1914

**Holothuroids. Second French Antarctic Expedition (1908–1910):
A Translation of *Holothuries. Deuxième Exédition Antarctique
Française (1908–1910)***

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DEUXIÈME EXPÉDITION ANTARCTIQUE FRANÇAISE

(1908-1910)

COMMANDÉE PAR LE

D^r JEAN CHARCOT

SCIENCES NATURELLES : DOCUMENTS SCIENTIFIQUES

EXTRAIT

MASSON ET C^{ie}, ÉDITEURS

120, Bd SAINT-GERMAIN, PARIS (VI^e)

1914

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UNDER THE DIRECTION OF L. JOUBIN, Professor of the Museum of Natural History

SECOND FRENCH ANTARCTIC EXPEDITION (1908–1910)

COMMANDED BY

DR. JEAN CHARCOT

NATURAL SCIENCES – SCIENTIFIC DOCUMENTS

EXTRACT

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Translator's note

Vaney was a student of René Koehler. He was on the faculty at the University of Lyon when his publications on the holothuroids of the French Antarctic Expeditions appeared (1907 and 1914). His name appears on the *Revue de l'Université de Lyon* – No. 5 – Decembre 1930.

This cruise of the “Pourquoi Pas?” (the “Why not?”) was under the command of J.-B. Charcot. He also had commanded the French Antarctic Expedition of 1903-1905.

Regarding several place names in the memoir, Charcot named Jenny Island for the wife of the second officer of the expedition, Sub-Lieutenant Maurice Bongrain. Jenny Island is in Marguerite Bay, named by Charcot for his wife.

Unlike the disastrous preservation of holothuroids from the French Antarctic Expedition in 1903-1905 in formaldehyde and acids, the specimens from the second expedition were well preserved in alcohol. Vaney expressed his pleasure to the person responsible for preserving the collections, Louis Gain, by naming a new species (*Psolidium gaini*) for him.

Pagination in the original publication is indicated by numbers in bold brackets, e.g.: **12**

CARTE DES RÉGIONS PARCOURUES ET RELEVÉES PAR L'EXPÉDITION

MEMBRES DE L'ÉTAT-MAJOR DU "POURQUOI-PAS"

J.-B. CHARCOT

M. BONGRAIN	Hydrographie, Sismographie, Gravitation terrestre, Observations astronomiques.
L. GAIN	Zoologie (Spongiaires, Echinodermes, Arthropodes, Oiseaux et leurs parasites) Plankton, Botanique.
R.-E. GODFROY	Marées, Topographie côtière, Chimie de l'air.
E. GOURDON	Géologie, Glaciologie.
J. LIOUVILLE	Médecine, Zoologie (Pinnipèdes Cétacés, Poissons, Mollusques, Coelenterés Vermidiens, Vers et Protozoaires, Anatomie comparée, Parasitologie).
J. ROUCH	Météorologie, Océanographie physique, Electricité atmosphérique.
A. SENOUE	Magnétisme terrestre, Actinométrie, Photographie scientifique.

MAP OF THE REGIONS TRAVELLED AND SURVEYED BY THE EXPEDITION
MEMBERS OF THE STAFF OF THE "POURQUOI-PAS?"

HOLOTHUROIDS

Clément Vaney

Adjunct Professor, University of Lyon

The collection of holothuroids brought back from Antarctic regions by the “Pourquoi Pas?” contains only a dozen species but the various very well preserved specimens have given me valuable information on the Antarctic littoral fauna and on the biology of certain species.

I am very grateful to M. Joubin, Professor of the Museum, for having graciously given me the responsibility for identification of this interesting collection that has allowed me to complete my previous studies on Antarctic holothuroids.

I had great difficulties in identifying the holothuroids of the “Français” because of the ossicles were dissolved by certain more or less acid preserving fluids. For this reason, some of my descriptions of new species remained incomplete. The study of the collection brought back by the “Scotia” had given me the opportunity to complete some of the previous diagnoses. The perfect preparation of the specimens from the “Pourquoi Pas?” allows me to revise my description of *Psolus charcoti*, whose single specimen from the “Français” lacked superficial ossicles because of the action of corrosive solutions.

The collection of the “Pourquoi Pas?” like that of the “Français” essentially contains only littoral synallactids and cucumariids. I had the good fortune to observe among the holothuroids of the “Scotia” a certain number of Antarctic forms of very great depths of such kind that the study of these three collections has allowed me to have a very complete survey of the Antarctic holothuroid fauna.

2 Among the synallactids of the “Pourquoi Pas?” is a new form, *Synallactes* (?) *gourdoni*, which I attach with doubt to *Synallactes*, and the first species of Antarctic *Bathyplores*, *B. bongraini*, whose ventral sole is defined by a very clear marginal border.

I have found again numerous specimens of my *Cucumaria antarctica* and *C. grandis*, species that had already been reported by the “Français” and the “Scotia”. But the specimens collected by the “Pourquoi Pas?” show great variation in size. The small specimens have the integument filled with ossicles while the large individuals have only few very scattered ossicles. Ludwig (1898) had already observed similar facts in another Antarctic species *Cucumaria laevigata* and the same peculiarity is found in an obviously arctic species *Cucumaria frondosa* (Gunner).

I describe three new species of *Cucumaria*: *C. godfroyi*, *C. liouvillei* and *C. joubini*.

C. godfroyi has great affinity with my *C. antarctica* and *C. grandis* but it is distinguished from them by its ossicles.

C. liouvillei is a very polymorphic species that has great variation in color, number and distribution of pedicels, number and structure of tentacles as well as in the Polian vesicles and madreporic canals. However, in spite of this polymorphism, it has ossicles that are completely characteristic and very constant in form.

As for *C. joubinni*, it is an incubating species. Certain specimens show a slight rudiment of a ventral sole recognizable only by the differences in size of the pedicels of the trivium. It is

approached by this character by psolids. Moreover, it has five incubatory pouches. Each opens separately to the exterior by an opening in the anterior region of an interradius. Eggs obviously in the same stage of development are found in these pouches.

The “Pourquoi Pas?” also collected a new *Psolidium*, *P. gaini*. It has numerous nearly microscopic pedicels scattered on the dorsal surface. **3** This species has a ventral sole defined by a well-marked marginal border.

The collection includes numerous specimens of two species of *Psolus*. One, *Psolus charcoti*, was reported first by the “Français”. The other is a new species, *Psolus koehleri*. Certain specimens have a single appendage located entirely in the anterior part of each dorsal radius. The inconstancy of this character indicates it is in process of regression and that this species is a transitional form between *Psolidium* and the true *Psolus*. As another peculiarity, *Psolus koehleri* has five shallow interradiial incubatory pouches placed at the base of the tentacular crown.

This Second French Antarctic Expedition thus has reported two new incubating species: *Cucumaria joubini* and *Psolus koehleri*.

The first expedition had also reported two, *C. lateralis* and *Psolus granulosus*. In such a way, our Antarctic expeditions have allowed us to report four new incubating species of cucumarids, each having a special incubating mode. The most curious is that in *Psolus granulosus* where the eggs are enclosed in kind of verrucose cups on the ventral sole.

The collection of holothuroids of the “Pourquoi Pas?” contains the following species:

Synallactids.

Synallactes ? gourdoni nov. sp.

| *Bathyplores bongraini* nov. sp.

Cucumids.

Cucumaria antarctica Vaney

--- *grandis* Vaney

--- *godfroyi* nov. sp.

--- *liouvillei* nov. sp.

| *Cucumaria joubini* nov. sp.

| *Psolidium gaini* nov. sp.

| *Psolus charcoti* Vaney

--- *koehleri* nov. sp.

We divide our study into two parts. We devote the first part to the description of the different species of the collection of the “Pourquoi Pas?”. In the second we develop general considerations of the holothuroids of the Antarctic and sub Antarctic regions.

FIRST PART

DESCRIPTION OF THE SPECIES

ASPIDOCHIROTES

SYNALLACTIDS

***Synallactes* (?) *gourdoni* nov. sp.**

(Pl. 11, fig. 1-2, 5 and 6.)

No. 165. Dredge VII. 16 January 1909. 68° 34' S; 72° 05' W. Near Alexander Land. Depth 250 m. Rock. – one specimen damaged by the dredge.

This specimen is in large part skinned and eviscerated. I can thus give only an incomplete description.

The more or less cylindrical body is 70 mm long and 20 mm in diameter. The living color was violet but the specimen preserved in alcohol is no more than rose white. This tint is moreover only visible on the dorsal surface. The mouth and anus are terminal. The mouth is surrounded by a circle of eighteen (?) orange yellow tentacles with a short peduncle and a more or less lobed disc. This tentacular circle is outlined, at least in the anterior region, by a little collar formed of a series of papillae.

The ventral median radius has about thirty pedicels arranged in two more or less alternating rows. Each lateral-ventral radius also appears to have about thirty yellowish pedicels. Between the different radii are found some scattered pedicels. There is no trace of a lateral border.

The dorsal surface is in bad state. Some pedicels still are observed in the anterior and posterior regions but it is not possible to indicate the exact distribution.

The integument is thick and contains cruciform ossicles whose branches have perforated extensions (Pl. II, fig. 3). Sometimes these arms are ramified (Pl. II, fig. 1). The central part of [5] these ossicles are formed of tables with four supports surmounted by a dome covered with a series of spines (Pl. II, fig. 6.).

The ventral pedicels enclose a terminal plate and numerous cruciform ossicles with more or less latticed arms. In the pedicles of the little collar small arched batons with forked ends and sometimes slightly spiny surfaces are found near the table-like ossicles (Pl. II, fig. 2 and 3.).

The longitudinal muscles of the radii are well developed. The only internal organs preserved are the bundles of whitish, ramified gonad tubes.

SIMILARITIES AND DIFFERENCES. – Because of the bad state of preservation of this specimen, it is only with doubt we attach it to the genus *Synallactes*. However it does not have the lateral border and its pedicels are localized in large part on the radii. Moreover, its ossicles recall very much those of *Synallactes moseleyi*. Third, in our species the top of the tables bristles with numerous spines and the small batons are forked. Moreover the number of tentacles and the arrangement of the pedicels in the trivium are not the same as in these two species.

This new species clearly differs from the other *Synallactes* of Antarctic and sub Antarctic regions. It is separated from *Synallactes carthagei* Vaney and *Synallactes robertsoni* Vaney by the

form of the ossicles and the number of tentacles. *S. carthagei* has only ten tentacles and *S. robertsoni* has six. It is the same for *Synallactes challengerii* Théel which has nineteen tentacles and whose cruciform ossicles have a central column terminated by a small number of teeth.

I dedicate this species to M. Gourdon, member of the French Antarctic Mission.

***Bathyplores bongraini* nov. sp.**

Pl. I, fig. 4 ; Pl. II, fig. 4, fig. 7-9, fig. 11-12.

No. 268. – Dredge IX. – 21 January 1909. Lat. 68° 00' S lat., 70° 20' W long. South of Jenny Island. Depth: 250 m. Green sand and rock. 1 specimen.

This specimen is oval and flattened dorsal-ventrally. It is no more than 180 mm although it was 210 mm when alive. Its greatest width towards the middle of the body is 10 mm. After preservation in alcohol, the sample is grayish white with black dots. Alive, its color was red wine scum.

The ventral surface of this individual has a sole that is extended the entire length of the body and is defined on each side by a projecting border with very clear pedicels arranged in three or four more or less alternating rows (Pl. I, fig. 4). In the posterior region of the unpaired radius are two rows of more or less alternating pedicels that are extended forward. They are accompanied the entire length of the radius by interradiol pedicels that are especially numerous in the anterior region of the sole. These pedicels are often only visible microscopically and are much smaller than those located on the bourrelets. Some blackish dots distributed on the entire surface of the sole make it difficult sometimes to find these appendages. Each bourrelet has a row of about twenty well separated papillae on its marginal border that extends the entire length of the body and is followed forward below the tentacular circle by a kind of small collar of about twenty isolated appendages.

The mouth is ventral and nearly terminal. It is surrounded by a circle of nineteen (?) peltate tentacles with a short peduncle. The diameter of the circle is 18 mm. The subterminal anus is absolutely dorsal.

The back is convex. About a dozen appendages are arranged along the length of each dorsal radius in a more or less alternating double row. Most of these appendages are made up of a tubercle with a base 10 mm in diameter surmount with a short cylindrical papilla 3 mm long. Sometimes only the papilla cannot be distinguished.

The body wall is thin. It has table-like ossicles with a tetraradiol base (Pl. II, fig. 4).

The distal ends of the rays of the ossicle base are 7 enlarged and have numerous perforations. They can sometimes be fused. In the center of each base is raised a table made up of four short pillars joined at the top by transverse crossbeams (Pl. II, fig. 8 and 9).

The ventral pedicels contain tables very like those of the body wall although the batonnets at the forked ends have some fine spines (Pl. II, fig. 7, fig. 11 and 12).

From the point of view of internal organization, we see five large longitudinal muscular bands with a width attaining 10 mm. The single Polian vesicle is 33 mm long. The respiratory trees are inserted on the intestine at a very great distance from the anus. They extend the entire length of the body and have short lateral branching caeca. The digestive tube is thin with a double S-shaped curve. The gonads are made up of two short bundles of yellowish white tubes.

SIMILARITIES AND DIFFERENCES. – This new species of synallactinids should be placed in the genus *Bathyplores* because it has a single sole well marked off by a row of papillae. Its lateral-

ventral radii have pedicels arranged in several rows. Papillae are distributed on the dorsal radii. The ossicles contained in the integument are tables with four pillars supporting by a cruciform base. But here the unpaired radius has small pedicels scattered over a large part of its length although they are well arranged in the posterior region. This fact is found moreover in other *Bathyplores*. Likewise *B. phlegmaticus* Sluiter reported from the Dutch Indies by the “Siboga” has pedicels on the posterior third of the unpaired radius. *B. natans* (Sars) from the Norwegian coasts can have appendages on this radius and *B. fallax* Ostergren, from Bergen has an unpaired radius with pedicels smaller than those of the lateral radii but much more numerous. *B. profundus* Koehler and Vaney from the Indian Ocean have two or three pairs of pedicels on the anterior quarter of the unpaired radius and some in the posterior region. All these facts show the unpaired radius of *Bathyplores* is not always naked. A certain number of species classified either in [8] *Bathyplores* or in *Synallactes* can be links between these two genera. Likewise the “Challenger” has collected a species from the Patagonian coasts that Théel has described under the name *Stichopus moseleyi* but that Ostergren and Ludwig attached to the genus *Bathyplores*. R. Perrier (1910) correctly considered it a *Synallactes* because of the absence of a sole. Our new species collected by the “Pouquoi Pas?” shows that the genus *Bathyplores* is represented in antarctic regions.

I dedicate this species to M. Bongrain, member of the Second French Antarctic Expedition.

DENDROCHIROTIDS

CUCUMARIIDS.

Cucumaria antartica Vaney.

1907. C. Vaney. Holothuries. *Expédition antarctique française*, p. 6.

1908. C. Vaney. Les Holothuries de l'*Expédition antarctique écossaise*, p. 427.

No. 71. – Dredge V. – 29 December 1908. Peltier Channel, between Goetschy Island and Doumer. Depth: 92 m. Gray mud and gravel. – 4 specimens.

No. 78. – Dredge V. – 1 specimen.

No. 119. – Dredge VI. – 15 January 1909. Entrance of Marguerite Bay, between Jenny Island and Terre Adelaide. 67° 45' S lat., 70° 45' 42" W long. Depth: 254 m. Gravelly rocks. 7 specimens.

No. 167. – Dredge VII. – 16 January 1909. 68° 34' S lat., 72° 05' W long. Near Alexander Land. Depth: 250 m. Rock. 1 specimen.

No. 168. – Dredge VII. – 1 specimen.

No. 170. – Dredge VII. – 5 specimens.

No. 308. – Dredge X. – 22 January 1909. 68° 35' S lat., 72° 40' W long. Near Alexander Land. Depth: 297 m. Rock, blue mud. 1 specimen.

No. 478. – 10 October 1909. Holothuroid attached to an alga collected in 6 m depth at Port Circumcision, Petermann Island. – 1 specimen in bad condition.

- No. 605. – Dredge XIV *b*. – 18 November 1909. Along the northeastern coast of Petermann Island, in the Lemaire Channel. 2 specimens.
- No. 632. – Dredge XV. – 26 November 1909. 64° 49' 55" S lat., 65° 19' 18" W long. Before Port Lockroy, Roosen Channel. Depth: 70 m. – 3 specimens, 2 in bad condition.

The various specimens we attach to this species are often of much different sizes. Some whose length is between 40 and 60 mm have all the characters of specimens **9** collected by the “Français” and the “Scotia”. But others, smaller, 20-30 mm long and 3-20 mm in diameter, have a completely different exterior appearance. The color of these small individuals is sometimes entirely white. However, only the tentacles and the pedicels are whitish in many of the small specimens. It is especially the texture of the integument that has the greatest variation. The large specimens have integuments having the appearance of leather and contain some ossicles often very difficult to detect because of their great scattering. To the contrary, small individuals have very rigid, rugose integuments rich in ossicles completely like those seen in specimens of large size. Between these two series of forms we observe some intermediary types. From this comparison it seems that the young individuals of *C. antarctica* would have integuments very rich in ossicles while older individuals contain a very small number. As we shall see further, these facts seem to occur in another antarctic *Cucumaria*, *C. grandis*. According to the notes taken on living individuals, most of the specimens had deep violet or violet brown integuments, generally deeper towards the tentacles. The latter were white or yellowish. This species seems to have a great variation in its color. It is the same, from the same dredge VII was collected 1° a specimen with yellowish tentacles and a light brown integument, deeper towards the tentacular crown; 2° specimens with a mixture of white and violet tentacles and a whitish integument but light brown towards the tentacular region; and finally 3° an individual with tentacles a mixture of white and violet and a whitish integument. Other dredges produced entirely whitish specimens.

***Cucumaria grandis* Vaney**
Pl. II, fig. 10.

1907. C. Vaney. Holothuries. *Expédition antarctique française*, p. 12.
1908. C. Vaney. Les Holothuries de l'*Expédition antarctique écossaise*, p. 428.

- No. 69. – Dredge V. – 29 December 1908. Peltier Channel, between Iland Goetschy Island and Doumer Island. Depth: 92 m. Gray mud and gravel. – 1 specimen.
- [10] No. 73. – Dredge V. – 1 specimen.
- No. 77. – Dredge V. – 2 specimens.
- No. 171. Dredge VII. – 16 January 1909. 68° 31' S lat.; 72°05' W long. Near Alexander Land. Depth: 250 m. Roch. – 2 specimens.
- No. 567. – 16 November 1909. Holothuroid found at low tide in an urchin test on a beach on Petermann Island.

I established this species from a single specimen collected by the “Français”. I was able to complete the diagnosis with the aid of specimens collected by the “Scotia”. All individuals I have examined until the present were of very great size. In the collections of “Pourquois Pas?”, I find a specimen of large dimensions, 240 mm long and absolutely like specimens that I have already described except from the point of view of color. Its color originally was violet brown and after

the action of the preserving liquids it has become grayish. Besides this specimen of large size I found seven small specimens whose length varies from 13 to 60 mm and whose diameter is between 5 and 20 mm. They have all the species characteristics.

Most of the small specimens have whitish bodies with a brownish anterior end. Their tentacles are also whitish. But according to the color taken from life, they were very pale yellow, sometimes pink and even sometimes and carmine pink. The integument is rugose and very rigid. It contains numerous spatula-like ossicles, generally having a simple handle. In larger specimens, the integument is soft, not thick. It sometimes contains ossicles whose handle and often also the spatulatory plate are subdivided into two or more parts (Pl II, fig. 10). Comparison of all these specimens shows us the integument of young individuals contains numerous ossicles that give it its rugosity while the larger specimens have only some very scattered spatula-like ossicles in the midst of the relatively soft integument. It seems in the course of development of this species the formation of ossicles stops and perhaps there is a disappearance of the ossicles already formed. We have observed identical facts [11] in another antarctic species, *Cucumaria antarctica* Vaney. These two antarctic *Cucumaria* often are regenerating parts of their tentacles. There is in the same way in the collection of the "Pourquoi Pas?" an individual of *C. grandis* with five of its tentacles reduced to the state of stumps while another individual of the same species and origin has only ten tentacles of which several are in the process of regeneration. I have already observed similar facts in specimens collected by the "Français" and by the "Scotia".

***Cucumaria godfroyi* nov. sp.**

Pl. IV, fig. 1 to 5.

No. 169. – Dredge VII. 16 January 1909. 68° 34' S lat.; about 72° 05' W long. Near Alexander Land. Depth: 250 m. Rock. – 5 specimens.

They are up to about twenty mm long with a diameter of only 4 to 5 mm.

The pedicels are localized to the radii where they are arranged in two rows. The radii of the trivium have more than the radii of the bivium.

The ten tentacles are all alike. The branching is very distinct. In one specimen, we find only eight tentacles among which two are reduced to the state of stumps.

The integument is thin and very rugose. It contains numerous spatula-like ossicles with the blade with the aspect of a tower. It is large and made up of two or three extensions. These are more or less spiny and joined by perforated and toothed lamellae (Pl. IV, fig. 1 and 2). The widened portion of the spatula is sometimes much extended. It has numerous openings but has neither tubercles nor teeth.

The pedicels contain very peculiar ossicles (Pl. IV, fig. 3 to 5). These are flat and arched rods with enlarged middle parts and ends into a perforated plate with distinct and spiny contours. The middle region is to the side of the axis so that the ossicle has the aspect of a fronton.

The calcareous ring is formed by a group of ossicles [12] that are not fused into hard and compact pieces. The retractor muscles are inserted towards the middle of the body. The single madreporite is convoluted and directed forward. It has a very visible madreporic plate. The Polian vesicle is filiform. The digestive tube has a masticatory stomach. The gonads are formed of two tufts of simple yellowish tubes in the middle portion of the body.

SIMILARITIES AND DIFFERENCES. – *Cucumaria godfroyi* is closely related to our *C. antarctica*. But we believe it necessary to separate them because of the very different ossicles:

those of the integument have a kind of table displaced to the side and those of the pedicels recall more or less those of *C. crocea*. Its spatula-like ossicles recall those of our *C. grandis*, but here the handle of the spatula is not simple and is always formed by the joining of two or three parallel rods. These different Antarctic species have great affinities with *C. steineni* of Ludwig but they do not have anal teeth like the latter. They are separated from *C. georgiana* Lampert because their ten tentacles are always alike while the two ventral tentacles of Lampert's species are smaller than the others.

I dedicate this species to Godfroy, member of the Second French Antarctic Expedition.

***Cucumaria liouvillei* nov. sp.**

(Pl. III, fig. 1 to 3,)

No. 72. – Dredge V. – 29 December 1908. Peltier Channel, between Goetschy Island and Doumer Island. Depth: 98 m. Gray mud, gravel. – 1 specimen.

No. 75. – Dredge V. – 1 specimen.

No. 119. – Dredge VI. – 15 January 1909. 67° 45' S lat.; 70° 45' 42" W long. Entrance to Marguerite Bay between Jenny Island and Adelaide Land. Depth: 254 m. Rock, gravel. – 3 specimens.

No. 171. Dredge VII. – 16 January 1909. 68° 34' S lat.; 72° 05' W long. Near Alexander Ist Land. Depth: 250 m. Rock. – 3 specimens.

No. 267. – Dredge IX. – 21 January 1909. 68° 00' S. lat.; 70° 20' W long. To the south of Jenny Island. Depth: 250 m. Green sand and rock. – 1 specimen.

No. 270. – Dredge IX. – 2 specimens.

No. 307. – Dredge X. – 22 January 1909. 68° 35' S lat.; 72° 40' W long. Near Alexander Ist Land. Depth: 297 m. Rock, blue mud. – 2 specimens.

[13] This new species seems to have very great variations. The dimensions of the specimens are very variable. The largest reaches 60 mm in length and 20 mm in diameter. Much smaller ones are only 15 mm long and 7 mm in diameter. Most are 30 to 45 mm in length and 10-15 mm in diameter.

Their color also has notable variations. According to the notes taken of living individuals, the integument of different specimens was orange yellow, pinkish white, rose or white. After preservation in alcohol, most specimens had become whitish. The ventral surface of No. 72 is brownish and contains numerous pedicels distributed along each radius of the trivium. The medio-ventral radius has four rows of very dense pedicels while the latero-ventral radius has only three. The dorsal surface of this specimen is white on the sides and brown in the mid-region. Most of the pedicels of the bivium are distributed on each radius in two more or less alternating rows but one finds some of them spread out in the interradiial spaces.

In other specimens there are only two alternating rows of pedicels in each radius. But these appendages are much denser in the trivium than the bivium.

Most samples have ten similar tentacles, often yellowish in color. In certain very relaxed individuals the tentacles are very branched but in others the branching is less developed and looks rough. Specimen 270 has ten tentacles reduced to stumps and two other individuals have only nine tentacles, the much larger one appears to come from fusion of two original tentacles.

The integument is thin and sometimes translucent. The most precise character of this species that is so polymorphic is furnished by the ossicles of the body wall that are more numerous

in small species than in the large ones. The ossicles are more or less circular latticed plates and very shallow cups. Their diameter is very variable. They often have about a dozen [14] openings with toothed edges (Pl. III, fig. 1 and 3). This denticulation is very characteristic and is sometimes observed on the periphery of the plate. Some of these plates with toothed borders are found in the pedicels (Pl. III, fig. 2). Towards the end of these appendages, the ossicles sometimes have a much less defined border.

The calcareous ring is not made up by strong and resistant plates but is reduced to a mass of whitish granulations. The retractor muscles insert towards half the body length. According to the specimen one finds one to four fusiform Polian vesicles with a length between 17 to 20 mm. There is either a single madreporic canal or a group of four to five canals 3 mm long. The gonads are made up of two tufts of simple yellowish tubes. The respiratory trees are very distinct with a transparent wall.

SIMILARITIES AND DIFFERENCES. – This species is very polymorphic. However it is very clearly characterized by its ossicles that are perforated plates with each hole bordered with teeth. This peculiarity has not yet been reported in each *Cucumaria* but it is frequent in synaptids.

I dedicate this species to Liouville, member of the Second French Antarctic Expedition.

***Cucumaria joubini* nov. sp.**

(Pl. I, fig. 1, 3 and 10; Pl. III, fig. 4 to 11.)

No. 77. – Dredge V. – 29 December 1908. Peltier Channel, between Goetschy Island and Doumer Island. Depth: 98 m. Gray mud, gravel. – Numerous specimens.

No. 634. Dredge XV. – 26 November 1909. 64° 49' S lat.; 65° 49' 18" W long. Before Port Lockroy. Roosen Channel. Depth: 70 m. Mud and pebbles. – Numerous specimens.

The specimens are of different sizes. The largest are 40 to 45 mm long and 10 to 12 mm in diameter. The integuments as well as their tentacles were rose colored in life. They are whitish after the action of the preserving fluids except sometimes for the dorsal region which is slightly [15] brown. The mouth and anus are at the ends. The mouth is surrounded by a circle of ten tentacles. The two ventral ones are smaller than the others. Some tentacles are sometimes reduced to stumps. Others have pigmented spots. The posterior part of the body is rounded. The anus is bordered by five small papillae.

The pedicels are few in number and only on the radii. They are more numerous on the ventral radii than on the dorsal radii. The rows of pedicels stop at some distance from the mouth and anus (Pl. I, figs. 1 and 3). In certain specimens the pedicels near the mouth region are smaller than those in the middle of the body. This difference is especially very visible on the trivium. There are about a dozen pedicels in each radius of the bivium. They are very far each other and arranged in a double row. But sometimes there is a single row. In certain individuals the large appendages of the trivium appear to border the ruminant of a ventral sole. They are arranged in each radius in a double row. The lateral-ventral radius has about twenty pedicels. They tend to be disposed in certain specimens in a single very dense row. Some ambulacra of the second row appear from place to place. The median radius also has about twenty pedicels. In most specimens they are arranged in a double alternating row. But in certain individuals they form only a single row in the posterior region of the body. In others they are in groups that are separated by a very great interval.

The integument contains perforated ossicles. Sometimes they are very scattered (Pl. III, fig. 6, 7, and 11). Some of the plates have only four large openings. Sometimes a very large

mamelon occurs in the center of the ossicle. And sometimes smaller mamelons are found on the ribs of the ossicle. Some integumentary plates are large and are pierced with numerous perforations between which are distributed a large number of mamelons (fig. 6). Towards the pedicels, the ossicles are elongated along an axis. They have **16** very numerous perforations but only some mamelons (Pl. III, fig. 4 and 10). The tentacles contain flat and sometimes arched batonnets that have one or two rows of perforations and some fine projecting granules on their surface (Pl. III, fig. 5, 8 and 9).

The calcareous ring (Pl. I, fig. 10) is formed by ten pieces. The interradial parts are in the form of chevrons while the radials are massive. The single madreporic canal ends in a madreporic plate direct forward. There is only a single Polian vesicle 10 mm in length. The gonads are made up of two bundles of about a dozen moniliform tubes 20 mm in length and with reddish swellings. A genital papilla projects near the tentacular circle.

Certain specimens (Pl. I, fig. 1) have immediately behind the tentacular region some swellings coming from groups of reddish eggs in incubatory pouches. There are five of these. Each has an anterior opening in an interradius at some mm from the base of the tentacles. The pedicels situated on the wall of these pouches are much more reduced than the others. The eggs are developing and all are in the same stage.

SIMILARITIES AND DIFFERENCES. -- *Cucumaria joubini* looks very much like *C. georgiana* Lampert, especially the form that Lambert had first described under the name *C. pithacnion* whose pedicels were localized in a double row in the radii. In fact, the plates of the body wall have nearly the same form. The calcareous ring is similar and the two ventral of the ten tentacles are smaller. In spite of these common characters, it seems necessary to me to separate this species for the following reasons:

1° The ossicles of the tentacles are elongated plates are much different than the ossicles reported by Lampert and Ludwig in *C. georgiana*;

2° The pedicels in each radius here are less numerous than in *C. georgiana* and the distribution in the trivium is very peculiar [17] with this rudiment of a ventral sole that one meets in certain specimens;

3° The existence of five interradial incubatory pouches also appear to be completely special to *C. joubini*. However this character that seems so important at first should not be considered as preponderant as we do not know all the biology of *C. georgiana*. It is necessary to recognize our knowledge of a species is often fragmentary and is only completed progressively. It is this that we show well the observations made recently on the *C. crocea* (Lesson). This old species has been described repeatedly. In the course of the voyage of the "Challenger", Wyville Thomson has observed that young *C. crocea* were carried on the bivium of the parents. The two dorsal radii were modified and had a verrucose aspect. This fact was confirmed by Théel, Ludwig and me. But it was only an incomplete observation. Specimens collected by the "Discovery" permitted MacBride and Simpson (1908) to report the presence of two ventral incubatory pouches in this species.

Our new incubating species is far from *C. crocea* not only by the different number of incubatory pouches but also by the form of the ossicles and the presence of two tentacles smaller than the others. It is also separated from *C. lateralis* Vaney that, from the point of view of the ossicles, is near *C. georgiana* but which has two ventral incubatory pouches and distribution of pedicels very different from that we report in *C. joubini*.

Because of the beginning of a rudiment of a ventral sole, our *Cucumaria* should be considered in terms of a transition between *Cucumaria* and *Psolidium*.

I dedicate this species to Dr. Joubin, Professor at the Museum, who so kindly gave me the opportunity to study the collections of the “Français” and the “Pourquoi Pas?”.

18

***Psolidium gaini* nov. sp.**
(Pl. I, fig. 7 to 9; Pl. IV, fig. 6 to 14.)

No. 635. – Dredge XV. – 26 November 1909. Lat 64° 49' 55" S lat.; 65° 49' 17" W long. Before Port Lockroy, Roosen Channel. Dept: 70 m. Mud and pebbles. – 2 specimens.

Simple examination with the naked eye would tempt one to classify these specimens with *Psolus* whose ventral sole is limited by a marginal border. But microscopic examination of a portion of the dorsal-lateral body wall shows in this entire region a large number of small pedicels with terminal plates (Pl. IV, fig. 10). These two specimens should be attached to the genus *Psolidium*. They are types of a new species that we name *Psolidium gaini*, dedicated to Louis Gain who prepared so well the echinoderm collection during the “Pourquoi Pas?” expedition.

The two specimens in life had a slightly orange rose integument and tentacles. After preservation, they are white. They have very different sizes. The larger individual is 40 mm long, 7 mm wide and 10 mm high. The small specimen is only 30 mm long and 6 mm wide and high. Both have a ventral sole with a thin wall well set off by a small marginal border more or less inflected on the internal side (Pl. I, fig. 8). This sole is oval with a major axis of 32 mm in the large specimen and 20 mm in the small specimen. The corresponding minor axes are 7 mm and 4 mm.

The dorsal surface of the body is convex (Pl. I, fig. 9). It is slightly elevated anteriorly where it is prolonged as a more or less erect straight siphon. Posteriorly the dorsal surface ends in a short siphon in the form of a cone. The two siphons are covered with small spines but there are no differentiated plates at all around the buccal and anal openings. The mouth is surrounded by a crown of ten tentacles. The two ventral ones are smaller than the others.

19 The inflected border of the sole prevents precisely indicated the arrangement of the pedicels along the ventral-lateral radii. For nearly the entire length of these radii the pedicels appear to have four rows but at certain points there are only two. The ventral median radius has only two groups of pedicels at the ends. The anterior group is always more important. It has about a dozen pedicels arranged in a triangle 5 to 6 mm high and a base made up of four appendages. It is applied against the marginal border. Some longitudinal folds of the sole following the unpaired radius make it difficult to examine this region. But it seems there are no pedicels between these two groups. At the base of the buccal siphon each of the two radii of the bivium has a very clear pedicel. The entire dorsal surface is granular. Microscopic examination shows a large number of small pedicels.

The integument of the convex region of the body is rigid and very thick. It contains two kinds of ossicles: 1° elongated plates (Pl. IV, fig. 7) with numerous perforations more or less elongated in the direction of the major axis of the plate; 2° small latticed ossicles in the form of a basket with a lateral handle (Pl. IV, fig. 8). These latter ossicles are superficial. The lateral body wall of the dorsal pedicels has perforated plates (Pl. IV, fig. 14). Each has a terminal plate (fig. 10).

The integument of the sole has plates with an irregular border and several perforations each located in a projecting part (Pl. IV, fig. 6, 9 and 13). The pedicels of this sole have more or less elongated plates and perforations arranged in one or two obviously alternating rows.

The calcareous ring (Pl. I, fig. 7) is made up of ten nearly identical pieces in the form of a chevron. Each has an anterior point. The retractor muscles are 7 mm long.

The single Polian vesicle is 5 to 6 mm long. The madreporic canal is short and ends in a scarcely visible plate. [20] The gonads are formed of two tufts of yellowish white filaments. The anterior ones are very large.

SIMILARITIES AND DIFFERENCES. – *Psolidium gaini* is separated from *Psolidium convergens* (Hérourard) and *Ps. (Cucumaria) coatsi* Vaney of Antarctic regions by the presence of a sole set off by a marginal border. This brings it near the true *Psolus* while the two other reported species are rather near *Cucumaria*.

This new *Psolidium* is close to *Ps. dorsipes* Ludwig that also has a sole with a marginal border and irregularly distributed dorsal pedicels. But the dorsal surface of Ludwig's species is covered with numerous imbricated scales that are visible to the naked eye. Its ventral sole has three complete rows of pedicels marking the three ventral radii. The unpaired radius has two rows full of dense pedicels. Moreover the ossicles of the two species are not alike. In the same way the wall of the ventral sole of *Ps. dorsipes* has three kinds of ossicles while we have observed only one kind in *Ps. gaini*.

***Psolus charcoti* Vaney**
(Pl. V, fig. 11 to 16.)

1907. – C. Vaney. Holthuries. *Expédition antarctique française*, p. 21.

No. 76. – Dredge V. – 29 December 1908. Peltier Channel, between Goetschy Island and Doumer Island. Depth: 92 m. Grey mud and gravel. – 5 specimens.

No. 79. – Dredge V. – 6 specimens.

No. 633. – Dredge XV. – 26 November 1909. 64° 49' 55" S lat.; 65° 49' 17" W long. Roosen Channel before Port Lockroy. Depth: 70 m Mud and pebbles. – Numerous specimens.

I hesitated for some time before attaching these diverse specimens to the specific type collected by the "François" in Biscoe Bay at 110 m depth that I had been unable to study well because of the contracted state of the body and the attack of the preserving fluids.

As in the specimen from Biscoe Bay, all the specimens of "Pourquoi Pas?" have a more or less cylindrical body. According to notes 21 the integument of living individuals was brownish or dull rose sometimes shading up to nearly brown. After preservation in alcohol the color is grayish white and the tentacular crown entirely white. The more or less wrinkled integument is thin. It has a checkered appearance. All the specimens are much larger than the type specimen. Some are 75 mm long and 25 to 30 mm in diameter although the majority has an average length of 40 to 60 mm and a diameter of 20 to 25 mm. Two individuals only are 20-22 mm long and 10 mm in diameter.

In this species the ventral sole is characterized by its flatness and by a surface generally much smoother than other regions of the body. However in some specimens there seems to be a very slight lateral pad on the sides of the sole. If this formation is not the result of the contracted state of the body under the influence of the preserving fluids, it would represent the rudiment of a marginal border.

The sole does not fill all the ventral surface of the body. It often extends only two thirds of the animal's length and even sometimes half the length. The pedicels are exclusively localized in the radial areas of the sole. Their number as well as their distribution shows very great variation.

The lateral radii of the trivium have seven to twenty five pedicels arranged in a single row. There is often a very marked dissymmetry between the two lateral radii of the same individual. One can have more pedicels than the other. In a specimen 75 mm long I counted nine pedicels on the right and thirteen on the left. But the greatest variation is in the ventral median radius. I counted in this radius from four to nineteen pedicels arranged in two sometimes alternating rows. These appendages are especially localized in the middle region of the radius. They can be either absent or in small number and then very dissimilar. Comparing **22** those of different individuals, in general the larger specimens have a greater number of pedicels on the ventral median radius. Thus a small specimen 22 mm long with a sole of 12 mm length with seven to eight pedicels in each lateral radius of the trivium has only four pedicels in the unpaired radius with a pair at each end.

It seems there would be an increase in number of pedicels in the course of growth but this increase does not happen in a regular fashion. Individuals of the same length can sometimes have very great variation from the point of view of number of these appendages. Some of these *Psolus* are relaxed and have a tentacular crown of ten branching tentacles. The two ventral ones are smaller than the others.

If we compare these different specimens collected by the “Pourquoi Pas?” with the single specimen of our *Psollus charcoti* coming from the first French Antarctic Expedition, we find a certain number of differences that explain our initial hesitation to place all in the same species. In fact, we must first all report that the species type has only a single row of pedicels extending the entire length of the ventral median radius. But this difference is of little importance because we have seen a very great variability in the number and distribution of these appendages. But the most marked difference involves the ossicles. In the species type, we never found a single layer of ossicles while in the integument of all samples collected by the “Pourquoi Pas?” we observe two layers of ossicles: a superficial one formed of kinds of latticed cups (Pl. V, fig. 13 to 17) and a deeper one made up of numerous reticulated plates with varied aspect according to whether they come from the wall of the sole or the lateral-dorsal wall of the body. Certain of these plates are formed by several stages of supports making up the superposed network as we have already described. But here the plates often reach **23** much greater dimensions than those of the type. In the pedicels of the only specimen from the “Français” we have never been able to detect any ossicle at all while in the appendages of all individuals from the “Pourquoi Pas?” we observe latticed cups and some elongated ossicles with numerous perforations (Pl. V, fig. 12 *a, b, c, d, c*). All these differences from the point of view of the ossicles are probably due to the fact that the specimen of the “Français” had been submitted to the action of acid formaldehyde that dissolved the more superficial ossicles. We can consider in the same way the presence of superficial latticed cups as constant in this species. This character very much attaches our *Psolus charcoti* to *Psolus murrayi* Théel. The latter species was established from a single specimen collected by the “Challenger” at 37° 17' South latitude and 53° 52' West latitude at 600 fathoms. It has a sole that seems well defined by a marginal protruding border. Its dorsal region is strongly verrucose. Each verruca seems to be formed by a network of the same as the scales themselves. In addition, the arrangement of the pedicels is not the same as in our species. All this ensemble of characters separates well *Ps. murrayi* from our *Ps. charcoti*.

From the internal organization point of view, we observe that the calcareous ring of *Ps. charcoti* is made up of ten pieces strongly fused together (Pl. V, fig. 11). Each piece, radial and interradial, has an anterior pointed extension. There is a single elongated Polian vesicle 100 in length. It is located a little to the left of the median plane. The madreporic canal ends in a large ovoid plate. The interior of the body wall is whitish. The longitudinal muscle bands are thin and

whitish. There are two tufts of simple white genital tubes. The respiratory trees have a very thin and transparent wall.

On numerous specimens we find attached animals.

24

***Psolus koehleri* nov. sp.**

(Pl. I, fig. 2, 5 and 6; Pl. V, fig 1 to10)

No. 74. – Dredge V. – 29 December 1908. Peltier Channel between Goetschy Island and Doumer Island. Depth: 98 m. gray mud, gravel. – Numerous specimens.

No. 629. – Dredge XV. – wt November 1909. 64° 49–55” S lat; 65° 49’ 18” W long. Before Port Lockroy, Roosen Channel. Depth: 70 m. Mud and pebbles. – Numerous specimens.

No. 630. – Dredge XV. – 4 specimens.

This new *Psolus* very much recalls externally our *Ps. granulatus* but it is of much greater size. Certain specimens are 65 mm long and the smallest still is 38 mm long.

The body of this *Psolus* has a strongly convex dorsal region and a flat ventral surface filled for the most part by a sole defined by a very projecting border (Pl. I, figs. 2, 5 and 6). According to notes, the sole of living individuals is white while all the rest of the body is a beautiful red. The tentacles are pink or a very pale violet rose. After the stay in alcohol, the living colors have disappeared and all the specimens have become uniformly whitish. The ventral sole has a thin wall. It is oval or rectangular. Its length is only two thirds of the total length of the body while its width is nearly the same as that of the body. This width, moreover, varies according to the state of contraction of the animal: in certain specimens 55 mm in length it varies from 15 to 25 mm.

The height of the body is between 10 to 22 mm. It has great variation and most often it decreases from front to back. On the dorsal surface of the body the anterior buccal siphon and the posterior anal siphon are both more or less projecting. The buccal siphon is nearly always cylindrical and its diameter is between 12 to 20 mm. Its direction is very variable so that the tentacular crown is directed either forward or upward. The anal siphon has the form of a truncated cone 7 mm in diameter and 3 to 5 mm tall.

25 Except for the sole, all the rest of the body has a very rigid reticulated integument. No large differentiated plate borders the buccal or anal openings.

There are ten tentacles. The two ventral ones are smaller than the others. Some small plate points occur on the digitations of the tentacles. A certain number of specimens have five interradial depressions around the tentacular crown. These are true incubatory pouches largely open to the exterior and in which are found small *Psolus* (Pl. I, fig. 6). Sometimes there are two small pedicels towards the anterior region of the dorsal radii and between the incubatory pouches (Pl. I, fig. 5). These are the only pedicels of the bivium. In one specimen I observed two pedicels on the portion of the median radius between the tentacular crown and the anterior body of the sole. But in most specimens the pedicels are exclusively localized on the sole. In certain individuals, the border of the ventral sole has on its free border a series of fused ambulacra in a continuous marginal fold whose structure is especially very clear in the well-studied specimens (Pl. I, fig. 2). In a large individual, the marginal border of the sole thus appears to be made up of more than eighty appendages. Within this border and on the sole itself are arranged about thirty pedicels arranged in two alternating rows, of which one seems nearly always preponderant.

The arrangement of the pedicels following the ventral median radius is very variable. However, in all specimens the pedicles occur the entire length of the radius. But at the ends they are more numbers and closer to each other, especially at the anterior end. They are very scattered in all the middle region (Pl. I, fig. 2). Thus in a large number of the specimens collected in Dredge V, the unpaired radius has eight pedicels in front arranged in two rows and entirely behind a clump of three pedicels in two rows. These two terminal ambulacral clumps are connected to each other by eight pedicels scattered throughout the middle region **26** and arranged in a single file. In another smaller individual, the ventral median radius had twenty to twenty five pedicels arranged in two alternating rows. These appendages very far apart and not very close in the middle of the radius. But they are concentrated at the ends. In front, ten are disposed in two rows and behind are only four to five pedicels.

The dorsal and dorsal-lateral walls of the body contain oval plates with numerous perforations and have a double and even sometimes a triple network of superposed bars. In these plates are arranged coups with a reticulate wall whose opening is bordered by well-marked teeth (Pl. V, fig. 2I).

The thin wall of the sole contains large ossicles (Pl. V, fig.1) with irregular contours and large openings, and coups shallower than those in the other regions of the body (Pl. V, figs. 3 and 5). In the pedicels of the sole are kinds of cup-like ossicles as well as elongated plates with numerous perforations (Pl. V, figs. 4,8 and 9).

The calcareous ring (Pl. V, fig. 10) is made up of ten chevron-shaped pieces each with an anterior point. The radial parts are much more massive than the interradians.

There is a Polian vesicle 7 mm in length. The gonads are made up of two tufts of tubes that extended well forward in the body and which unite anteriorly in a genital tube with a very large diameter.

SIMILARITIES AND DIFFERENCES. – Based on the presence of some pedicels in the bivium and on the form of ossicles, one could place this new species in the genus *Psolidium* as defined by R. Perrier. But we have though it should be attached to the genus *Psolus* because the single appendage in each dorsal radius does not exist in all specimens and appears to give a impermanent character to the point of disappearance. This new species shows clearly the genera *Psolus* and *Psolidium* are very close and it constitutes a transition form between the two genera.

27 The mode of incubation of *Psolus koehleri* is very peculiar and is completely different from that we reported in *Psolus granulatus* Vaney. In fact, the eggs in the latter species are enclosed in verrucosities of the ventral sole while in the new *Psolus* the eggs are in interradian pouches located at the base of the tentacular crown.

In addition, *Psolus granulatus* is distinguished from *Psolus koehleri* by other characters. The size of *Ps. granulatus* is always smaller than that of *Ps. koehleri*. In a relaxed *Ps. granulatus* the buccal siphon is clearly terminal and the anal siphon is always slightly projecting. In our new species, the buccal siphon is instead oblique and directed upwards. The anal siphon is a truncated cone. The form of the sole and the structure of the marginal border that defines the sole is well differentiated in the two species. Moreover, the unpaired radius in *Ps. granulatus* has pedicels only at its anterior and posterior ends. The middle portion is naked. While in *Ps. koehleri* the pedicels are always scattered the entire length of the unpaired radius although they are denser at the ends. These two species thus are quite distinct but their ossicles have so great similarity that we have to admit they are very close. One is obviously a *Psolus* while the other has characters of *Psolidium*.

I am happy to dedicate this species to my mentor and friend, R. Koehler, Professor of Zoology of the Faculty of Sciences of Lyon, whose works on echinoderms are universally known and appreciated.

LIST OF SPECIES COLLECTED AT THE DIFFERENT STATIONS

Dredge V. – 29 December 1908. Peltier Channel between Goetschy Island and Doumer Island. Depth: 92 m. Grey mud and gravel. Water temperature at the bottom: -0.1° .

<i>Cucumaria antarctica</i>	<i>Cucumaria joubini</i>
<i>Cucumaria grandis</i>	<i>Psolus charcoti</i>
<i>Cucumaria liouvillei</i>	<i>Psolus koehler</i>

Dredge VI. – 15 January 1909. $67^{\circ} 43' \text{ S lat.}; 70^{\circ} 45' 42'' \text{ W long.}$ Entrance of **28** Marguerite Bay between Jenny Island and Adelaide Island. Depth: 254 m. Rock and gravel. Temperature at the bottom: -1.18° .

<i>Cucumaria antarctica</i>	<i>Cucumaria liouvillei</i>

Dredge VII. – 16 January 1909. $68^{\circ} 34' \text{ S lat.}; 72^{\circ} 05' \text{ W long.}$ Near Alexander 1st Land. Depth: 250 m. Rock. Water temperature at the bottom: -1.6° .

<i>Synallactes (?) gourdoni</i>	<i>Cucumaria godfroyi</i>
<i>Cucumaria antarctica</i>	<i>Cucumaria liouvillei</i>
<i>Cucumariaa grandis</i>	

Dredge IX. – 21 January 1909. $68^{\circ} 00' 5'' \text{ S lat.}; 70^{\circ} 02' \text{ W}^{\circ} \text{ long.}$ South of Jenny Island. Depth: 205 m. Green sand and rock. Water temperature at the bottom: -0.5° .

<i>Bathyplores bongraini</i>	<i>Cucumaria liouvillei</i>

Dredge X. – 22 January 1909. $68^{\circ} 35' \text{ S lat}; 72^{\circ} 49' \text{ W long.}$ Near Alexander Ist Land. Depth: 297m. Rock and blue mud. Water temperature at the bottom: -0.6° .

Dredge XIV *b*. – 18 November 1909. Along the northeastern coast of Petermann Island in Lemaire Channel.

Cucumaria antarctica

Dredge XV. – 20 November 1909. $64^{\circ} 49' 35'' \text{ S lat.}; 65^{\circ} 49' 18''$. Roosen Channel before Port Lockroy. Depth: 70 m. Mud and pebbles.

<i>Cucumaria antarctica</i>	<i>Psolus charcoti</i>
<i>Cucumaria joubini</i>	<i>Psolus koehleri</i>
<i>Psolidium gaini</i>	

Petermann Island: 65° 10' 34" S lat.; 66° 32' 30" W long. On the beach

Cucumaria grandis

SECOND PART

GENERAL CONSIDERATION OF ANTARCTIC AND SUB-ANTARCTIC HOLOTHUROIDS

In his beautiful memoir on the holothuroids of Magellan of 1898, Ludwig revised the Antarctic holothuroids and then compared them to arctic forms. This scholar took the Antarctic region to be the entire southern polar cap limited by 40° S latitude. Now this southern cap is subdivided itself into Antarctic and sub Antarctic regions. Ludwig probably did not take into account this subdivision because the Antarctic fauna was little known at that time.

Since 1898, Antarctic explorations have multiplied and we have collected so many holothuroids of southern polar regions it seems useful to synthesize now all our knowledge on Antarctic and sub Antarctic species. But first it is necessary to clearly define what we mean by the Antarctic region and the sub Antarctic region.

Pelseneer (1903) limited the Antarctic region to the Antarctic, i.e. to the continent with more or less hypothetical borders, to the South Pole. This region contained not only the southern lands located inside the polar circle with different projecting points but also the neighboring islands. These are separated only by shallow depths. This is the definition Mortensen adopted in the study of the echinoids of the "Gauss". In his important memoir on the echinoderms (asteroids, ophiuroids, echinoids) of the Second French Antarctic Expedition, Koehler (1912) correctly found this conception was not convenient to apply too exclusively to the littoral fauna. It is necessary to modify it to make it more general and to permit use of the entire littoral and abyssal fauna. Koehler discussed at length the results permitting fixing the limits of the Antarctic region by the marine fauna. He showed that the maximum extension of the ice pack as well as the absolute minimum of -1.11°C (30°F) of surface water of the sea and the isothermal of 0°C for the air make up three curves that have obviously the same shape. Finally Koehler set as the northern limit of the Antarctic region the line of the maximum extension of the ice pack. I completely accept this point of view that has the advantage of being applicable to both the littoral and abyssal holothuroids.

We divide this Antarctic region into four quadrants: to the West, from 0° to 90° longitude, the American or Weddell quadrant, from 90° to 180° longitude, the Pacific or Ross quadrant, to the east from 0° to 90° longitude, the African or Enderby quadrant and from 90° to 180° the Australian or Victoria quadrant.

The Antarctic holothuroids that we know are especially those coming from the collections of the "Challenger", the "Southern Cross", the "Belgica", the "Français", the "Scotia", the "Discovery" and the "Pourquoi Pas?". Our results on the Australian and Pacific quadrants are of little importance because the "Southern Cross" and the "Discovery" have collected only a very few number of identifiable specimens. Most of our knowledge comes from the American quadrant. They result from the Belgian, Scottish and French Antarctic explorations. Our information on Antarctic holothuroids are more limited than those we have from the other echinoderms, the echinoids for example. This is because the holothuroids collected by the "Gauss" have not yet been published. But, although fragmentary, our knowledge on Antarctic holothuroids are interesting because they report not only littoral forms but also some abyssal species. They are dredges of the

“Challenger” and the “Scotia” that have made known representatives of this abyssal fauna. The dredges of the “Challenger” were done primarily in the African quadrant while those of the “Scotia” took place at depths between 2515 to 4740 m in different stations in the Weddell quadrant.

31 The maximum extension of the ice pack provides a natural very precise limit to separate the Antarctic region from the sub Antarctic region. It is more difficult to indicate the northern limit of the latter region. In fact, it is not clear. One often observes the exchange of species between the sub Antarctic and those of neighboring regions of lower latitude. This makes setting the limit somewhat arbitrary. This limit is sometimes simply fixed at 50° South. Pelseneer set his line as the minimum surface sea water temperature of +4.44 °C that obviously has the same aspect as the isothermal of – 4.44 °C for the air in July, more or less cold of the southern hemisphere. Koehler considered with good reason that this northern limit of the sub Antarctic region would always be arbitrary and must be very elastic. We completely agree with his point of view based in large part on faunal characteristics.

According to Koehler, the sub Antarctic region is found to the north part of Chiloë Island near 43° S on the west coast of South America. On the east coast it does not pass Cape Blanco near 48° S. It includes not only the southern point of America, the Strait of Magellan and Tierra del Fuego but also other neighboring islands, the Falkland Islands and South Georgia. The Falkland Islands has a large number of species in common with South America. South Georgia has a special fauna. In the African quadrant, the sub Antarctic region includes the Kerguelen Islands, Heard or MacDonald, Crozet, Marion and Prince Edward that are below between 43° and 46° South latitude. In the Australian quadrant, this region includes the Macquarie Islands and Auckland. Although New Zealand has a small number of species in common with the sub Antarctic region, we separate them for separate study because its fauna has very special characters. We shall have no difficulty at all in separating the abyssal fauna from the littoral fauna because of very great differences that exist between the depths where abyssal holothuroids have been collected and the lower limits of the littoral zone that we see to be about 400 m depth. However a small number of species **32** are encountered at very variable depths. *Cucumaria crocia* (Lesson), which is generally littoral, was collected by the “Scotia” not only at a depth of 4 fathoms but also at 2,103 fathoms.

In these general considerations, we shall study abyssal and littoral holothuroids separate. In each of these faunas, we shall classify the forms according to the regions where they are localized into Antarctic and sub-Antarctic species. That will allow us to report holothuroids peculiar to each of these regions and those that are in common or which have a more extended area of distribution. The general characters of these faunas will make it possible also to give some information on the origin and peculiarities of the Antarctic holothuroids.

ABYSSAL HOLOTHUROIDS

1° ANTARCTIC REGION. – The abyssal holothuroids of Antarctic regions that we presently know were collected by the “Challenger” in 1874 and the “Scotia” in 1902-1904. The “Scotia” collected eleven species from dredges made at depths from 1,410 to 2,620 fathoms in a region between 66° 40’ and 71° 23’ South latitude and 15° 19’ and 41° 20’ West longitude, i.e., belonging to the Weddell or American quadrant. The “Challenger” collected eight species of abyssal holothuroids in two clearly Antarctic stations belonging to the African or Enderby quadrant, or near those in the Australian or Victoria quadrant. Of these two stations, one is located at 60° 52’ South latitude and 80° 20’ East longitude and the other at 62° 26’ South latitude 95° 44’ East longitude. The dredges were done at a depth of 1,260 fathoms for the first station and 1,975

fathoms for the second. Here is a list of the obviously Antarctic abyssal holothuroids collected, classed by families.

SYNALLACTIDS

<i>Pseudostichopus villosus</i> Théel		<i>Synallactes robertsoni</i> Vaney
-- -- variety <i>violaceus</i> Théel		

33

ELPIIDS

<i>Elpidia incerta</i> Théel		(?) <i>Kolga nana</i> Théel
-- <i>willemoesi</i> Théel		<i>Peniagoni mossmani</i> Vaney
<i>Scotoplanes globosa</i> Théel variety <i>murrayi</i>		-- <i>pirei</i> Vaney
Vaney		-- <i>wiltoni</i> Vaney
<i>Scotoplanes insignis</i> Théel		

PSYCHROPOTIDS

<i>Benthodytes recta</i> Vaney		<i>Psychropotes brucei</i> Vaneyi
-- <i>sordida</i> Théel		-- <i>laticauda</i> Vaney
-- <i>spuma</i> Vaney		-- <i>longicauda</i> Théel
<i>Euphronides scotiae</i> Vaney		-- <i>longicauda</i> Théel var. <i>antarctica</i>
		Vaney

CUCUMARIDS

Cucumaria abyssorum Théel

This table shows the abyssal holothuroid fauna of Antarctic regions is very variable because it contains eighteen species and two apparent varieties belonging to ten distinct genera that distributed in four families. It includes a great number of elpiids and psychropotids, two synallactids and one cucumarid. It is a fauna with a well-marked specialization in which is found four genera of elpiids and three genera of psychropotids. In the latter are besides the three species of *Benthodytes*, one *Euphronides* and three forms of *Psychropotes*. These results moreover are only partial because they are only the results of dredges in two antarctic quadrants. It is very probable the collections of the "Gauss" or future Antarctic explorations will greatly increase this list.

As imperfect as they are, these results are interesting in that they show the abyssal fauna has no genus special to the Antarctic at all and is formed exclusively of genera with a very much greater area of distribution.

Certain of these Antarctic species belong also to sub-Antarctic regions and even to other regions of lower latitude of the southern hemisphere and sometimes of the boreal hemisphere. Among the eighteen abyssal Antarctic species six, or a third, are 34 restricted to the Antarctic region. These are *Pseudostichopus villosus* (?), *Kolga nana*, *Scotoplanes globosa*, *Psychropotes*

laticauda, *Benthodytes sordida* and *Cucumaria abyssorum*. We are going to examine each in some detail.

The “Scotia” collected two specimens of *Pseudostichopus villosus* Théel, one from 69° 62’ South and the other from 67° 33’ South. It or its variety *violaceus* had been collected by the “Challenger” in about a dozen stations between 62° 62’ and 38° 6’ South latitude and between 2° 56’ and 35° 22’ North latitude at depths varying from 1,295 to 2,900 fathoms. Although Théel reported his specimens from the boreal hemisphere differ a little from those of the southern hemisphere in their ossicles and form of pedicels, all these reports prove *Pseudostichopus villosus* has an a very great area of distribution in which are perhaps established some geographical varieties.

Théel attached to *Cucumaria ayssorum*, three holothuroids lacking ossicles collected by the “Challenger” at 62° 26’ South and 95° 45’ East° at a depth of 1,975 fathoms. In the course of its various dredges, the “Challenger” collected other specimens of this species at 46° 16’ South and 48° 27’ East at 1,600 fathoms depth and between the 33rd and 38th South parallels and between 73° and 94° East longitudes at a depth varying from 1,500 to 2,225 fathoms. The “Investigator” found this species in the Pacific between 1° North and 27° North at depths from 905 to 2,232 fathoms. *Cucumaria abyssorum* is thus found in the two hemispheres. In the southern hemisphere it penetrates into the Antarctic region.

Kolga nana also appears in both hemispheres. The typical form of this elpiid was found at 1,250 fathoms depth in the North Atlantic Ocean near Halifax. The Antarctic form was collected at 60° 52’ South and 80° 20’ East at 1,260 fathoms depth. Given the great distance separating these two stations, it is necessary to ask if these individuals even belong to the same species. Théel is not very affirmative on this point. In any case, if they belong to the distinct species they will be very closely related.

Pseudostichopus villosus, *Cucumaria abyssorum* and *Kolga nana* **35** can be considered three cosmopolitan species found in the antarctic fauna. In this fauna are three species found only in the southern hemisphere: *Benthodytes sordida* Théel, *Psychropotes laticauda* Vaney and *Scotoplanes globosa* Théel.

Benthodytes sordida was collected by the “Challenger” at depths from 2,225 to 1,800 fathoms at four different stations. One located at 62° 62’ South and 95° 44’ East is Antarctic. Two others at 53° 55’ South and 108° 35’ East and 50° 1’ South and 123° 4’ East are sub-Antarctic. The fourth at 34° 7’ South and 73° 56’ West is Pacific.

Psychropotes laticauda was collected by the “Scotia” from two widely separated stations. In fact, one is Antarctic at 67° 39’ South and the other is in the Atlantic Ocean at 39° 48’ South and 2° 33’ East. These two specimens that I have been able to compare are very similar and prove this species has a very large area of distribution.

I consider *Scotoplanes murrayi* Théel, collected by the “Challenger” at 1,260 fathoms depth at 60° 52’ South latitude is only a simple variety with five pairs of pedicels of *Scotoplanes globosa* Théel. This species has a very great extension in the southern hemisphere. In fact the “Challenger” collected numerous specimens, some at 53° 55’ South and 108° 35’ East at 1,9590 fathoms depth and others in the North Pacific Ocean at 33° 31’ South and 74° 43’ West at 2,160 fathoms depth. The “Scotia” collected this species at 39° 48’ South and 2° 33’ East at 2,645 fathoms depth but some of the specimens have only six pairs of pedicels.

Scotoplanes globosa thus extends in the southern hemisphere to the southern Pacific Ocean and from the Atlantic Ocean into sub Antarctic and Antarctic regions. The Antarctic and Atlantic

forms appear to be forms of the type species because they have a reduction in the number of pedicel pairs.

If one removes the cosmopolitan abyssal species, there remains a group of **36** fifteen species localized in either the southern hemisphere of the Antarctic. Further research alone could allow confirmation if the species presently considered as exclusively Antarctic do not have affinities with certain species of lower southern latitude.

2° SUB-ANTARCTIC REGION. – Abyssal holothuroids of the sub Antarctic region are known chiefly from the dredges done by the “Challenger” in 1873 and 1874. The principal ones were done at depths from 1,800 to 1,950 fathoms depth at 50° 01’ South and 123° 04’ East and at 53° 55’ South and 108° 35’ East, or near Crozet Island at 500 fathoms depth. *Benthodytes browni* was reported by the “Scotia” at a depth of 1,742 fathoms at 48° 0’ South and 10° 05’ West. Here is the list of sub Antarctic abyssal holothuroids classed by families.

SYNALLACTIDS

<i>Pseudostichopus villosus</i> Théel		<i>Mesothuria thomsoni</i> (Théel)
<i>Synallactes challenger</i> (Théel)		

ELPIIDS

<i>Peniagone challenger</i> Théel		<i>Scotoplanes robusta</i> Théel
--- <i>horrifer</i> Théel		<i>Elpidia ambigua</i> Théel
--- <i>naresi</i> Théel		--- <i>purpurea</i> Théel
<i>Scotoplanes globosa</i> Théel		

DEIMATIDS

<i>Oneirophanta mutabilis</i> Théel		<i>Laetmogone wyville-thomsoni</i> Théel

PSYCHROPOTIDS

<i>Benthodytes sanguinolenta</i> var <i>marginata</i>		<i>Psychropotes longicauda</i> var. <i>monstrosa</i>
Théel		Théel <i>Psychropotes longicauda</i> var. <i>fusco-</i>
<i>Benthodytes sordida</i> Théel		<i>purpurea</i> Théel
--- <i>browni</i> Vaney		
<i>Psychropotes longicauda</i> Théel		

CUCUMARIIDS

Cucumaria abyssorum Théel

As we have seen previously, five of these species or their varieties are found in the Antarctic region. They are:

Pseudostichopus villosus Théel

Scotoplanes globosa Théel var. *murrayi* Vaney

Benthodytes sordida Théel

Psychropotes longicauda Théel var. *antarctica*

Vaney

Cucumaria abyssorum Théel

37 They can even extend in the other direction and attain regions of lower latitude.

The two deimatids, *Laetmogone wyville-thomsoni* Théel and *Oneirophanta mutabilis* Théel, just as *Benthodytes sanguinolenta* Théel have an area of distribution encroaching into the two hemispheres. Thus the typical *Laetmogone wyville-thomsoni* was collected in the Pacific Ocean at 23° 42' South and 78° 18' West at a depth of 1,375 fathoms. A specimen was also collected in the sub Antarctic at 50° 01' South and 123° 04 East. It is very probable individuals coming from 46° 16' South and 48° 27 East at 1,600 fathoms are only varieties of this species. As for the incomplete specimen collected at in the northern hemisphere at 35° 11 North and 139° 28' East in 345 fathoms, Théel himself said that it should without doubt belong to a distinct species.

Oneirophanta mutabilis Théel also has a very great distribution. The "Challenger" reported specimens from six stations located between 22° 21' South and 53° 55' South in the Pacific, Atlantic and Indian Oceans and two other stations in the North Pacific located at 35° 41' North and 35° 23' North. The "Albatross" collected this species at more equatorial locations in the Pacific and the "Talisman" collected it in the Atlantic at 42° to 46° North latitude. This species moreover has very great variation.

Benthodytes sanguinolenta Théel up until now has been found only in the Indo-Pacific area. The "Challenger" collected it at latitudes 34° 7' South and 38° 07' South at depths of 1,500 and 2,225 fathoms. The "Albatross" collected 25 specimens from various stations between the equator and 14° 46' North latitude at depths from 1,067 and 1,879 fathoms. The "Investigator" found this species in the Indian Ocean at 11° 16' 30" and 15° 2' North latitude. The variety *marginata*, that Théel hesitated to accept because the differences with the type are so slight, is located more to the south from two stations. One is in the Indian Ocean at 42° 42' South and the other at 50° 1' South at depths of 1,800 and 2,600 fathoms.

38 If we deduct from our list all species whose limits of distribution pass the sub Antarctic region, we see that the number of species belonging exclusively to this region is reduced to nine. They appear very localized but they belong to no genus special to the Antarctic fauna. They seem to have great affinities with species located in regions of lower latitude

Similar localization of the abyssal fauna of other regions has been documented. Koehler and I have reported a similar situation in the equatorial portion of the Indian Ocean when we studied the deep sea holothuroids of the "Investigator". In the same ocean between 40° and 50° South latitude, the "Challenger" took a very different fauna from that of the sub Antarctic including even other genera. The composition of the fauna follows:

PSYCHROPOTIDS

Psychropotes loveni Théel

ELPIIDS

Elpidia glacialis (?)Théel
Scotoplanes mollis Théel
Peniagone atrox Théel
--- *vitrea* Théel

Peniagone affinis Théel
Scotoanassa diaphana Théel
Achlyonice latcea Théel
Enypniastes eximia Théel

Some of these species of this last fauna have affinities with those of more southern regions. Others approach more equatorial forms. The two genera *Achlyonice* and *Enypniastes*, which are not found in antarctic and sub Antarctic regions, have representatives in the northern hemisphere. In fact, a second species of *Achlyonice*, *A. paradoxa*, has been found in the Pacific at 35° 44' North at a depth of 2,300 fathoms and, in 1910, Koehler and Vaney reported another *Enypniastes*, *E. decipiens*, in the Indian Ocean at 11° 26' 30" North and a depth of 378 fathoms.

We must make a special remark on *Elpidia glacialis*. The "Challenger" collected a single specimen in the Indian Ocean at 42° 42' South and a depth of 2,600 fathoms. This species inhabits especially the Arctic Ocean and the northern part of the Atlantic Ocean where it is not exclusively a part of the abyssal fauna because it is sometimes found [39] at shallow depths. Because this species has a very restricted area of distribution in the northern hemisphere, it is a little surprising to find it in the Antarctic part of the Indian Ocean. Théel well indicated that the southern form of the "Challenger" differs in various aspects from the northern type species although these differences are of little importance. It would be interesting to study it again.

Ludwig has justly remarked that the two abyssal species (*Kolga nana* and *Elpidia glacialis*), which according to Théel's results should belong both to the Antarctic and Arctic regions, have a very doubtful Antarctic distribution. Consequently, from the point of view of the abyssal fauna, no bipolar species seems to exist at all.

There is no longer genera special to the Antarctic region. Some Antarctic and sub-Antarctic species have a more or less restricted area of distribution. They sometimes show a very marked localization that can only be confirmed when new explorations will have been made.

LITTORAL HOLOTHUROIDS

1° ANTARCTIC REGION. – *Pseudopsolus ferrari* represents a second species of this genus established by Ludwig in taking *Ps. macquariensis* (Dendy) from Macquarie Island as type. The genus *Pseudopsolus* is observed thus in two stations of the Australian quadrant, one situated at 77° 51' South and 166° 45' East and the other at 54° 30' South and 158° 30' East.

The reports that we have on the holothuroids of the Australian quadrant of the Antarctic, although very limited, are interesting because they show the existence of a new form of this special genus, designated as *Pseudopsolus* and known at the present hour only in the antarctic and sub Antarctic regions of this quadrant as well as the presence of *Cucumaria crocea* and of *C. laevigata* that we find in other provinces of the Antarctic. If our results on the holothuroids of this part of the Antarctic are still very scanty, it is no longer the same for the Weddell or American quadrant because of the collections reported by the "Belgica", the "Français". the "Scotia" and the "Pourquoi Pas?".

The list of littoral holothuroids presently known in the Antarctic is the following:

Holothuriids

Holothuria sp. ? Bell

SYNALLACTIDS

<i>Mesothuria bifurcata</i> Hérourar	<i>Synallactes</i> (?) <i>gourdoni</i> Vaney
--- <i>magellani</i> Ludwig	<i>Bathyplores bongraini</i> Vaney
<i>Synallactes carthagei</i> Vaney	

ELPIIDS

<i>Peniagone vignoni</i> Hérourard	<i>Rhipidothuria racovitzai</i> Hérourard

CUCUMARIIDS

<i>Cucumaria analis</i> Vaney	<i>Cucumaria godfroyi</i> Vaney
--- <i>antarctica</i> Vaney	--- <i>grandis</i> Vaney
--- <i>aspera</i> Vaney	--- <i>irregularis</i> Vaney
--- <i>attenuata</i> Vaney	--- <i>joubini</i> Vaney
--- <i>conspicua</i> Vaney	--- <i>lateralis</i> Vaney
--- <i>crocea</i> (Lesson)	--- <i>liouvillei</i> Vaney
[41] --- <i>laevigata</i> Verrill	<i>Pseudopsolus ferrari</i> Bell
--- <i>perfidia</i> Vaney	<i>Psolidium</i> (<i>Cucumaria</i>) <i>coatsi</i> Vaney
--- <i>periprocta</i> Vaney	--- <i>gaini</i> Vaney
--- <i>psolidiformis</i> Vaney	<i>Psolus antarcticus</i> (Philippi)
--- <i>secunda</i> Vaney	--- <i>belgicae</i> Hérourard
--- <i>turqueti</i> Vaney	--- <i>charcoti</i> Vaney
<i>Thyone scotiae</i> Vaney	--- <i>granulosus</i> Vaney
--- <i>turricata</i> Vaney	--- <i>koehleri</i> Vaney

MOLPADIIDS

Molpadia (*Trochostoma*) *antarctica* Théel

SYNAPTIDS

<i>Taeniogyrus</i> (<i>Chiridota</i>) <i>contortus</i> (Ludwig)	<i>Chiridota pisanii</i> (?)

The littoral Antarctic fauna thus contains 28 cucumariids, 5 synallactids, 2 elpiids, 2 synaptids, 1 molpadiid and 1 holothuriid. It has representatives of most of the ordinarily littoral holothuroid families to which one must add elpiids and even certain synallactids that generally belong to the abyssal fauna. The “Belgica” moreover collected larval elasipodes at 100 m depth at 69° 55’ South latitude and 82° 36’ West longitude.

In this littoral faunal there is a very marked preponderance of cucumariids while the holothuriids have almost no importance in the Australian quadrant and have not been found in the American quadrant. The molpadiids and the synaptids also appear to have a very restricted development.

Among the cucumariids are 20 cucumarines made up of 18 *Cucumaria* and 2 *Thyone* and 8 psolines composed of 1 *Pseudopsolus*, 2 *Psolidium* and 5 *Psolus*.¹ It may be that further studies based on the examination of a large number of specimens will show that certain of these present species have a polymorphism comparable to those already observed in some sub-Antarctic forms. In spring of this eventuality, the number of obviously Antarctic cucumariids will still remain very important. Among the *Cucumaria*, three species have a rudiment of a true sole characterized by differentiation of the pedicels of the trivium. These are *C. joubini*, *C. conspicua* and *C. psolidiformis*. This character approaches the true psolines and *Psolidium coatsi* appears to be an intermediary type between the cucumariines and the psolines. *Cucumaria crocea* also has a very clear differentiation between the bivium and the trivium. Addition of all these *Cucumaria* to the described psolines show that about a dozen of the presently known cucumariids have the trivium more or less clearly differentiated into a creeping sole.

Moreover, seven of the cucumariids are incubators. These are *Cucumaia laevigata*, *C. lateralis*, *C. joubini* and *C. crocea* and *Psolus antarcticus*, *Ps. granulosus* and *Ps. koehleri*. The modes of incubation of these different species are varied: *Psolus antarcticus* and *Ps. granulosus* incubate their young under their ventral sole while the other species have incubatory pouches.

To these incubating cucumariids is added *Taeniogyrus contortus*, a synaptid species whose eggs develop in the interior of the genital duct, transformed into a uterus.

Now the formation of a ventral sole and incubation of eggs are considered in holothuroids as secondary acquisitions.

The littoral Antarctic fauna is thus composed in large part of specialized forms. In fact, it includes cucumariids rich in psolines and in incubating species. It has synallactids and elpiids, that is to say aspidochirotes secondarily adaptive to the abyssal life and it is nearly completely lacking in holothuriids. The presence of molpadiids and synaptids only accentuates this specialization of the fauna.

All these results prove well that the ensemble of littoral Antarctic holothuroids has no characters of a primitive fauna because it includes too many well specialized forms. The specialization of certain species, psolines for example, appear to be the result of a relatively recent adaptation.

The distribution of different holothuroids composing the Antarctic littoral fauna indicates well marked localizations and a great richness in species. Just as in the Orkneys of the South, a great number of cucumariids have been collected. But documentation on holothuroids is still too insufficient to permit the establishment of zoological provinces with particular species.

This littoral Antarctic fauna has relations with those of regions of lower latitudes. We find there the six following species that are common to the Antarctic region and the sub Antarctic region:

Mesothuria magellani
Cucumaria crocea
 --- *laevigata*

Psolus antarcticus
Molpadia (Trochostoma) antarctica
Taeniogyrus contortus

---

¹ It may be necessary to add some forms, probably new, reported in different collections, but the bad state of preservation has not allowed a precise specific diagnosis.

to which it may be necessary to add *Chiridota pisanii*.

Cucumaria crocea and *C. laevigata* are species that the "Discovery" found in the antarctic portion of the Australian quadrant. *Cucumaria crocea* was also collected in the American quadrant in both its Antarctic and sub-Antarctic portions. *Cucumaria laevigata* occurs in the sub Antarctic region of this same quadrant.

2° SUB ANTARCTIC REGION. – In their important memoirs on Antarctic holothuroids Ludwig (1898) and Rémy Perrier made chiefly an analysis of the littoral forms. Some were very clearly Antarctic but most rather are sub-Antarctic. Ludwig listed Antarctic species for each family and discussed at length the area of distribution of each of these forms. However, we do not entirely agree with this list for several reasons. First because this scholar limits this region to 40° South latitude and because it includes New Zealand. Now this country has very particular species that have only slight relations with the sub Antarctic forms. Next we take account the correct changes in synonymies by Lyman Clark (1907) in his very complete revision of apodous holothuroids. Finally it is necessary to complete these lists by the addition of new species described since the period Ludwig's memoir appeared.

After these various modifications, the list of littoral sub Antarctic holothuroids presently known is the following:

44

HOLOTHURIIDS

Stichopus fuscus Ludwig

| *Stichopus patagonicus* R. Perrier

SYNALLACTIDS

Pseudostichopus mollis Théel
Synallactes moseleyi (Théel)

| *Mesothuria magellani* Ludwig

CUCUMARIIDS

Cucumaria armata Vaney
--- var, *carnleyensis* Dendy
--- *chiloensis* Ludwig
--- *crocea* (Lessons)
--- *croceoida* Vaney
--- *georgiana* Lampert
--- *laevigata* Verrill
--- *leonina* Semper
--- *parva* Ludwig
--- *steineni* Ludwig
--- *squamata* Ludwig

| *Cucumaria tabulifera* R. Perrier
Thyone lechleri Lampert
--- *muricata* Studer
--- *spectabilis* Ludwig
Pseudopsolus macquariensis (Denby)
Psolidium convergens (Hérouard)
---- *dorsipes* Ludwig
Theelia disciformis (Théel)
--- *incerta* (Théel)
--- *porifera* (Studer)
Psolus antarticus (Philippi)
--- *ephippifer* Wyville-Thomson
--- *segregatus* Vaney

MOLPLADIIDS

Molpadia (Ankyroderma) musculus Risso
 --- (*Trochostoma*) *antarctica* (Théel)
Caudina chilensis J. Müller

Caudina pigmentosa R. Perrier
 --- *planapertura* Lyman Clark

SYNAPTIDS

Taeniogyrus (Chiridota) contortus (Ludwig)
Chiridota marenzelleri R. Perrier
 --- *pisanii* Ludwig

Chiridota benhami Dendy
Trochodota purpurea Lesson
Anapta fallax Lampert

The sub-Antarctic littoral fauna differs from the Antarctic fauna in several points. It no longer includes littoral elpiids. It contains some synallactids but the number of species is lower than in the Antarctic littoral fauna. One of these forms is referred to the genus *Pseudostichopus*, which also occurs in the Antarctic region but only in the abyssal fauna. The holothuriids are represented by two *Stichopus*. The number of genera and species of molpadiids and synaptids is greater than in the Antarctic. In these families, besides the genera already reported in the southern polar region, new genera make their appearance, the genera *Caudina*, *Trochodota* and *Anapta*.

45 In spite of some differences, the greater part of the sub-Antarctic littoral, as we have stated for the Antarctic, is composed of cucumariids. These cucumariids containing 24 species are separated in the following fashion:

12 species of *Cucumaria*
 3 --- -- *Thyone*
 1 --- -- *Pseudopsolus*

2 species of *Psolidium*
 3 --- -- *Theelia*
 3 --- -- *Psolus*

Of these 24 species, 9 belong to psolines, that is to say to cucumariids clearly having a ventral sole. This proportion is clearly the same that we reported in the Antarctic region, especially bearing in mind *Cucumaria* with a rudiment of the ventral sole. However, the number of true *Psolus* is greater in the Antarctic region because there are five species.

The littoral sub-Antarctic holothuroids include the following five incubating species: *Cucumaria crocea*, *C. laevigata*, *C. parva*, *Psolus ephippifer* and *Taeniogyrus contortus*. Two of these are not found like the others in the antarctic regions. These are *Cucumaria parva*, which has incubating pouches, and *Ps. ephippifer*, which carries its young between modified plates of the test.

The presence of incubating holothuroids and numerous species of cucumariids with a well differentiated ventral sole clearly characterizes the Antarctic and sub-Antarctic littoral fauna.

We now examine the distribution of some of the sub-Antarctic species.

We have already reported 6 species that are common to the Antarctic region and the Arctic region.

Molpadia musculus is a nearly cosmopolitan form that is encountered in the Atlantic, the Mediterranean, the Pacific and Indian Ocean. It is absent only in the Arctic Ocean and the North Pacific.

Molpadia antarctica is found not only in the Antarctic but also along the southern coasts of Chile and has been reported even in the Gulf of Mexico.

Taeniogyrus contortus, already observed in the Antarctic, is found **46** in the region that extends from Kerguelen Island to the Strait of Magellan, across the southern portions of the Indian Ocean and the Atlantic.

Cucumaria leonina also has a very extended area of distribution that includes the coasts of Peru and Chile, then curves around the southern end of America, reaching south of the Falkland Islands, then climbs to the north in following the eastern coast of South America up to 32° South latitude. This species is found at the Auckland Islands located in the Australian quadrant. Another *Cucumaria*, *C. brevidentis* also belongs to the south of America and the Australian quadrant. In the latter it is found in the Auckland Islands and New Zealand.

Chiridota pisanii and *Anapta fallax* have a more restricted area of distribution. They are found on the east and west coasts of the southern point of South America and near the neighboring islands.

Outside these species differences that are either cosmopolitan or distributed in regions more or less extended in the southern hemisphere, can we group the other littoral sub-Antarctic holothuroids according to well defined provinces?

Ludwig distributed the Antarctic cucumariids into four provinces he designated as Magellanic province, South Georgia province, Kerguelen province and New Zealand province. We have already noted that New Zealand is outside the limits that we have assigned to sub Antarctic regions and has a very specialized holothuroid fauna, of which only two species belong to the sub Antarctic fauna. It appears logical to us not to speak here of the New Zealand province for the sub Antarctic fauna because we do not include New Zealand in this region. However, in the Australian quadrant, the Auckland and Macquarie Islands have a more southern situation than New Zealand and below well to sub Antarctic regions. Their fauna, as we shall see, is special and is attached on one hand to the Antarctic fauna and on the other hand to that of New Zealand.

As for the Georgian province, it has too great affinities with the Magellanic province for us to separate it. In such a way we will separate the littoral sub Antarctic holothuroids only into two **47** large provinces: the Magellanic province and the Kerguelen province.

In the Magellanic province are found concentrated the majority of the sub Antarctic species presently known. We find there:

HOLOTHURIIDS

Stichopus fuscus

| *Stichopus patagonicus*

SYNALLACTIDES

Pseudostichopus mollis
Synallactes moseleyi

| *Mesothuria magellani*

CUCUMARIIDS

Cucumaria armata
--- *chiloensis*
--- *crocea*
--- *croceoida*
--- *georgiana*

| *Cucumaria tabulifera*
Thyone lechleri
--- *spectabilis*
Psolidium dorsipes
--- *convergens*

---	<i>leonina</i>		<i>Theelia disciformis</i>
---	<i>laevigata</i>		<i>Psolus antarcticus</i>
---	<i>parva</i>		--- <i>segregatus</i>
---	<i>steineni</i>		

MOLPADIIDS

<i>Caudina chilensis</i>		<i>Caudina planapertura</i>
<i>Caudina pigmentosa</i>		

SYNAPTIDS

<i>Chridota pisanii</i>		<i>Trochodota purpurea</i>
--- <i>marenzelleri</i>		<i>Anapta fallax</i>
<i>Taeniogyrus contortus</i>		

We observe localizations in this province because certain species are found only on the eastern coast while others have been collected only on the western coast of South America.

The fauna of the Falkland Islands is nearly the same as that of the extreme south of America because one finds there:

<i>Cucumaria armata</i>		<i>Psolidium convergens</i>
--- <i>leonina</i>		<i>Psolus antarcticus</i>
--- <i>laevigata</i>		<i>Taeniogyrus contortus</i>
--- <i>parva</i>		<i>Trochodota purpurea</i>
<i>Psolidium dorsipes</i>		<i>Anapta fallax</i>

On Burdwood Bank, located at 54° South, the “Scotia” collected

<i>Cucumaria laevigata</i>		<i>Cucumaria croceoida</i>

Cucumaria georgiana is special to South Georgia, which also has [48] *Cucumaria steineni*, *C. laevigata*, *Thyone muricata* and *Taeniogyrus contortus*.

The Kerguelen province, located in the African quadrant, contains the Kerguelen Islands, Marion, Crozet, Prince Edward. It is much less rich in holothuroids than the Magellanic province because it includes only:

<i>Cucumaria laevigata</i>		<i>Theelia incerta</i>
--- <i>parva</i>		--- <i>porifera</i>
--- <i>squamata</i>		<i>Psolus ephippifer</i>
<i>Thyone muricata</i>		<i>Taeniogyrus contortus</i>

four of which are incubators.

In the sub-Antarctic region of the Australian quadrant, we presently know *Pseudopsolus Macquariensis*, localized at Macquarie Island; *Cucumaria brevidenis* var. *carnleyensis* Dendy; *Cucumaria leonina* and *Cucumaria benhami*. The three latter species have been collected at the Auckland Islands.

Examination of these different distributions leads us to the following remarks:

Cucumaria leonina and *C. brevidentis* are found together in the American quadrant and the Australian quadrant.

Cucumaria laevigata and *C. parva*, as well as *Taeniogyrus contortus* belong to the American and African quadrants.

The fauna of Kerguelen is attached to the Australian fauna by *Theelia porifera*.

Macquarie and Victoria Land each have a particular species of *Pseudopsolus*, a genus that appears localized in the Antarctic and sub Antarctic portions of the Australian quadrant.

The Auckland Islands have a fauna attached to that of New Zealand by two species: *Cucumaria brevidentis* and *Chiridota benhami*.

Following the works of Hutton, Dendy (1909), Rémy Perrier (1905) and of Dendy and Hindle (1907) we know now the holothuroids of New Zealand. Dendy and Hindle have even analyzed earlier publications and have established correctly certain synonymies.

49 The New Zealand fauna is very special and is clearly separated from those of sub Antarctic regions. It is this that makes it worthwhile to examine the following list of holothuroid species of this province.

HOLOTHURIIDS

<i>Holothuria difficilis</i> Semper		<i>Stichopus simulans</i> Dendy and Hendle
<i>Stichopus mollis</i> Hutton		

CUCUMARIIDS

<i>Cucumaria alba</i> Hutton		<i>Phyllophorus dearmatus</i> Dendy and Hendle
--- <i>brevidentis</i> Hutton		--- <i>longidentis</i> Hutton
--- <i>huttoni</i> Dendy		<i>Pseudocucumis bicolumnatus</i> Dendy and
--- <i>ocnoides</i> Dendy		Hutton

SYNAPTIDS

<i>Rhabdomolgus novae-zealandiae</i> Dendy and		<i>Chiridota dunedinensis</i> (Parker)
Hutton		--- <i>geminifera</i> Dendy and Hendle
<i>Chiridota benhami</i> Dendy		--- <i>gigas</i> Dendy and Hendle

MOLPADIIDS

Caudina coriacea Hutton

If, with Dendy, we place *Rhabdomolgus* among the chiridotins, New Zealand has five species of this sub-family. *Cucumaria brevidentis*, which is a synonym of *C. calcarea*, is an intermediary between the genus *Cucumaria* and the genus *Colochirus* which belongs to more tropical regions.

Except for some species in common with the sub-Antarctic regions or with countries of lower latitude, most of the forms are found only in New Zealand and characterize well a special province of which Ludwig has already reported the main peculiarities.

In summary, the holothuroids of Antarctic and sub-Antarctic regions appear to make up a fauna already very strongly specialized, especially if one examines the littoral forms rich in psolines and in incubating species. They show by no means that the Antarctic forms are relics of a primitive fauna. It seems more probable that they are of relatively recent introduction and that they are established, at least **50** for holothuroids, after differentiation of certain families and subfamilies such as the synallactids and psolins.

In a preceding memoir (1907) we showed that the Antarctic form Rémy Perrier reported as *Psolus squamatus* and which he had considered a bipolar species was really a new species *Psolus segregatus*. Examination of collections brought back by new Antarctic expeditions has corroborated our opinion because they have furnished no example of bipolar holothuroids.

The study of holothuroids, which appeared at first to have confirmed the theory of biopolarity gives, actually, no argument at all in favor of this hypothesis.

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PLATE LEGENDS

PLATE I

- Fig. 1. *Cucumaria joubini* nov. sp. with its incubatory pouches filled with eggs in process of development. Mag.: 1.5.
 Fig. 2. *Psolus koehleri* nov. sp.; ventral surface. Mag.: 1.5.
 Fig. 3. *Cucumaria joubini*. Mag.: 1.5.
 Fig. 4. *Bathyplores bongraini* nov. sp.; ventral surface. Red.: $\frac{3}{4}$.
 Fig. 5. *Psolus koehleri*; lateral view. Mag.: 1.5.
 Fig. 6. --- --- retracted and showing five incubatory pouches filled with young. Mag.: 1.5.
 Fig. 7. *Psolidium gaini* nov.sp.: calcareous ring. Mag.: 5.
 Fig. 8. --- --- side view and showing the ventral surface. Mag.: about 2.
 Fig. 9. --- --- lateral view. Mag.: about 2.

PLATE II

- Fig. 1. *Synallactes (?) gourdoni* nov. sp.: base of an ossicle from the body wall with branching arms. Mag.: 250.
 Figs. 2 and 3. *Synallactes (?) gourdoni* nov. sp: ossicles from the papillae of the collarette. Mag. 250.
 Fig. 4. *Bathyplores bongraini* nov. sp.: base of an ossicle from the dorsal body wall. Mag.: 400.
 Fig. 5. *Synallactes gourdoni*; base of an ossicle from the body wall. Mag. 400.
 Fig. 6. --- --- tower of an ossicle from the body wall. Mag. 400.
 Fig. 7. *Bathyplores bongraini*; ossicle from ventral pedicels of the sole. Mag. 400.
 Fig. 8. --- --- tower of an ossicle from the dorsal wall. Mag. 400.
 Fig. 9. --- --- tower of an ossicle of the wall of the sole. Mag.400.
 Fig. 10. *Cucumaria grandis* Vaney; ossicle with branched handle. Mag.: 250.
 Figs. 11 and 12. *Bathyplores bongraini*; ossicles from ventral pedicels of the sole. Mag. 400.

PLATE III

- Fig. 1. *Cucumaria liouvillei* nov. sp.; ossicle from the body wall. Mag.: 250.
 Fig. 2. --- --- ossicle from the pedicels. Mag.: 250.
 Fig. 3. --- --- ossicle from the body wall. Mag.: 250.
 Fig. 4. *Cucumaria joubini* nov. sp.; ossicle from the base of the pedicels. Mag.: 400.
 Fig. 5. --- --- ossicle from the tentacles. Mag.: 250.
 Figs. 6 and 7. --- --- ossicles from the body wall. Mag.: 250 and 400.
 [54] Figs. 8 and 9. *Cucumaria joubini* nov. sp. ossicles from the tentacles. Mag.: 250.
 Fig. 10. --- --- ossicle from the base of the pedicels. Mag.: 400
 Fig. 11. --- --- ossicle from the body wall. Mag.: 400.

PLATE IV

- Figs. 1 and 2. *Cucumaria godfroyi* nov. sp.; ossicles from the body wall. Mag.: 250.
 Figs 3, 4 and 5. --- --- nov. sp. ossicle from the base of pedicels. Mag.: 400.
 Fig. 6. *Psolidium gaini* nov. sp.; ossicle from the wall of the sole. Mag.: 250.
 Fig. 7. --- --- --- plate from the body wall. Mag.:100.
 Fig. 8. --- --- --- superficial ossicle in form of a basket. Mag.: 250.
 Fig. 9. --- --- --- ossicle from the wall of the sole. Mag.: 250.
 Fig. 10. --- s --- --- terminal plate of dorsal pedicels. Mag.: 400.
 Figs. 11 and 12. --- --- --- ossicles from lateral-ventral pedicels of the sole. Mag.: 400.
 Fig. 13. --- s --- --- ossicle from the wall of the sole. Mag.: 250.
 Fig. 14. --- s --- --- ossicle from dorsal pedicels. Mag.: 250.

PLATE V

- Fig. 1. *Psolus koehleri* nov. sp. calcareous plate from the sole. Mag.: 400.
 Fig. 2. --- --- --- ossicle in form of a cup seen from the side. Mag.: 400.
 Fig. 3. --- --- --- ossicle in form of a cup from the sole. Mag.:400.
 Fig. 4. --- --- --- ossicle from the lateral pedicels of the sole. Mag.: 400.
 Fig. 5. --- --- --- ossicle in form of a cup from the sole. Mag.: 400.
 Figs. 6 and 7. --- --- --- superficial cups from the lateral body wall. Mag.: 400.
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 Fig. 10. --- --- --- calcareous ring. Mag.: about 5.
 Fig. 11. *Psolus charcoti* Vaney calcareous ring. Mag.: about 5.
 Fig. 12, a, b, c, d, e. --- --- ossicles from the pedicels. Mag.: 400.
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