at least four or five pairs. Actinosome decagonal, very slight cuts, buccal membrane bare, spines moderately slender, longitudinally striated, longer proportionately than those of true *Echinus*, and more slender than *Sphærechinus*.



This genus is well represented in Australia, and generally goes by the name of *Cidaris*. It lives in the hollows of rocks, browsing on seaweed, and is often left by the tide at low water. The spines are exceedingly sharp, and inflict painful wounds when carelessly handled. We have three species in Australia.

STRONGYLOCENTROTUS ARMIGER, A. Ag.

Test thin, flattened above, regularly arched below. Is at once distinguished from its congeners by its short, thick, swollen spines. Largest primary tubercles of both areas within three plates of abactinal system in the I. space. They cover the abactinal part of the flattened test, decreasing rapidly towards the ambitus and actinal surface. I have not seen this species, and do not know in what part of Australia it occurs.

STRONGYLOCENTROTUS EURYTHROGRAMMUS, Valenciennes.

The commonest of our species. Easily distinguished by its olive brown spines, though there are white varieties in Tasmania. Test regularly arched, subglobular or depressed. Two principle vertical rows of tubercles in the A. and I. space, a well defined vertical row of small tubercles separating the porif. zones from the primary tubercles in the I. space. Two irregular medium vertical interambulacral rows. Coronal plates closely crowded with small secondaries; the intervening space again crowded with closely packed milliaries surrounding them. Porif. zone broad, pores arranged in oblique arcs, separated by irregular rows of secondaries. Cuts very moderate. Membrane thin, with a few elliptical plates.

Found at low water in all E. Australia, as far as Cape York; Southern Australia, Bass Straits and Tasmania.

STRONGYLOCENTROTUS TUBERCULATUS, Lamarck.

Test greenish, spines large, sharp, and long, in colour, dark violet, or black. Anal system elliptical, covered by small plates, carrying a few minute tubercles. Madreporic body large and pentagonal. Two main rows of tubercles in the A. and I. spaces, each flanked in the I. space by a smaller one, meeting in a single



vertical row in the median space. Coronal plates loosely covered by minute tubercles and few milliaries. In the A. space there is one irregular central vertical row of small tubercles, with one exterior vertical row of tubercles somewhat larger, from the base of which smaller tubercles running obliquely, separate the arcs of pores. Porif. zone formed of arcs of five to eight pairs, more or less closed above the ambitus. Cuts not deep, but broad and well defined. Membrane thin, covered by few very distinct elliptical plates. It is larger than the last species, and the spines longer. It is not common, and found generally in N.E. tropical Australia, but I have seen a specimen from Port Stephens, and another from New Zealand. Neither this species nor *S. armiger* was found by the "Chevert," nor are there specimens in the Macleay or Sydney Museums.

Genus 6.—SPHÆRECHINUS, Desor, 1857.

Test thick, tubercles of uniform size, imperforate, not crenulate, numerous, closely packed together on both areas. Actinosome decagonal, with deep cuts. Membrane thin, with four prominent plates. Pores in closed arcs of four to eight pairs.

SPHÆRECHINUS AUSTRALIÆ, A. Agas.

Colour of test violet, with tubercles of dull green, spines short, tolerably stout, violet at base with greenish tips, old specimens, but when fresh the color is entirely a blue purple. In the I. space there are six to eight vertical rows of primary tubercles near the median space separating the principal rows, closely packed secondaries fill the rest of the coronal plates. The most prominent row of primaries is half way between the median line and porif. zone. Anal system large. The porif. zone narrow. Pores arranged in arcs of three towards the exterior, well separated from the inner fourth pair, which is quite hidden among the tubercles, forming almost an independent vertical row.

Not common. Often found, but stripped of its spines. It is sometimes washed ashore on the sandy beaches of the South Australian coast. Found also in Bass's Straits, King's Island,



Swansea, Tasmania. Agassiz gives also West Coast of Australia, New Zealand, and the Mauritius, as habitats. It was not obtained during the Chevert's dredgings.

Family ECHINIDÆ, Agassiz, 1846.

Arcs of pores of three pairs only.

Genus 1.—TEMNOPLEURUS, Agassiz, 1841.

Small urchins, test generally regularly arched, and somewhat conical. Actinal part more or less concave, tubercles crenulate, imperforate, forming two principal vertical rows in each area, pores in simple rows, but undulating and irregular, deep lateral and vertical grooves at the angles of the plates. Spines long, slender, fluted, those above shorter; auricles broad, with high connecting ridges and small foramen.

TEMNOPLEURUS TORUEMATICUS. Klein.

This, says Mr. A. Agassiz, is one of the earliest species figured by old authors. It is easily recognized by its furrows. In the I. space there are for each plate along the horizontal suture, two deep rectangular furrows, separated by the principal row of primary tubercles. Spines, long flattened, of a pink color, with three or four purplish transverse bands. Actinosome, small, cuts scarcely visible; membrane, bare; ten buccal plates, small, prominent. Auricles, high, thin, with a high connecting ridge and minute foramen.

Specimens of this interesting urchin were dredged by the Chevert expedition at Cape Grenville, Endeavour River, Darnley Island and New Guinea. Generally occurring on sandy mud, at from 10 to 20 fathoms. It was not hitherto known in Australia, though not uncommon in the Indian Ocean, China, Japan, &c. Diam. from 23 to 55 mil.

Genus 2.—MICROCYPHUS Agass, 1841.

Test stout; tubercles few, small, leaving marginal bare spaces in the I. area, but regular in the A. Porif. zones, narrow; pores



in double irregular vertical rows. Pores at the sutures indistinct in the median A. and I. spaces, but well-defined at the junction of the porif. zone and I. plates. Spines thin, slender, short.

MICROCYPHUS MACULATUS. Agass.

In the I. space the central part of the coronal plates have a bare lozenge-shaped area parallel with the horizontal sutures of the plates. These spaces rapidly decrease towards the ambitus, and disappear on the actinal surface where the tubercles are larger, occupying the whole surface of the plates. The general color of the test is greenish yellow, with bright violet bare sutural spaces. Diam., 11 to 37 mil. This species is tropical, but I have seen one specimen only which was said to come from the coast of N. S. Wales.

MICROCYPHUS ZIGZAG. Agass.

Much smaller and more globular than the preceding. In the I. space the tubercles cover, as a triangular shield, the greater part of each plate, leaving the median space, and a short length of the horizontal sutures bare from the anal system almost to the actinosome. Sutural pores small, often wanting. Porif. zone and tuberculiferous parts greenish yellow; bare spaces, dark chocolate color. Diam., 12 to 25 mil. I have seen specimens of this species in Tasmania, where it was thrown up on the sand; and I have found it myself at Port Denison, N. Queensland. There are specimens from West Australia and Tasmania in the British Museum.\*

Genus 3.—SALMACIS. Agass, 1841.

Test somewhat conical and thick; pores trigeminate, tubercles crenulate, not perforate, in several vertical rows and *primary regular horizontal rows* as well. A. system broad; median I. spaces frequently bare, angular pores at junction of plates; abactinal system prominent; actinosome small, with slight indentations; spines short, slender, finely striated. Auricles high, thin, with high connecting ridges and small foramen.

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\* Agassiz Revision of the Echini, page 146.



One specimen of this species was dredged by the Chevert off Darnley Island and others, have been found on the N. Queensland coast, though it is rare. Test when dry yellowish brown, moderately thick, subglobular, and thickly covered with short-pointed greenish spines, banded with five or six transverse bands of violet. The spines below are much longer, broader, frequently flattened. Actinosome moderate, decagonal, with slight indentations, anal system large. Pores at the median junction small, horizontal sutures of the coronal plates slightly furrowed. Diam. from 44 to 53; alt. from 27 to 35 mil. (Agass.)

SALMACIS RARISPINA, Agass.

Test usually quite conical, much thinner than any other species. The coronal plates above the ambitus are comparatively bare, owing to the distance of the primary tubercles, and the small number of the milliaries. The test above the ambitus is greyish, with lozenge-shaped figures along the horizontal sutures. Actinosome small, quite sunken, and almost circular. Spines, *long, slender, pointed, somewhat flattened*, straw color, with seven to eight bright purplish bands. Sutural pores quite minute. Diam., 25 alt. 16 mil. Darnley Island and Cape York, a few specimens dredged by the Chevert, at about twenty fathoms.

SALMACIS GLOBATOR. Agass.

Test quite stout. Tubercles remarkably uniform, and forming very regular horizontal and vertical rows, slightly larger on the actinal side. Porif. zone not so wide as other species, and the sutures of the plates becoming in places deep furrows, almost as marked as *Temnopleurus*. The spines (which easily fall off) are *short, stout, pointed*, greenish and tipped with violet. Color of test pinkish, sutures lighter in color, yellowish below. Auricles remarkably broad and thin, with high connecting ridge. Diam. from 60 to 70; alt. 36 to 52 mil. Port Jackson, dredged off the Sow and Pigs rocks, by Brazier, Bass's Straits, Kangaroo Island, S. Australia. Not common, and rarely found with the spines attached.



## SALMACIS SULCATA. Agass.

This species is closely allied to *S. bicolor*. It differs according to A. Agassiz in having a more deeply lobed and slightly longer actinosome; the abactinal system is less prominent, and some other details. The test when dry, a yellowish green, with sea green band on the I. area, with spines of the same color at the base tipped with dark violet; they are sharper, and more uniform in size. In some, however, they were cream colored, and banded with 5 or 6 dusk brown lines. Diam., 48 to 67; height, 27 to 40 mil. New South Wales coast. Agassiz says that the young, figured by Savigny, would be readily mistaken for young *Echinus*, as the difference in size of the vertical rows of the primary tubercles is not seen at that age.

## Genus 4.—MESPILIA. Desor, 1846.

Small ball-shaped urchins, with a thin test, and the *median areas quite bare as far as the ambitus*, and whole lower surface tuberculated and covered with spines. Porif. zones broad; pores arranged in two irregular vertical rows. Spines short, hair-like, slender. Actinosome decagonal, small, membrane bare. Auricles high, ridge low, foramen large.

## MESPILIA GLOBULUS. Agass.

This beautiful urchin is easily known. It is small, and round as a ball. The bare spaces are dark grey green, the spines, closely packed, and of uniform length, are light green at the base, and banded at the end with white or reddish purple. The bare spaces have a silvery appearance on the dry specimens from the pedicellariæ. It is not common; there are specimens in Mr. MacLeay's Museum from New Caledonia. Agassiz gives the Pacific, Japan, China, and Phillippine Islands as its habitat. It has been found between Brisbane and Rockhampton—at Lady Elliot Island.

## Genus 5.—AMBLYPNEUSTES, Agass, 1841.

Urchins spherical, or even with a greater altitude than breadth. Test thin, anal system small but prominent; actinosome small



without cuts; porif. zones broad, pores in well-defined vertical rows or short arcs of three pairs. A. space broad, tubercles of both areas, small and uniform in size; median spaces frequently bare. Spines few, slender, far apart. Sutural pores at angles of plates; auricles tall, slender, scarcely meeting above large foramen, with high connecting ridges.

AMBLYPNEUSTES OVUM. Lamk.

The common globular urchin of all the southern coasts where it is often found in immense numbers, drifted up by the tide on sandy beaches. It is not at all common on the east coast of Australia. As there are other species very closely resembling it, I must define them, for they are nearly always confused in collections. The general color of the test is light olive, but very variable in the depth of shade; in fact, I have seen it of cream color or yellow. Darker zigzag lines parallel to the median sutures, with sometimes lozenge-shaped figures near the porif. zone. Darker bands of color often extend from pole to pole. The spines are *short*, slender, pointed, dark green at base, tipped with red violet or orange. Anal system somewhat large. Sutural pores minute or absent.

AMBLYPNEUSTES GRISEUS. Blainville.

Test comparatively stout, somewhat depressed; remarkable for its broad poriferous zone, and the size of the anal system. Sutural pores more distinct. The A. space narrower than in *A. ovum*. Color, greenish yellow to grey. Spines stouter, and less tapering than previous species; light green or violet, tipped with darker color or orange. This species has exactly the same range as the former, but is the less common of the two,

AMBLYPNEUSTES FORMOSUS. Valenciennes.

Thin, ovoid, remarkable for the number and distinctness of the sutural pores. Test brownish pink, with yellow porif. zones, ornamented by dark brown lozenges. Spines, long, slender, pink at base, darker at the top, or red or orange. Generally smaller than *A. ovum*. The same habitat as the last, but more common in Tasmania. Found also in New Zealand.



## AMBLYPNEUSTES PALLIDUS. Lamarck.

Supposed to be a variety of *A. griseus*, by Agassiz. It is distinguished by its violet color, on which the white tubercles stand out with brilliant distinctness. I do not know the species, the habitat of which stretches out from South Australia across the Pacific.

## Genus 6.—HOLOPNEUSTES, Agassiz, 1841.

General character of *Amblypneustes*, but, A. space broader than I., owing to the peculiarity of porif. zone, which distinguishes this genus. The pores have a regular vertical row at each side between which they are packed closely, with apparent irregularity. Spines like *Amblypneustes*, but swollen at the extremity.

## HOLOPNEUSTES POROSISSIMUS, Lutken.

Test globular, stout. Porif. zone broader than median A. space. Pores forming an outer very regular vertical row, inner row somewhat undulating, while the remaining space is apparently filled with irregular pores. Spines short, stout, swelling at extremity, coarsely striated longitudinally, forming lamellæ at the swollen extremity, but otherwise, the shaft is uniform in width. Milled ring very prominent. Color, greenish at base, red at tip. Color of test greenish blue, shading to violet in median spaces. Tubercles of lighter colour.

Habitat.—All South Australia, Tasmania, Bass' Straits. I have seen no authentic specimen from E. Australia.

## HOLOPNEUSTES INFLATUS, Lutken.

Porif. zones narrower than in preceding, in three well marked vertical rows, the outside ones quite irregular, and the middle somewhat undulating and disconnected. Test yellowish orange, with zones of darker tint. I have never seen this species.

## HOLOPNEUSTES PURPURASCENS, Lutken.

The porif. zone is narrower than in either of the two previous species. The middle line of pores forms zigzag lines, and the outer row of pores is characterized by the great size of the inner pore. The younger specimens are a beautiful violet color, and the older ones a yellowish brown. I have not seen the species which Mr. Agassiz thinks may be only a variety of *H. porosissimus*.



## Genus 7.—ECHINUS, Rondel, 1554.

Urchins for the most part small, round, with small smooth imperforate tubercles, in two principal vertical rows in the coronal plates of both areas, the other tubercles smaller and irregular. Actinosome small, cuts slight, membrane bare, with ten small plates. Spines somewhat stout, sometimes equalling the test in size. *Pores in arcs of three*, jaws weak, auricles slender.

## ECHINUS MAGELLANICUS, Phillipi,

A small Echinus sent from Australia is supposed by Mr. Agassiz to be the adult of this species which occurs generally in Patagonia, Chili, and New Zealand.

ECHINUS ANGULOSUS, Agass., is said to occur in Adelaide.

## ECHINUS DARNLEYENSIS, N. S.

This may be the Australian species which Mr. A. Agassiz identified with *E magellanicus*.\* It is, however, quite different from that species, and found hitherto only in tropical Australia. Test small, circular, depressed, purplish, or livid, the tubercular rows and porif. zones being lighter in color. Primary tubercles in each area forming two vertical rows, the secondaries irregular, but with a tendency to form vertical and horizontal rows in the I. space, which is broader than the A. Sutures of coronal plates distinct, with two very distinct secondaries on each, between the primary vertical row of the I. and the porif. zone. Abactinal system sunken. G. plates large, long, with two or rarely three secondary tubercles irregularly placed on each, and G. pores large in groove at the end; ocular plates quite excluded, anal system with many plates, the opening distinct and round. Actinal surface rounded, depressed. Cuts slight. Membrane bare, with ten rounded small openings surrounded by Pedecellariæ. Opening for teeth scarcely visible. Jaws rounded, stout, auricles forming only slight thin processes, which do not meet. Pores in irregular arcs of three, forming narrow irregular line. Spines rather long, blunt, somewhat transparent, coarsely grooved, rose pink, dull

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\*Revision of the Echinidæ, p. 492.



green, or reddish, and sometimes banded or tipped with yellow. Diam, 25; alt.,  $12\frac{1}{2}$  mil. Longest spines, 6 to 7. Diam. of actinosome, 10. Diam. of abactinal system, 7.

Cape Grenville and Darnley Island, on sandy mud, 10 to 20 fathoms.

This species seems to me to differ from *E. magellanicus* in the actinosome being larger; in the abactinal system, where the G. plates have only two tubercles, and in the color of spines and test.

#### Genus 8.—HIPPONOË, Gray, 1841.

Echini of large size, and thin test. Tubercles small, smooth, imperforate, arranged in horizontal and somewhat irregular vertical rows. Medium A. and I. spaces frequently bare. Actinosome small, deeply notched. Porif. zones broad, in three vertical rows, outer ones regular, middle one irregular. A. area very broad. Spines short, stout, finely striated, not easily falling off.

#### HIPPONOË VARIEGATA, Leske.

A very variable species, differing very much in various localities in size, shape, and color. The tubercles are very small, the porif. zones somewhat narrow, and the median areas seen from above, form five radiating bands, gradually increasing in width. These are blue or violet in the tropical specimens, which are somewhat conical and small. The Port Jackson specimens are much larger, rounded, depressed, and of a light cream color, but I have seen some from the same locality almost conical, and of deep brown color. It is not given as Australian in Mr. Agassiz's lists. Mr. Macleay obtained it at Cape Grenville, Endeavour River, Darnley Island, and New Guinea. Its habitat is generally tropical. If it were not for the fear of adding to the host of synonyms which this species has obtained, I should consider the large Port Jackson species as a variety to be distinguished as *Jacksoniensis*. It is found in shallow water, on a sandy bottom.



## Genus 8.—EVECHINUS, Verril, 1871.

Very like Hipponoë; circular, somewhat depressed, tubercles very unequal, primaries in regular vertical rows, secondaries irregularly grouped round their bases. Porif. zone broad in three irregular vertical rows. Actinosome small; cuts slight: spines stout, tapering, rather short, very unequal in size.

EVECHINUS AUSTRALIÆ, N.S. Test thin, circular, or in small specimens obscurely pentagonal, depressed. Profile regularly arched, actinal region very slightly sunken. A. a little broader than I. Tubercles of A. slightly smaller than I. both surrounded by an irregular ring of secondaries and milliaries. Two vertical rows of primaries in the A. area, four in the I. at the ambitus, but the two inner ones diminishing in size at the actinal and abactinal region, while the two outer ones preserve their size and regularity to the edge of both regions. Porif. zone wide of three vertical rows. The two outer ones a regular vertical row of pairs, the middle an irregular arc of three pairs. Zones narrowing at abactinal region but only slightly at the actinosome. The three rows separated by two irregular rows of secondary tubercles with milliaries scattered between. Abactinal area wanting in all the specimens seen by me. Actinal region somewhat large, pentagonal; cuts deep, circumscribed by a raised margin. Auricles high, narrow, triangular and scarcely united over the large foramen; no connecting ridges.

Three specimens with no information as to habitat were found in the Sydney Museum, but I have every reason to believe they came from the N. S. Wales coast. They are bleached and without spines, the anal system has disappeared. The following are the dimensions in millimetres:—

DIAM.	ALT.	DIAMETER OF MOUTH.	ANAL SYSTEM.
36	18	13	$6\frac{1}{2}$
30	14	12	$4\frac{1}{2}$
27	13	11	3



## Sub-Order 2.—CLYPEASTRIDÆ, Agass., 1836.

Urchins generally depressed, scutiform, with petaloid ambulacra, anal and apical system separate. Spines somewhat resembling regular Echini. Ambulacral pores of petals passing between the plates, and the ambulacral system greatly developed. Lines of minute pores extend at right angles to the general course of the porif. zone. Actinal surface with ambulacral furrows irregularly crowded with pores, the furrows terminating in the actinosome. Plates round, actinosome cuneiform, forming a buccal rosette. A. broader than I. Tubercles small, crepulate, and perforate. Teeth simple, articulating on the auricles, without the muscular system of *Desmosticha*.

## Family EUCLYPEASTRIDÆ, Hæckel, 1866.

Test with simple supports, connecting the upper and lower floors, and covered with spines of a uniform structure. The supports are either internal pillars, needles, or radiating partitions.

## Sub-Family FIBULARINA, Gray, 1855.

Small, globular, petals rudimentary, simple partitions radiating from the periphery to the actinosome.

## Genus FIBULARIA, Lamk., 1816.

Ovoid, flattened anteriorly, partitions absent. Petals rudimentary imperfectly petaloid, not closing, diverging pores not congregated, few. Actinosome central, anus nearer to it than the edge.

## FIBULARIA AUSTRALIS, Desmoulins.

A large ovoid species, measuring 20 mil., with large pentagonal mouth and large elliptical anal opening. I have never seen a specimen.

## FIBULA VOLVA, Agass.

A very small elongate species, pointed at both ends, with mouth and anus round, close together, and small, the latter especially so. One specimen dredged by the Chevert at Bet Island, Torres Straits.



## Sub-Family 2.—ECHINANTHIDÆ, Agass., 1872.

Large urchins, petals greatly developed, pillars on acute projections, connecting the two floors, ambulacral furrows straight, auricles two.

## ECHINANTHUS TESTUDINARIUS, Gray.

This is the large depressed tortoise-like species, so common in Port Jackson, with a very concave under surface and depressed mouth. Petals broad, closed. The anal orifice is near the edge. It is found throughout the Pacific, even as far as California, the Red Sea, and Japan. Is a fossil on the Murray River beds.

## ECHINANTHUS TUMIDUS, N. S.

I give this name to a large oval swollen urchin which is in the Sydney Museum, and which I have every reason to think came from the coast of N. S. Wales, though there is no precise information as to its habitat. It is regularly arched, dome-shaped, rising gradually from the edge to a height of nearly half the length. The apex a little flattened, the edge is very thick and rounded, but thinner posteriorly, and a distinct slight depression at each side. The base is flat, but more so posteriorly than anteriorly, so as to bring the transverse small elliptical, marginal, anal opening, with its lower edge level with the base of the test. Tubercles larger below than above, well sunken, and surrounded by rings of milliaries, which also fill up the intervening space. By the side of the milliaries on the lower surface there are many minute pyriform pores. Scrobicular circles of actinal surface wide and deep. I. and A. areas about equal in width. Petals *not closed*, but gradually diverging to very near the ambitus. Porif. zones gradually enlarging from apical system, being a single row on each side, connected by an oblique groove, and sometimes connected from apex to ambitus by a distinct groove; also a zigzag groove from apex to edge on both I. and A. areas. Actinosome deeply and abruptly sunken. Apical system slightly anterior, small, pentagonal, G. pores at the angles, O. pores between macdreporic body, occupying the central space, and rather scattered in its perforations. Spines small, like *Echinus*;



milled ring prominent, grooves large. Maj. diam, 140; min., 115; alt., 63; actinosome 25, but very irregular in shape. Largest spines scarcely 10 mil. in length.

Sub-Family LAGANIDÆ, Desor, 1857.

Outline pentagonal, petals crenulate, connection between floors by walls running parallel to the edge of test. I. extremity narrow on actinal side, ambulacral furrows straight.

Genus I.—LAGANUM, Klein, 1734.

Test generally large, sub-pentagonal, depressed, with swollen edge. Petals short, closed. Pores congregated. Actinal surface flat, with peristomal star, and porous ambulacra not reaching the margin. Primary tubercles few, and uniformly scattered, milliaries more numerous, anus inframarginal.

LAGANUM BONAMI, Klein.

A small sub-pentagonal species, with somewhat long petals, which are not quite closed. Anus and mouth not far apart, the latter large and pentagonal. Length, 33; breadth, 28 millim. Rather common in Port Jackson and in Tasmania.

LAGANUM DEPRESSUM. Lesson.

More flattened and larger than the last; edge thinner, not swollen, anus nearer edge, and transversely elliptical or circular; apical system larger. Peristomal star distinct, while on the last species it cannot be traced. The pairs of pores become more separated as they near the tip of petals, but never so indistinctly conjugated as in *L. Bonami*. Length, from 27 to 79; breadth, from 23 to 70 mil. It is found in the Pacific and Indian Oceans as well as Australia.

Genus, PERONELLA, Gray, 1855.

Regarded as a subgenus only by Agassiz. The Genital pore far away from the abactinal system in the I. Partitions ramify, extending half-way to the centre instead of forming a narrow belt of three or four near the edge. Four G. openings.



## PERONELLA DECAGONALIS. Lesson.

Test large and graceful, much flattened, edges scarcely swollen, central part rising abruptly, but slightly from end of petals; shape, regularly decagonal. Petals narrow, porif. furrows closely packed; zones converging slightly towards extremity, and not rounded along sides of petals. Actinal surface flat. Actinosome round, central, with furrows extending nearly to the edge; anus elliptical near edge, but oblique to the longitudinal axis. Tuberculation uniform on both surfaces, but larger on lower. Color variable, but red when living. Port Jackson and along the east coast. Long diam. from 50 to 120 mil.

PERONELLA ORBICULARIS.—Much smaller than the last; more rounded with shorter petals, and more swollen edge. Supposed by Agassiz to be the young of *P. decagonalis*. Diam., 26. Same localities.

PERONELLA PERONII, Agass. Four G. openings in A. spaces a considerable distance from apex. Outline circular, edge swollen slightly, petals broadly lanceolate; mouth transversely elliptical. A. furrows indistinct, short. Long, 26. Tasmania, Jervis and Twofold Bays, Port Jackson, Broken Bay.

## Family SCUTELLIDÆ. Agassiz, 1841.

Extremely flat, circular urchins, perforated or cut at the margin. A. furrows spreading, branching, and anastomosing. Partitions radiating from single points. Tubercles of upper and lower surface differing greatly in size.

## ECHINARACHNIUS PARMA. Lamarck.

A common rounded form, with indentations on the edge, which is found almost all over the world. Common on the east coast. Many specimens collected by the "Chevert" Expedition within the tropics. It is also common at Guichen Bay on the S. coast and along the coasts of Victoria.

## Genus 2.—ARACHNOIDES, Klein, 1734.

Circular urchins depressed, but conical. Ambulacral furrows, simple. Partitions of interior by pillars, numerous, slender,



radiating or branched, generally parallel to the outer edge, and extending two-thirds towards centre. *Tubercles of both surfaces arranged in oblique lines across the plates.* There is only one species.

ARACHNOIDES PLACENTA. Linnæus. Found at Cape Grenville and Darnley Island, by the "Chevert." It is also known in New Zealand, and is very common on sandy shores, within the tropics of E. Australia, where it is found lightly covered with sand at low water.

Sub-Order 3.—PETALOSTICHA, Hæckel, 1866.

Generally heart-shaped urchins without teeth. Ambulacral system petaloid. Anal and apical system disconnected. In this order we have certain narrow bands of fine milliaries which we called *Fascioles*, which are visible as depressed lines when the urchin is covered with spines, and which latter are of greatly disproportionate size. The large bristle-like curved spines are seated on the larger tubercles. The smaller ones frequently make a coat-like fur. The fascioles are covered with small embryonic spines which act as a sieve, and serve to keep particles of dirt from the pores. They are either round the petals, (peripetalous) anal, (round the anus) *internal* running along the grooved side of the test which corresponds to the odd ambulacrum, and between the end of the posterior petals and the apical system, or *lateral* Petalosticha are further distinguished by the formation of *Plastrons*: that is, a closely packed tubercular area of defined outline between the mouth and the anus. Pores round the mouth connected by furrows, forming elegant designs, to which the name of *phyllodes* is given. These phyllodes are separated by clusters or nobs of tubercles in the A. spaces called *Bourrelets*; the phyllodes and bourrelets form the *Floscelle*.

The first family is Cassidulidæ, which does not seem to be represented in Australia. It is limited to species without plastrons or fascioles. There is one species of *Echinobrissus* in New Zealand.



## Family SPATANGIDÆ. Agassiz, 1836.

Urchins with plastrons limited by bare ambulacral avenues. The posterior ambulacra, frequently divided by a fasciole, with a sub-anal plaston. Other fascioles variously present.

## Genus 1.—MARETIA, Gray, 1855.

Test thin, flattened, large tubercles upon the I. areas, except the odd one. Actinal plastron *smooth*, without spines. Only an indistinct anal fasciole. Petals long, spreading, anterior groove indistinct. Only one living species known.

MARETIA PLANULATA, Leske, which was found by the "Chevert" Expedition at Cape Grenville and Darnley Island. I have also seen specimens from New Caledonia; and it is rather common in Port Jackson. The Australian species are smaller and of light straw color, the spines much longer, and more prominent than the New Caledonian species.

## Genus 2.—EUPATAGUS, Agassiz, 1847.

Test thin, depressed, elliptical, petals arched, not sunk. I. areas covered by large tubercles, crenulate, and perforate, circumscribed by an elliptical peripetalous fasciole, a sub-anal fasciole present, no anterior groove, and no tubercles in odd I. space.

EUPATAGUS VALENCIENNESH, Agas. The only living species known, and which is found occasionally on the E. coast in deep water. I have seen a specimen from Bass' Straits, and the "Chevert" Expedition obtained it at Cape Grenville.

## Genus 3.—LOVENIA, Desor, 1847.

Ambulacral petals somewhat triangular, adjoining zones forming crescents on each side of apex. Large tubercles, with deep scrobicular circle on upper side, but not on posterior I. space. Internal and sub-anal fascioles. There is only one living species in Australia.

LOVENIA ELONGATA, Gray, 1854. Distinguished by the deep funnel-shaped cavity, in which anal opening is placed. Tropical Australia, but sometimes found at Port Jackson.



## Genus 4.—BREYNIA, Desor, 1847.

Test thick, remarkable for three fascioles, peripetalous, anal and internal, only associated in this genus. Large tubercles deeply sunken, enclosed within the peripetalous fasciole.

## BREYNIA AUSTRALASIÆ, Leach.

A large urchin, from 60 to 75 mil. in diam, the test a deep chocolate colour, and clothed with a brownish fur of spines, on which the fascioles are very distinct. Found from Cape York to Port Jackson, and sometimes 80 millim. in length.

## Genus 5.—ECHINOCARDIUM, Gray, 1825.

Test thin, swollen, petals triangular, with internal fasciole, anterior groove distinct, and with small pores. Anus in a truncated posterior extremity. Sub-anal fasciole with ascending branches round anal system. Actinal spines long and spathulate, the others fine and silky.

## ECHINOCARDIUM AUSTRALE, Gray.

A somewhat high test, with central apex, mouse-colored or brown. Common in S. E. Australia as far as Port Stephens, and in all Tasmania, Bass' Straits, S. Australia, as far as W. Australia. Found in 15 to 20 fathoms, on sandy mud.

## Genus 6.—BRISSOPSIS, Agassiz, 1840.

BRISSOPSIS LUZONICA. A small urchin, with short confluent ambulacra, which form conspicuous long crescents, and a peripetalous and sub-anal fasciole. Very thin. I do not enter into the details of the genus, as its Australian habitat is entirely doubted by me. Still it has been reported as from tropical Eastern Australia.

## Genus 7.—METALIA, Gray, 1855.

Test with a more or less broad elliptical undulating or re-entering peripetalous fasciole, and an anterior A. groove. Lateral A. petals narrow, elongate, pores well separated, apex anterior, actinal plastron narrow, heart-shaped, sub-anal area with a broad



fasciole and anal branches, sub-anal A. pores sending radiating grooves through the centre of sub-anal area; actinosome anterior crescentic. Tuberculation within peripetalous fasciole coarse, frequently consisting of primary tubercles.

METALIA MACULOSA.

Smaller than the following species, depressed, elliptical, indented at anterior edge, truncated posteriorly, *vertex posterior*. Greatest breadth across posterior petals, apical system more central, narrow ambulacral petals, a shallow anterior groove which is almost flush with test, except at the ambitus. Long., 43 to 78. Lat., 36 to 63. Alt., 21 to 34.

Rare at Port Jackson, and occasionally on the S. East coast.

METALIA STERNALIS. Lamouroux.

This large solid, swollen urchin, which is found in so many collections (generally bleached), is of dark brown color, with anterior apex, a broad zigzag peripetalous, and heart-shaped sub-anal fasciole. The sub-anal plastron is distinguished by a fan-shaped series of grooves, which converge from the fasciole. Anterior petals form an acute angle with anterior groove. It is sometimes met with, measuring 150 mil. in diam. Found throughout the Pacific, and tropical Eastern Australia, the latter rarely.

Genus 8.—LINTHIA, Gray, 1851.

Fascioles peripetalous and lateral, the first angular; the other extending under the anal system. Anterior groove, shallow, and broad; *anterior petals at right angles to the odd ambulacrum*; posterior narrow, long, and sunken.

LINTHIA AUSTRALIS, Gray.

Test thin, elliptical, angular, anterior groove descending to the ambitus, posterior end tuberculated, apical system anterior, vertex central. Long., from 38 to 61. Lat., 33 to 50, 25 to 39 mil. Common at times in South Australia and Tasmania. On one occasion, thousands of them were thrown on the beach at



Portland Bay, Western Victoria, after a slight storm. I have often seen it on the N. S. Wales coast, and it has been dredged in Bass' Straits at 30 fathoms. There is a specimen in the Sydney Museum which measures 150 mil. in length.

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NOTE.—Just as the foregoing sheets were being printed, I have been enabled to compare my new species of *Evechinus* (*E. australiæ*,) with a good series of the New Zealand *E. chloroticus*. The differences are that my species are smaller, higher, hexagonal, the secondary tubercles in the I. spaces fewer, the spaces themselves becoming bare near the abactinal region. The outer and inner pairs of pores are a vertical series. I must, however, candidly admit that as far as my experience goes, the aforesaid differences *may be* a young stage of *E. chloroticus*. In any case I may add that specimens recently seen enable me to claim an Australian habitat for the latter.

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Woods, Julian Tenison. 1878. "The Echini of Australia (including those of the Chevert Expedition)." *Proceedings of the Linnean Society of New South Wales* 2, 145–176.

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