1846

**Catalogue Raisonné of the Families, Genera and Species of the
Class of Echinoderms: A translation of Agassiz, Louis, Desor, E.
1846. *Catalogue raisonné des familles des genres et des espèces
de la Classe de Echinodermes. Annales des sciences naturelles***

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Z. D.

ANNALES

DES

SCIENCES NATURELLES

COMPRENANT

LA ZOOLOGIE, LA BOTANIQUE,
L'ANATOMIE ET LA PHYSIOLOGIE COMPARÉES DES DEUX RÈGNES,
ET L'HISTOIRE DES CORPS ORGANISÉS FOSSILES :

RÉDIGÉES

POUR LA ZOOLOGIE

PAR M. MILNE EDWARDS,

ET POUR LA BOTANIQUE

PAR MM. AD. BRONGNIART ET J. DECAISNE.

Troisième Série.

ZOOLOGIE.

TOME SIXIÈME.

PARIS.

VICTOR MASSON,

LIBRAIRE DES SOCIÉTÉS SAVANTES PRÈS LE MINISTÈRE DE L'INSTRUCTION PUBLIQUE,
PLACE DE L'ÉCOLE-DE-MÉDECINE, 4.

1846

Catalogue raisonné of the families, genera and species of the class of echinoderms.: A translation of Agassiz, Louis, Desor, E. 1846. Catalogue raisonné des familles des genres et des espèces de la Classe de Echinodermes. Annales des sciences naturelles. Volume: 6, Series: 3, Pages: 305–374 by John M. Lawrence. University of South Florida.

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Translator's notes:

The title of this memoir refers to echinoderms. This is because Agassiz' introduction in the first memoir concerns echinoderms. The rest of this memoir, the "catalogue raisonné", concerns regular echinoids. Two subsequent memoirs consider clypeasteroids and spatangoids.

"Catalogue raisonné" is a very French phrase and is not translatable into English. It is accepted in English without change in spelling as obsolete.

"Catalogue raisonné." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/catalogue%20raisonn%C3%A9>. Accessed 5 Dec. 2020.

It means a systematic annotated catalog, especially a critical bibliography.

In his introduction, Agassiz states, p. 305, "In 1835 I published an announcement of a monograph of echinoderms, that excited sufficient interest to give birth to different monographic works and to numerous more or less extensive anatomical research." This refers to his "Prodromus of a monograph of the Radiata and Echinodermata." Prodromus is an obsolete word that is accepted in English. It means a book or treatise which is introductory or preliminary to another, usually larger, work. An English translation is available from Biodiversity Heritage Library ([XLIX.—Prodromus of a monograph of the radiata and Echinodermata](#)).

I have not changed apparent misspellings or printing errors.

Agassiz and Desor used "*baguettes*" ("rods") for the thick, blunt spines of cidaroids and "*piquants*" ("spines") for the slender, pointed spines of other sea urchins. I have translated both as "spines".

I thank Michel Jangoux and Jean-Pierre Féral for their help with difficult words and phrases.

Jean Louis Rodolphe Agassiz (May 28, 1807 – December 14, 1873) was a Swiss-born biologist and geologist. He received the doctor of philosophy and medical degrees at the universities of Erlangen and Munich, respectively. After studying with Cuvier and Humboldt in Paris, he received an appointment as Professor of Natural Science at the Academy of Neuchâtel. Agassiz received, through the help of Lyell, the geologist, an invitation to deliver lectures before the Lowell Institute in Boston. In 1846, Agassiz went to America and never returned except for visits. In 1847, he was appointed to the Chair of Zoology and Geology in the Lawrence Scientific School of Harvard College. In 1859, Harvard established the Museum of Comparative Zoology with Agassiz as its head.

A handwritten signature in cursive script, reading "L. Agassiz". The signature is written in dark ink on a light-colored, slightly textured background.

Pierre Jean Édouard Desor (13 February 1811 – 23 February 1882) was a German-Swiss geologist and naturalist. Desor studied law at Giessen and Heidelberg. He was involved in the republican movements of 1832/3. He escaped to Paris. He became interested in geology. He made field trips with Élie de Beaumont. In 1837 met Louis Agassiz. Desor became an active collaborator with Agassiz, studying palaeontology and glacial phenomena. Desor accompanied Agassiz in 1847 to the United States. He was employed in the coast survey. He returned to Neuchâtel in 1852 and became professor of geology at the academy of Neuchâtel, focusing his research on Jurassic echinoderms. Having receiving an inheritance, he retired. He died in Nice on 23 February 1882.

CATALOGUE RAISONNÉ
OF THE FAMILIES, GENERA AND SPECIES OF THE CLASS
ECHINODERMS,
BY L. AGASSIZ and E. DESOR
PRECEDED BY AN INTRODUCTION ON THE ORGANIZATION, CLASSIFICATION
AND PROGRESSIVE DEVELOPMENT OF TYPES IN THE GEOLOGICAL HISTORY OF
THE EARTH,
BY L. AGASSIZ

INTRODUCTION.

The class of echinoderms has been circumscribed in its present limits by G. Cuvier. But this illustrious zoologist has not made a detailed study of these animals. He limited himself to summarizing in his *Régne animal*, the knowledge acquired by his predecessors on the different genera composing it. It is to Lamarck that we owe the most complete enumeration of the species known to him. Later, DeFrance, de Blainville, Müller, Goldfuss and Charles Demoulin have even increased the number in their works. However, important works on the organization of echinoderms had already appeared at that time. A revision of the genera, based on a more complete knowledge of the organization, became daily more necessary. Material increased in the museums. The perseverance of geologists in collecting, in all the layers that make up the outer surface of our earth, the remains of the organisms they contain, has enriched the collection of a group of undetermined fossil species. It was then that I began to study their characters. In 1835 I published an announcement of a monograph of echinoderms¹ that excited sufficient interest to give birth to different monographic works and to numerous more or less extensive anatomical research.

¹ *Prodrome d'une Monographie des Radiaires ou Échinodermes*, in the *Mém. de la Soc. des Se. nat. de Neuchâtel*, Tome I.

After remaining a stranger, in appearance at least for a fairly long time, to these studies, it is with a feeling of gratitude that I recall the approval with which my first attempts were received by MM. Ed. Forbes, Ed. Gray and J. Müller in the recent publications they have made on asteroids. Having always taken advantage of favorable circumstances in which my works on fossil fish have placed me for the study of fossils in general, I can today present an overall summary of work that I have done on echinoderms in general, and echinoids in particular, of which I have already published some monographs with MM. Valentin and Desor.

Material of this work

The material on which this work is based is distributed in the principal museums and in the principal private collections of Germany, Switzerland, England and France, as I have indicated in a more detailed manner in my monographs. Quite recently, I have been making a new revision of very considerable scale, M. Valentin, having kindly placed at my disposition with his usual generosity, the immense material in the galleries of the Jardin du Roi. I have been able to compare directly with the species of the galleries of zoology, those of the École des Mines that I owe to MM. Cordier and Élie du Beaumont and those of MM. Michelin, d'Orbigny, D'Archiac and Graves. At the same time, M. Desmoulins of Bordeaux sent me all the types of his collection that I desired to study, M. Sismonda all the species of the Museum of Turin described by his brother, and M. Requier, the vast collection of the Museum of Avignon. Finally, at the same time, I received the new work of MM. Dubin and Koren on the Echinoderms of Scandnavia, M. Desor brought back from the north a large part of the species described in this remarkable work². So that for several months there was in Paris an assembly of echinoids containing typical specimens of almost all the species described to date, and a very large number of new species that had been directly compared with each other and not just after memories, notes and figures. These comparisons have permitted me to bring into my work a degree of precision that I would never have been able to attain otherwise and to rectify many errors in the determinations made according to descriptions, and in the identification of species of different areas or different localities.

These details, which we could call insignificant in themselves, appear important to me to report because they give a measure of the degree of confidence that my work merits. They give me the opportunity to express my appreciation to the persons who have given me such precious material.

Importance of the Study of Echinoderms

Despite their smallness and the apparently insignificant role echinoderms play in nature, these animals have a great importance in appreciating general genetic phenomena relating to the successive establishment of the animal kingdom on the surface of our earth. This importance is due to, on one hand, their complex organization and, on the other, to their presence in all the stages in fossiliferous areas. Without recalling here what is well known in the history of their organization, I shall limit myself to note that the study of fossil species is fertile in interesting results for knowledge of modifications animal structures have undergone over time. In fact, the solid covering of echinoderms is not simply a production of an integument that surrounds the general mass of the body. It is, to the contrary, a very complex solid frame and intimately connected to all the principal organs. This is how the opening of the mouth and the attachments of

² *Öfversigt af Scandnavien Ecinodermer af M. S. von Duben och. J. Koren. — Mem. de l'Acad. ds Sc. Stockholm. 1816.*

the jaws, when they exist, are attached to the anterior or low parts of the test itself. This is how the anus crosses a group of special plates located variously in the different families; this is how the locomotor appendages, often very powerful, are articulated on the exterior surface of the solid covering. This is how the test has points of attachment to all the soft organs, that it forms in the interior walls sometimes simple, sometimes complicated, destined to protect the circumvolutions of the intestine, to separate the buccal cavity from the rest of the body, to surround respiratory organs and to give passage to numerous tubes by which the animal communicates with the exterior. This is how the ovaries and testes cross the articulating plates, that we have sought in vain in other classes. Even the eyes, these very important organs, are developed in most echinoderms and lodged in true sockets or recesses in particular plates that cross the nerve net of the organ of vision. A solid exterior covering that is so intimately connected to the most important organ systems of life, should reflect in a very complete manner the modifications of the interior organization and show, in the details of its structure, characters of great importance, substantial in the fossil species as in the living species. There is more: No class of the animal kingdom presents in its details a more precise localization of peculiarities that distinguish its types. The smallest pores, the smallest tubercles, their arrangement, their position, the relations that exist between them and the plates that support them, all is repeated with admirable constancy in the different species of the same genus. Modifications, which at first glance we might think without importance, acquire, when properly studied, the value of important generic characters. So nothing appears more difficult than to give a good description of echinoderms, as there are so many details to observe and as nature has put order and method in their arrangement.

But it is not in the details only that these animals show amazing diversity. Even their orientation in the environment that varies in a family and even in from one genus to another. Thus, some holothuroids lie on their side, the mouth forward and the anus behind. Thus, there is a true anterior and posterior end, a stomach, a back and sides, that is very contrary to the ideas that we have ordinarily of radiate animals. In the cidaroids, the mouth is down, the anus up, and the periphery regular. It is necessary to have recourse to minute details of the structure to find traces of similarities. Spatangoids and clypeasteroids have forms and an orientation between the cidaroids and holothuroids. The anus is posterior, indicated well by the posterior end. The elongation of the body allows distinguishing the right and left sides. But the position of the mouth, that is not always at the anterior end of the body, that still remains subcentral in clypeasteroids, obscures the similarity that exists between the upper surface of these animals and the back of holothuroids and, with greater reason, that of the ventral surface. In asteroids, the usual position of the body is the same as in asteroids, while in crinoids, in all attached forms at least, the relations are completely reversed. The animal, attached to the substrate by a stalk emerging from one of these surfaces, spreads out in all directions. But, inverse to sea stars, the mouth is turned upward and the anus opens beside the mouth. Moreover, the flexibility of the stalk of most crinoids, permits them to bend in all directions and take, consequently, all postures possible in regard to the environment. In this respect again, crinoids occupy the last rank among echinoderms because the respective position of their organs in relation to their surroundings is not even fixed.

As a result, echinoderms, despite the lower rank that they incontestably have in creation are, however, better to provide us with clearer information on the modifications the entire class has undergone over geological time and the value of these modifications that the mollusks cannot, however diverse they are. Thus, I do not doubt that the knowledge of echinoderms will acquire before long a very great value for the history of changes on our earth, a value that has it already acquired for me. I hope to make this appreciated by the results of the work I am going to present.

Moreover, their frequency in the layers of the earth, the perfect state of preservation in which we frequently find them, the fixity of their characters, the elegance and the diversity of their forms, recommend them in a very special fashion to the attention of geologists. Their frequency on our coast should be a powerful stimulus to engage zoologists to study them, in a way still more than complete than has been done up until now, their remarkable organization and the phases of their development, about which we still have unfortunately no complete results.

Division of the Echinoderms

The class of echinoderms is divided very naturally into three orders, namely 1° Stellerides, 2° Echinoids, and 3° Holothuroids, characterized in the most general way by their exterior form that corresponds to peculiarities of organization of first importance. The star-shaped form of the Stellerides seems to relate this order in a more particular way to other radiate animals, and to assign them a lower rank in the class. This explains likewise their whole organization³. They are also the first to appear on the surface of the earth. They are nearly the only representatives of the all the class in the formation in transition, including the carboniferous era. At first, it may be necessary to separate the star-shaped echinoderms into two or even three distinct orders. However, when we examine them carefully, do not know the asteroids strictly speaking, we cannot ignore a star connection between the asteroids strictly speaking, the ophiuroids and the crinoids. In fact, the very clear differences that seem to exist between them, when we compare the crinoids and asteroids, disappear, so to speak, completely when we take into account the modifications that these extreme forms have in the ophiurids and euryalids.

In the extension that I assign it here, the order of Stellerides is composed of animals sometimes free, sometimes attached to the substrate by a more or less long stalk, whose body is surrounded by plates, in part mobile, surrounding a central cavity with a median opening, the mouth, and often a second opening, sometimes opposite it, sometimes next to it that is the anus. More or less set off appendages extend in the form of rays around this center. Sometimes they form simple extensions of the main cavity, sometimes distinct and articulated arms, and even branched and very complicated rays. In genera whose central cavity is clearly circumscribed, the arms are set off in the form of more mobile appendages, but also in less direct relation with the internal organ systems. Such are the crinoids. In the others, the arms, although distinct from the central cavity, are composed of plates that are still bound closely to the central cavity. These are the ophiuroids. Finally, the extensions of the asteroids are nothing more than sinuses of the central cavity.

Relations that exist between the different orders of Echinoderms

M. J. Müller affirms, in his great work on the asteroids, that the character that distinguishes most clearly from the other echinoderms is the interior skeleton, a kind of vertebral column on which the solid plates of the exterior skeleton are attached. He even affirms that we see nothing similar in the echinoids whose solid frame is all exterior. But this assertion is erroneous. The anatomist scholar from Berlin appears to me to have completely misunderstood the similarity that exists between the ambulacrum of the urchins and the lower furrow of the rays of sea stars. This similarity is, however, is even more complete, because we note the same arrangement of plates,

³ Lamarck went so far as to separate the encrinids from the echinoderms and rank them among the polyps.

the same openings for the passage of the pedicels, the same relations with the ocular plate that is at their top and with the masticatory apparatus that is at their base. Even the ambulacral plates do not support the comparison despite their larger number. As for the anal disk, it is much more extensive, but this is easily understood if we regard the extension that takes, in sea stars, a very narrow region circumscribed by the ocular and genital plates of echinoids. The similarity of asteroids and urchins is even so complete that we can call asteroids, urchins that are open and flat posteriorly and, vice versa, urchins are asteroids that are contracted and swollen into the form of a sphere. This conformity made me doubt the exactness of the observations that place the nerve nets that go to the eyes on the lower or exterior of the ambulacra in sea stars while they go to the interior surface of the test in urchins.

After the stellerides, we place naturally the echinoids. Like the stellerides, these animals have the body surrounded by solid plates, but these plates have acquired a greater rigidity. Their number is determined. They form constantly then zones of plates arranged in pairs, of which some are perforated while the others are not. These plates, that alternate in a constant manner, are arranged in a way to form a spherical body, sometime globulose, sometimes elongated and more or less flat. Some plates of a particular nature surround the mouth, which is placed in the center of radiation of the ten zones while the anus opens either behind or opposite the mouth.

The gradation that exists between the echinoids and the stellerides is evident. It is the certainly the same elements found in the two groups as is seen in animals of the same class. But, while the stellerides have very varied combinations and an arrangement that is fixed only in some parts, while, in others, they are multiplied, so to say, infinitely, which is always a character of inferiority. The echinoids offer us a fixity in their frame that proves that, in these animals, the basic characters of the class are circumscribed in determined and constant limits. Nevertheless, the echinoids have still a very evident radiating form. The mouth is the center around which all the organs are arranged. The systems that surround it and to which it is attached, consolidate the first and, as the means of approximation based on the position of the madreporite and gonopores, it is always easy to take an identical position the areas of the zones of the plates of echinoids and the rays of asteroids. A tendency for bilaterality is found in sea stars the most regular in appearance, no less than in the most elongated spatangoids.

Growth of Echinoids.

If it is easy to know these relations, it is not as easy to make a correct idea of the mode of growth of spherical animals and stars having a determined number of rays, and an external covering composed of solid pieces whose number is going to increase. In the absence of direct observations, I have been able to take some indications on the subject, from the comparison of numerous individuals of different size of the same species. I was able to assure myself that these are the opposite ends of the body, i.e., in echinoids, on one side, the mouth and on the other, the genital and ocular plates that form the two poles of the sphere. The plates of the periphery increase first in volume and in number around the mouth. As the urchin grows, it is between the plates already formed on a side, and the genital and ocular plates on the other that it forms new division and multiply the rings as in annelids and helminths, according to the beautiful observations of MM. Milne Edwards and Eschricht. As for the asteroids, it is evident that the unpaired plate, that is found at the end of each arm and in which is lodged the eye, is identical to the ocular plate that is found at the top of each ambulacrum of the echinoids. We know likewise that it is near the angle between the rays that the ovaries open. What could be more natural, therefore, than to look for the

new plates below these points. It is, in fact, between the ocular plate and the pieces already formed that develop the new ambulacral plates of asteroids, while the interambulacral plates form on the sides. This leaves some uncertainty on the relation of the two series of interambulacral plates that border each side of an ambulacrum. There is, thus, still a difficulty in responding to this particular point in the comparisons that we are, naturally tempted to make to the least detail of the organization, when the similarity is so striking as a whole.

Echinoids from the geological point of view

The existence of echinoids in the series of strata goes back to the epoqué of the deposition of the carboniferous. They are thus after the stellerides, to which they succeed in the order of their organic gradation⁴. I am going to summarize, with the greatest generality, the facts relative to their order of succession in the series of strata that best seen up to this day. We shall note without doubt without any surprise the similarity that exists in this regard between the echinoderms and the fossil fish. Having developed elsewhere in a very detailed manner, the results of the research on the latter animals⁵. I shall limit myself to recalling here the most general facts that I have deduced from my observations that is a natural classification, based on the study of the organization, established in these two classes the closest relation between the zoological gradation of the types and their order of succession in the strata, or, in other terms, that the most natural zoological arrangement and the most general expression of geological order and *vice versa*, the order of genetic succession, the surest indication of natural affinities. And if it is thus in echinoderms and fish, it is more than probable that it will be the same in all the other classes of the animal kingdom. Also, this result appears to me to open a new era for zoological studies. We would not have the least doubt now that this method of verifying zoology by paleontology and paleontology by zoology can lead to the discovery of many still unknown affinities. It will raise the study of fossils to the rank of a science complementary to zoology as physiology is complementary to anatomy. In fact, paleontology will take the rank in the natural sciences due it only when its goal is to make known to us the development of the animal kingdom in its entirety, with as many details that we have sought to study in recent times, the history of the development of individual species. We would, however, have a false idea of the successive establishment of the animal kingdom on the surface of the earth, if we applied too rapidly the general result that I just stated to a gradual progression of each of the particular types of the classes to which I have made more specific allusion. To the contrary, the detailed study of these animals in all their branches has taught us that, in this general march toward a progressive development, each secondary group, taken alone, has peculiarities worthy of all our attention and that will clarify the trends that are seen in genetic work.

⁴ What little new information I would have to present on sea cucumbers leads me not to expand on these animals, which appear exclusively specific to the current creation, although the softness of their integument does not allow denying in an absolute way their existence at an earlier time. I will confine myself to note that, by the arrangement of their ambulacra in vertical series, especially in the Pentacles, the holothuroids are related in the most direct way to the echinoids, although their elongated shape and the absence of solid plates in their covering gives a rather striking resemblance to certain worms. They are assigned without a doubt, to the highest rank in the class of echinoderms.

⁵ *Recherches sur les Poissons fossils*, vol. I.

Unfortunately, we still have no results on the embryological development of urchins⁶ and holothuroids. The information that we have on the sea stars is restricted to a period too short in their existence for us to be able to establish, at this time, relations between their development and the order of their geological succession of these animals as we have for fish. Nevertheless, the geological facts are quite sufficient in themselves to give us a glimpse of very important results for physiology, in a detailed embryological study of echinoderms. In any case, these facts coincide with the results at which zoologists are most generally stopped in their classification.

It is thus that the star-shaped echinoderms that, as we have seen above, are the primitive source of all the class and at the same time, its lower order, commencing their development in the most ancient areas by a group of genera and species that, in many ways, appear to us much superior to their present representatives. The study of vegetable fossils already has given evidence of similar facts. It is sufficient, to be convinced, to recall the ferns, lycopodians, equisetums of the carboniferous and to compare them to present representatives of these families. Without generalizing these observations, we can consider the prototypes of the echinoderms as synthetic beings, precursors of all the other types and sharing, as such, both the specific characteristics of the order to which they belong, and recalling the very peculiarities that distinguish them from their present representatives, the modifications in the organization of the class that, when they are developed in a later period, will give rise to other, very clearly defined orders. From this point of view, thus, the first echinoderms, the crinoids from areas of transition, are the highest stellerides. The state of preservation of a large number of them leaves no doubt that they all had a distinct mouth and anus, which is no longer the case in a large number of asteroids of modern geological times and the present epoch. The Paleozoic crinoids take a spheroidal form like the echinoids, their superiors, to pass later to the clearly star-shaped form of the sea stars, strictly speaking, which no one hesitates to assign a lower rank than that of the urchins. In one regard, the old crinoids are inferior to all other echinoderms. They are always attached to the substrate and lack eyes, which even exist in asteroids. But, little by little, these primitive forms disappear, new types successively come to replace the old ones, so well that at the end, the pedunculate crinoids are found reduced to two genera that are associated, in the present epoch, to an infinity of genera entirely detached from the substrate and that have completely lost the external similarities that the ancient crinoids had with the other groups of the class. Some examples will make it better to accept the truth of these results. The cystideans and the echinocrinites can easily be confused with urchins. Now, they are exclusively limited to regions of transition. The comatulids, to the contrary, that are the free crinoids, have fossil representatives only in the Jurassic regions. It is the same with the ophiuroids and the asteroids, strictly speaking. In contrast, the latter are very numerous in the present creation, as we have learned from the beautiful works of MM. Gray, E. Forbes, J. Müller and Troschel on these families. A more complete study of the development of comatulids will doubtless confirm the ingenuous views of M. de Buch on the relations between the phases of development that are already known and the different modifications of the crinoid type.

Echinoids from the zoological point of view

These general results keep all their value, even though we would separate definitively the crinoids, ophiuroids and asteroids as independent families. It would then be the latter as plectognaths vis-à-vis ganoides. To be more clearly separated, they will nonetheless appear in the

⁶ We are announcing a work soon to be published on the embryology of urchins by M. de Baer.

whole of the class as successors and replacements to each other, deviating only more or less from the original source, and taking little by little their role in a more or less complete way.

The order of echinoids forms a very natural group by the anatomical characters although it has some fairly great modifications in form. We note in them a very obvious organic gradation that is easy to see. It consists especially in the successive transformation of the spherical type of the true urchins into a more or less elongated form, such as seen in the spatangoids, passing by numerous intermediaries sometimes depressed sometimes swollen, with a tendency to a marginal displacement of the primary centers of structure. These modifications offer an easy means to subdivide the echinoids into natural families. In my first works on these animals, I distinguished three, based essentially on the relative position of the mouth and anus. In the echinids whose form is perfectly symmetrical and radial, the mouth is exactly central, the organic rays that are attached to it are all equally developed, convergent toward the opposite at the center of which is the anus, always surrounded by five oculars that alternate with the five genital plates. In these animals, the mouth and anus are exactly opposite and occupy, so to say, the two poles of a spherical body. The normal position of the animal is vertical, the mouth below and the anus above.

The family of clypeasteroids keeps a similar position. The mouth is central or a little toward the anus, abandoning the opposite top toward which converge the ambulacra and the gonads, with which the oculars alternate as in the true echinoids, open sometimes on the upper surface, sometimes on the lower surface or even on the edge. It is easy, therefore, despite the more or less circular form of these animals, to determine the antero-posterior axis because it is evident we must consider as posterior the anal region and this especially because the anus opens between two series of plates of an interambulacral region so that a plane drawn through the middle of the mouth and anus cuts the body into two symmetrical halves. We shall see below that this family, as I have established in my Prodrôme, contains distinct types that it will be necessary to separate in the future.

In spatangoids, the elongated form becomes more obvious. The antero-posterior axis is recognized immediately with the elongation of the animal itself and the position of the two openings of the alimentary tract that are found at opposite ends of the body. In fact, in these urchins, the mouth no longer occupies the center of the ventral surface. It is, to the contrary, located forward, under the anterior edge, while the anus is posterior, sometimes above, sometimes below the posterior edge. Despite the displacement of the mouth, the rays of the body still diverge regularly from the buccal opening. The unite on the dorsal surface as in the clypeasteroids. Here also, the ambulacrals, the oculars, and the gonopores converge toward the same center, while the anus opens between the posterior interambulacral plates.

I have noted above that the clypeasteroids, such as I first have circumscribed them, constituted a group composed of two distinct types. In fact, the true clypeasteroids have strong jaws armed with sharp teeth, while the echinonids and the nucleolitids completely lack them. This fact has led me to a new examination of the value of the characters associated with the teeth, which M. Charles Desmoulins has already used advantageously in the distinction of several genera⁷. I have recognized that the peculiarities that we observe in the masticatory system of different genera with teeth can all be related to two distinct types of teeth. In cidaroids, the jaws are composed of numerous vertical pieces suspended in the center of the buccal opening by means of vigorous muscles that attach on one side to the exterior surface of the maxillary side and, on the other, to the protruding auricles that emerge from the internal surface of the solid rim of the buccal opening. Independently of the five teeth, the jaws are composed of thirty pieces of which twenty are

⁷ *Etudes sur les Échinides*, by Charles Desmoulins (*Actes de la Soc. Linn. De Bordeaux*, v. VII).

connected as pairs fused two by two and embracing a tooth while the ten others are applied above and between the paired pieces that serve at the same time to connect and move it.

In clypeasteroids, the dental system is much simpler. The jaws are composed of only ten pieces, fused by pairs, in the middle of which are fixed the five teeth. The jaws themselves are set in ten supports emerging from the internal surface of the test. They pivot on these with the aid of a small intermediary rotula. There is thus, in clypeasteroids, neither accessory pairs to the jaws nor intermediary pieces above the paired pieces. All the system is reduced to horizontal, triangular blades, in the angles of which the teeth protrude. Whether these blades are now thin and simple, or whether their edges are united and layered is of little importance. Because always still, the jaws of the true clypeasteroids, those of laganids, scutellids, echinocyamids, fiibularids and all the genera that we have dissected, conform in the same manner and adapted in their usage after a different plan than that of cidaroids. I think therefore that these genera should constitute a distinct family to which I shall keep the name *Clypeasteroidæ* that I separate from it the echinonids, the nucleolitids, the echinolampids, cassiduloids, discoidids and galeritids, all of which lack jaws and will constitute in the future a family for which I propose the name *Cassidulidæ*.

Division of the Echinoids into families.

The result of this comparison is that the order of Echinoidea contains now four families, of which two have teeth and two that do not, the cidaroids and clypeasteroids on one side and the cassiduloids and the spatangoids on the other. If we now examine in more detail, the relations of the different members of these families between them, and with the related orders, we cannot ignore a more intimate relationship between the asteroids and the cidaroids, a connection that is betrayed by the rigorously radial form of the latter, to which it is then necessary to assign a lower rank in the order of echinoids. As for the cidaroids themselves, we subdivide them into four tribes: the *true cidaroids*, with a thick test having heavy, large spines, sometimes clavate, and often granular, having simple teeth, open jaws, very narrow ambulacra, and two rows of large, perforated tubercles in the interambulacral areas. The *salinids*, which are distinguished by an apical shield of a completely peculiar structures. The *true echinids*⁸, with a thin test, trilaminate teeth, tubercles with nearly the same size in the ambulacral and interambulacral areas, and pointed spines, finely striated or scaled. Finally, the *echinometrids*, that have all the characters of the true echinid, but that are distinguished by their oblong form and the oblique position of their antero-posterior axis. This exceptional character of the echinometrids is perhaps a first tendency toward the regular elongation of the body that is so clearly marked in the spatangoids. In this case, the echinometrids merit occupying the first rank in the family *Cidaridæ*. A geological consideration, that is not without importance, tends to confirm this assumption. It is the order of succession in which the true cidarids appeared in the middle of the deposits. We know that the diademids in the muschelkalk and the Lias, the true cidarids and pedinids in the lower oolitic, in the Triassic and even in the calcareous carboniferous. But the true echinids do not descend even to the Lias. There are only a very small number of echinometrid fossils in the Tertiary deposits, while the living species are very abundant. Now, as we have already recognized so often a surprising coincidence between the organic gradation of animals and their relative age, we would have reasonable doubt

⁸ The group of echinids can be subdivided into two sections: the echinids strictly speaking, whose pores are arranged in three oblique pairs (the genus *Echinus* is the type) and *Echinocidaris*, whose pores are simple pairs (the diademids, *Echinocidaris*, etc.).

only if the echinometrids have exceptional characters in the order of echinoids is because of their rank.

We have already noted at the beginning, that the order of echinoids, in its entirety, recalls, in a higher degree of organization, the type of crinoids of the oldest deposits. This resemblance, all exterior as a whole, and that, taken in its generality, recalls only the globular form of the corona of these ancient fossils, shows more particularly in the true cidarids that, as we have just seen occupy the lower rank among the echinoids. In fact, in no family of the echinoids, the interambulacral plates are no longer comparatively taller than their peripheral diameter. In no other family are these plates more distinct. Finally, nowhere do the ambulacrals occupy less space of the surface of the body. These comparisons are thus not philosophical exaggerations, but a good expression of a real resemblance of types, moreover very separated, resulting without doubt from the mode of realization of creative thought that showed itself successively in types that are partially expressed.

The constancy of forms in all the genera of the family of cidarids is a fact worth noting. This uniformity makes the distinction of genera and species very difficult. It is such, in many, we would hardly capture distinctive characters without direct and very careful comparisons. It is good to point out here how far we are from the truth when we consider even the most natural divisions of our systematic framework as groups of equal value, and when we admit that the genera and species must be based on equally clear and distinct in all divisions of the animal kingdom. It is the families that are could call *families by series*, where the species appear so closely connected to each other, that bringing them together into distinct genera seems sometimes to be a violence made to nature. However, if we consider the constancy of these small differences in some limits, we should recognize that they have a value just as great as some prominent and distinct characters on which are based the genera in the more strongly defined families. There is more: not only are the genera constituted of groups of unequal value, and unequally separated from each other by the differences that distinguish them, but even the species of the same genus are far from having the same affinities among them. There are very few genera that do not contain some species very close to other more clearly separated species. In a way that makes exactly all these graduations in the natural affinities of organized beings, it will be necessary to multiply the divisions well beyond that we are used to making and assigning to these division a determined value in their hierarchy in order to express as much as possible the astonishing diversity that nature presents in the affiliation or organized beings.

As we just saw, the group of clypeasteroids approach that of cidarids by the position of the mouth that is found in the middle of the ventral surface in a location more or less central, and by the convergence of the ambulacrals toward the top of the dorsal surface that is opposite the buccal opening. The only fundamental differences are that the posterior opening of the alimentary canal is moved backwards, the dental system is simpler and suspended in another way and, finally, in the general form that is not spherical nor even regularly circular, because the antero-posterior and transverse diameters are always clearly indicated, without the first always being predominant. There are, in fact, clypeasteroids whose transverse diameter is greater than the longitudinal diameter. There are others where it is the inverse. Some are very swollen, even ovoid, while others are very flat. Their borders are sometimes round, but most often compressed, notched, and even toothed and perforated. This diversity of contours seems to indicate, in clypeasteroids, an absence of precision in the plan, even their organization, that is betrayed by these monstrosities, by default and by excess, and even by deformities that are very rare in other families. It is thus that we sometimes encounter true clypeasteroids with four and six ambulacra, and very remarkable

variations in form in the same species. It is thus the scutellids are often deformed with the notches and perforations of mellitids, encopes and lobophores. Even the position of the anus can vary in the same species. It is sometimes found above, sometimes below the posterior border or in the edge itself. In this family, the species are as difficult to distinguish as in those of the cidarides, but for very different reasons. It is that they vary to a degree that we can hardly find the limit of the extent of the variations, so great are they. While in cidarides, there are hardly apparent differences between the most distinct species, nevertheless these differences have an admirable constancy.

After what we have just said about the instability of the characters in clypeasteroids, we should not expect to see this family separated into natural tribes. In fact, however great are the differences that distinguished exteriorly the general *Rotula*, *Arachnoides* and *Fibularia*, it is obvious they belong to the same type and that they are related to each other by a series of intermediary genera. The fibularids pass to the true clypeasteroids by the echinocyanids and the laganids, like the perforated and toothed scutellids are related by their simple contour. We do not believe it is possible to establish natural subdivisions in the family of clypeasteroids, despite the quite notable differences. They have genera in which the masticatory system is contained in a cavity distinct from the cavity that contains the intestine, while in others, these organs are not separated. In other genera, there are simple pillars between these two regions. Finally, in some, the walls of the test are simple, while in others, we see very complicated canals.

The existence of the family of clypeasteroids does not appear at a very remote age. It appears with the first Tertiary deposits. It is in the present creation that is dominant and that species are more diverse. The great diversity of living forms seems to me a fact similar to that presented by family of ammonites in the last epoch of its existence in the Cretaceous deposits where we see appear a large number of oddly coiled genera following such regular species and so perfectly symmetrical of the oldest deposits.

The family of cassiduloids, separated from the clypeasteroids because of the particular conformation of the mouth, that is the disappearance of the jaws and the teeth, include still a considerable number of genera and species sufficiently different to be grouped in two tribes. In all, the mouth is central and the anus marginal, sometimes dorsal and sometimes ventral. Nevertheless, the family of cassiduloids is divided naturally into two very distinct groups. One of them has ambulacra composed of single pores, such as the galerites, the discoides, the holotypes, the caralomus, the pyrites, echinones, etc. It is my group of *Echinoneidæ*. The other, to the contrary, has petaloid ambulacra, like the clypeasteroids, such are the cassidules, the nucleolites, the clypens, the echinolampas, etc. This I made my group of *Nucleolidæ*. These differences establish at first glance the multiple relations between the cassiduloids and the other families of the order Echinoidea. As the galerites are related to the Dysaster and to the anachytes of the family of spatangoids by the hyboclypes, while the echinolampids recall on one hand the true spatangoids and on the other, the true clypeasteroids.

The two groups of the family of cassiduloids appear simultaneous in the layers of the formation. As we find in the lower oolite, Clypens and Pygurus associated with Holotypes and Hoboclypes. Here also, the round forms precede the elongated forms, because from the clypens we pass successively to the echinolampas and from the holotype to the galerites and the pyrites.

The two groups are not maintained with the same perseverance in the following epochs. While the group of nucleotidids takes a considerable development in the Tertiary deposits where we see appear the genera *Echinolampas* and *Pygorhynchus* remarkable for their size. The group of galerites disappears, to the contrary, nearly completely, so well that it has only a single representative in the present epoch, the genus *Echinoneus*.

The family of cassiduloids has also on its side some relations with the cidarids. Some genera, such as *Pygaster* and the holotypes recall by their form the true *Echinus*. Their tubercles, more protruding than those of clypeasteroids, are distinctly mamelated and form vertical series. Their mouth is circular. The rim is notched to imitate the form of support of the jaws. It produces in the mold an impression similar to that of the teeth. However, these resemblances are more apparent than real. The masticatory system is lacking. The anus, instead of opening opposite the mouth, occurs in the unpaired interambulacral area.

The similarity is more striking between the cassiduloids and the clypeasteroids. Considering echinolampids and clypeasteroids only by their exterior form, we would be tempted to unite them. Authors of great merit, like Lamarck and Goldfuss, have in fact united them. But if they had known that the echinolampids entirely lacked teeth, while clypeasteroids have a formidable masticatory system, they probably would have preceded MM. de Blainville, Gray and Desmoulins in the establishment of his genus. In fact, the echinolampids, cassiduloids and nucleolitids differ only very little in the principal characters of their organization. Their forms are the same. The constancy of the characters that they have in common show us in a more obvious way how their bizarre form that affects the anus in the genera *Clypeus*, *Nucolites*, *Pygurus*, etc., are secondary in this family so well that they scarcely merit being taken into consideration in the establishment of the genera. In this tribe, as in the preceding, we note that the circular forms of *Clypeus* and *Pygurus* precede, in the series of deposits, the more elongated forms of the echinolampids.

The family of spatangoids, finally, seems to occupy a higher rank in the order of echinoids. The strictly radial shape of cidaroids, that undergoes only a slight elongation in some clypeasteroids and some cassiduloids, produces here very obvious symmetrical pairs. One of the five rays takes ordinarily a structure different from the other four, which makes the symmetry that appears even more striking. The gonopores are often reduced to four, and even to two. The mouth no longer occupies a central position, and, although it is still the center of radiation of the different organs, it is moved toward the anterior end of the body, where it nevertheless always occupies a ventral position, while the anus located at the opposite end opens sometimes above, sometimes behind, sometimes below.

Lamarck divided the spatangoids into two genera, anachities and spatangues. The first contains all the species whose anus is infra-marginal, the second those whose anus is supra-marginal. However, it is easy to perceive that these two genera contain very different types, especially the spatangids. I split it a long time ago into several genera, based mainly on the form and structure of the ambulacra. These divisions, some of which can appear arbitrary at the beginning, have been validated in a very satisfactory way by the investigations of MM. Krohn and Desor on the pedicellariae. These organs are not distributed on the entire surface of the test, as in *Echinus*. They are, to the contrary, found in curved zones or rows that are distinguished in several species by a particular color. When the urchin is stripped of its spines, these zones appear at the surface of the test in the form of smooth bands. But if we examine them with a magnifying glass, we see that they are composed of very small granules, true tubercles, on which the pedicellariae articulate. These bands that I and M. Desor call *fascioles* are thus not an insignificant character because they correspond to a particular organ and without doubt important in the organization of these animals.

However, not all spatangoids have fascioles. It is worth noting they are precisely the oldest in the series of deposits that do not have them: *Holaster*, *Toxaster*, *Ananchytes* and *Dysaster*, i.e, precisely the genera that are nearest the cassiduloids. Now, these same genera are distinguished also by a particular arrangement of the tubercles that recalls those of the galerites. *Dysaster* is the most separated from the true spatangoids, so much that I have for a long time had doubts about the

most convenient place to assign it in the system. With the elongated form of the spatangoids, they combine some characters that approach to some degree the cassiduloids. These include the mouth that is not bilabiate but sub-pentagonal, and the structure of the ambulacra on the ventral surface. On the other hand, their test is thin and their ambulacra unconnected. It is only an exaggeration of what we see in *Holaster* and *Anachytes*. It leads me to place them preferably in the spatangoids, of which they are in a way the prototype. These are the only Jurassic spatangoids.

This comparison of the types of the different families shows that independently of the zoological characters, each geological epoch has its predominant character, impressed on all the representatives of a class. This character, which we can call the *character of the epoch*, although difficult to appreciate, shows us that the study of a class is complete only when it includes successively all the diversity of forms in the genera and species that compose it, all the peculiarities of its structure in all its organization, all the phases of its development from the formation of the embryo up to the end of growth of the individual, the order of succession of all the types in the series of deposits and, finally, the relations that exist between the organization, the development and order of succession, without speaking of behavior about which we have still few, very imprecise data.

A detailed study of the mode of successive establishment of all the classes on the surface of the earth shows that it alone, in a most evident manner, how much the idea of a simple and single series of living beings expresses imperfectly the various relations that unite them. The diversity of the nature of these relations is itself proof of the impossibility of a linear arrangement. I shall not say of all animals, nor even of species of a class and of a family. I shall go further. I affirm that any attempt for a linear relationship of fairly numerous species of a single genus, must necessarily falsify the affinities and, in this assertion, I use the following considerations. It is that if we only want to have regard for the relations of organization, we obtain different series if we arrange the species according to the nervous system, locomotory organs, to organs of circulation and respiration, to organs of digestion, or reproductive organs. In fact, if we want to unite the echinoderms that have eyes and those that do not, we place on one hand, asteroids and echinoids and, on the other, the holothuroids and the crinoids. If we consider, in an exclusive way, the faculty of movement, we shall separate the fixed crinoids from the mobile species, although they have no other essential difference. If we relate more particularly to ambulacra, we unite the asteroids, echinoids, and holothuroids, to which we oppose the ophiuroids and comatulids. If we insist on the forms of the alimentary canal, we unite the comatulids, the urchins and the holothuroids with some asteroids that have the alimentary canal open at two ends to separate them from those that have a mouth without an anus. Finally, if we neglect organization, as so many zoologists do, and prefer to consider external resemblances, the general aspect, we continually run the risk of taking similarities for affinities. Then the cystideans of the order Crinoidea would appear nearer the cidaroids than the comatulids and the ophiuroids. Then the cassiduloids would be nearer the spatangoids than the galerites. In the confusion of these false relations, we would no longer appreciate the value of the influence of the period of appearance. In the confusion of these false relationships, we would no longer know the importance of the period of appearance. We would no longer know the individual importance of the characters of a class according to the gradation of its types. We would no longer perceive the more or less persistent deviations in a rigorously determined development. In a word, instead of a natural method, which considers all, even that which appears the least natural, we shall place the narrow views of our arbitrary decisions.

Geographical distribution of Echinoids

Regarding the geographical distribution of echinoderms, I have little to say. The information that we find in the collections in the countries of these animals are too vague to merit our confidence and to serve as the basis of a complete work. There are, however, some facts that appear to me worthwhile to consider.

First, there are echinoderms at all places on the earth that are covered with sea water. We should therefore expect to find their fossil remains in all marine regions. The species with a lower organization are more abundant in cold regions than those that have a higher rank, if we consider the total number of echinoderms that live in the country. On this occasion, I shall note that the presence of pedicellate crinoids in tropical seas is in fact a completely different order, that there was a preponderance of these animals in earlier periods than ours, during which the temperature was higher. It is the pentacrinus from Guadaloupe and the crinoids of deposits in transition and of the secondary epoch, nearly like the hippopotamuses, the tapirs, the elephants of our time and the paleotherians, mastadons and so many other extinct genera of Tertiary deposits.

The species are circumscribed in very narrow limits, to judge at least from the distribution of those that live on our coasts and that differ from the North Sea to the Mediterranean and even in areas still more restricted. The species that have the most extensive area of distribution sometimes have fairly notable differences, according to the different stations. These differences and the mode of distribution are of a nature that suggest that the animals are restricted to the areas that they inhabit, and that their geographical limits vary little, and that the species have from the beginning lived in all the regions they occupy now. This localization does not extend only to species. There are entire genera that are circumscribed to limited basins. We can even say that, in general, the genera have a narrow distribution, at least in the sense that those that are better characterized do not find the species in all zones.

May these fragmentary indications make it apparent how much is still to be done, even in the study of the classes that appear best known!

The following pages contain the characteristics of the families and genera of the order of Echinoidea, with the enumeration of all the known species, living and fossil, with the indication of their distinctive characters when it is a matter of new species or imperfectly known species. In addition, I have cited the best known figure of all the living and fossil species. The number of genera that I can distinguish already is more than ninety, of which approximately a third are unpublished or at least very imperfectly characterized in my previous publications. The number of species that I know today in a complete way is nearly a thousand, without counting a few hundred fossils of which I have been able to examine only fragments or very imperfect specimens⁹.

I have indicated in the following catalogue, beside each species, the habitat and, if it is a fossil, the deposit, with the indication of the collection where it is found. For the fossil species I have had care to report not only the formation, but also the stage from which they came whenever I had in this regard sufficient information. I have adopted several names proposed recently by specialist geologists. I thus adopted the name *marnes résuliennes*, proposed by M. Thurmann, for the layer with *Ostrea acuminata*, of the lower oolite; the name *séquaniea deposit* by the same author for

⁹ Most of these species have been figured with sufficient detail to recognize them, even when we have only fragments. These figures, which form an atlas of 100 plates, are unfortunately so numerous, that their publication which is too expensive, seems to have been postponed indefinitely.

the deposit of calcite intermediate between the kimmeridien and the coralline, that up to now had not been specified. Finally, the name of *danien deposit*, proposed by M. Desor for the pisolitic of Picardy and the upper stages of the chalk of the north of Europe.

After the catalog is a geographic and geological table, where the living species of the same area are in the same key, so that it is possible to have an idea of the particular character of the fauna of urchins in an area or some latitude at a glance.

The habitat for the living species, and the deposit for the fossil species, is indicated in a separate paragraph after the description with the museum or collection where the species is found. Here is the key to the geological abbreviations.

Tert.	Tertiary.	Portl.	Portlandian.
Calc. gr.	Large chalk.	Séquan.	Sequanian.
Terr. numm.	Nummulitic deposit.	Kimmer.	Kimmeridian.
Terr. crét.	Cretaceous deposit.	Coral.	Corallian.
Cr. bl.	White chalk.	Argov.	Marne.
Dan.	Danien.	Oxford.	Oxfordian.
Terr. pisol.	Pisolitic deposit.	Kellov.	Kellovian.
Cr. marn.	Chlorite chalk.	Ool. Inf.	Lower oolite.
Marn. néoc,	Marly chalk.	Vésul	Vesulian.
Néoc.	Neocomian.	Marn. vésul.	Vesulian marl.
Terr. jurass.	Jurassic deposit.	Ool. Ferrug.	Ferruginous oolite.

The uppercasse numbers placed after the names of the authors in the fossil species indicate the numbers of order of the collection of mussels of the Museum of Neuchâtel. This collection exists in addition to the Museum of Paris, the British Museum, the museums of Berlin, Turin, Montpellier, and of MM. Michelin at Paris and Charles Desmoulins at Bordeaux, etc.

CATALOG
OF THE SPECIES, GENERA AND FAMILIES OF ECHINIDS

FAMILY OF CIDARIDÆ

Circular form. Mouth central, located on the ventral surface, formed by a membrane (the buccal membrane) that is sometimes naked, sometimes covered with scales. Anus opposite the mouth opening between the ring of plates composed of ten pieces, i.e.: five genital plates and five ocular plates, alternating with each other. The antero-posterior diameter is indicated by the madrepor that merges with the unpaired genital plate. The test has tubercles arranged in rows, having spines of very diverse forms, and sometimes very long. The very complicated masticatory apparatus (known as the Aristotle's lantern) is composed of numerous pieces, of which the principal ones are the pyramids, the rotula, the compass and the teeth strictly speaking. On the periphery of the mouth, on the ventral surface, is a circle of bony pieces that support the lantern and that are designated by name of auricles.

GROUP OF CIDARIDÆ STRICTLY SPEAKING

Test thick. Interambulacral tubercles not numerous, very large, crenelated and perforated, having spines of a considerable size. Pores arranged in simple ais. Teeth in the form of a gutter without a keel on the internal surface. Pyramids of the lantern open at the top.

I. CIDARIS LAMK. (AGASS.)

Circular form, flat above and below. Tet thick. Narrow ambulacral areas equally in width to hardly a fourth of the interambulacral areas covered with small, very dense tubercles with small, flat bristles. Pores arranged in simple pairs. Very large, perforated tubercles on the interambulacral areas, all having heavy spines sometimes smooth, sometimes rugose or spiny. Genital plates large, pentagonal, all equal. Ocular plates small, triangular. Mouth circular without notches. Buccal membrane covered with subequal scales on which extend the ambulacral pores. Lantern strong, composed of massive pyramids on which the branches are not united at the top. Teeth with canals, without a keel on the internal surface. This genus is divided naturally into two types: in one the tubercles are smooth; in the other, crenelated at their base.

FIRST TYPE. — *Tubercles with smooth base, not crenelated. This type contains living species, fossils of formation in transition, of the Triassic, of the chalk, and Tertiary regions.*

imperialis Lamk. Species characterized by its large tubercles with a very wide base, surrounded by very protruding granules. Spines of smooth appearance finely granular, pleats at the top. Dark purple.
Southern seas (Quoy and Gaimard), Australia, Red Sea. — Mus. Paris.

Hystrix Leske Tab. 39, fig. 2. — Gault. Tab. 108, fig. D.
Mediterranean. — Mus. Paris and Avignon.

papillata Flem. Brit. Anim. P. 477. — Leske Tab. 7, fig. B, C. — Düb. and Kor. Acad. Stockh. 1841, p. 233, Tab. 9, fig. 25. — *Cidaris borealis* Düb. and Kor. *Ibid.* 1841, p. 111. Perhaps only a variety of *C. Hystrix*.
Scottish and Norwegian coasts. — Mus. Stockholm. Desmoulins.

Stokesii Agass. Differs from *C. Hystrix* by its more flattened form; the tubercles are more sunken and the granular space between the large tubercles, wider. Fusiform spines, thin. Very bright red.
Mediterranean. — Stokes, Mus. Paris and Soleure.

Thouarseii Val. (Museum). Ambulacral areas narrow, composed of four rows of granules, of which the two internal are scarcely developed. Base of the tubercles wide. Intermediary granular space between the rows narrow. Granules very apparent, not dense. Spines subcylindrical, swollen, very granular, recalling those of *C. Blumenbachii*.
California. (Neoux.) Galapagos. — Mus. Paris.

Danae Agass. Very small species, with pointed spines: those of the ventral surface and the middle of the body are covered with very apparent linear granules; those of the dorsal surface of smooth.
California (Neoux.) — Mus. Paris.

tribuloides Lmk. Leske Tab. 7, fig. A. var. *maxima*. Ambulacral areas composed of six rows of granules, of which the internal are very small and very dense. Tubercles small, with smooth narrow zone. Intermediary granular space between the tubercles very wide, with very dense granules. Pointed spines, covered with fine granular striations but without asperities.
Indian Ocean, island of Cuba. — Mus. Paris. D'Orbigny. École des Mines

metularia Lmk. Leske. Tab. 37, fig. 3. Species a little less tubercular than *C. tribuloides*. Spines cylindrical finely granular, rings of white and brown.
Seychelles, Ile de France (Rousseau) Solomon Islands, Gulf of Mexico ?. — Mus. Paris, Michilin.

pistillaris Lmk. — Encyl. meth. Zooph. Pl. 137. — Large species with pointed spines, swollen at the top, with granules in rows.
Seychelles (Rousseau) Ile de France (Mathieu). — Mus. Paris.

baentosa Lmk. — Descript. Egypt. Zool. Tab. 7, fig. 1. — Mich. Mag. Zool. Tom. IV, pl. 8. Ambulacra composed of two external rows of very apparent granules, and four very small internals scarcely visible to the naked eye and very sparse. Base of the large tubercles elongated transversally. The granular intermediary space between the rows is very wide. Granules very dense. Spines with asperities in the form of barbs, pointed on the dorsal surface, truncated on the lower surface. Patches of pink on the collar.
Red Sea (Savigny), Ile de France (Sonnerat) — Mus. Paris.

Lima Val. (Museum.) Ambulacra composed of six rows of granules. Very large tubercles recalling those of *C. imperialis*, but the secondary tubercles that surround the base are much smaller. Spines very long, swollen at the base, narrow toward the top, patches of pink at the articulation.
Ile de Bourbon (M. Brevu). — Mus. Paris.

Krohnii Agass. Species with spines fairly near those of *C. baculosa*, but compressed and more spinose.
Seychelles (Rousseau). — Mus. Paris.

annulifera Lamk. Large species with elongated spines, compressed, with white and pink rings, pointed at the top, with the exception of those of the dorsal surface that are blunt.
Australia (Peron) — Mus. Paris.

tubaria Lamk. Species remarkable for its very barbed spines, patches of white and pink.
Malacca. (Eyedoux and Soulyet.). — Mus. Paris.

verticillata Lamk. — Encycl. meth. Zooph. Pl. 136, fig. 2 and 3. — Base of tubercles small, surrounded by dense granules. No miliary granules between the rows of tubercles. Spines whorled, with the exception of those that surround the mouth, which are pointed.
Southern seas. (Peron and Lesueur. Quoy and Gaimard.) — Mus. Paris. École des Mines, Michelin.

Fossil species

etavigera Koenig. — M 37, M 38, M 39, M 47 — lecon. foss. seel. — Deluc. Tom. IV, p. 467, Tab. 12. — Leske p. 134, Tab. 46, fig. 2 and 3. — Park. Org. Rem. III, Pl. 4, fig. 1 and 21. — Agass. Cat. syst. P. 10. — *Cidaris margaritifera* Auet. — Tubercles dense, contiguous at their base. Intermediary granular zone wide. Spines very characterized by the clavate form.
Lower cr. bl. of Kent, Lewes, Brighton, Dieppe, Fécamp, Trichateau (Oise), Evreux. — Mantell, d'Orbigny, Michelin, Deluc.

punctata Roem. — Q 27, Q 32. — *Cidaris vesiculosa*. Agass. (non Goldf.) Foss. crét. In Mém. Sue. Neeuh. I, p. 141. — Cat. syst. P. 19. Echin. Suiss. II, p. 66, Tab/ 2. Fig. 11–19. *Cidarite variabilis* Koch and Dunk.
Néoc, of Merlassun, near Neuchâtel, Censcau (Jura), Périgueux, Saint Dizier, clay of Hills (Hanover). — Mus. Neuchâtel. Dubois, Marvou, d'Orbigny, Rœmer.

regalis Goldf. Petref. P. 116. Tab. 39, fig. 2.
Dan. (Mæstricht). — Mus. Bonn.

sceptrifera Mantell. — 5 b. — Geol. of Suss. Pl. 17. — Park. Org. Rem, III, Pl. 4, fig. 2. — Agass. Cat. syst. P. 10. — Tubercles surrounded by larger granular beads. Intermediary granular zone wide and depressed. Spines unequal, covered with small granules in rows.
Cr. bl. of Reims, Dieppe, Mendon, Beauvais, Caine, Susses, Angoulême. — Michelin, Graves, Duval, Deshayes. Mus. Paris.

vesiculosa Goldf. — 86, T. 18. — (non Agass.) Petref. P. 120, T. 40, fig. 2. — Park. Org. Rem. III, Tab. 4, fig. 3. — Intermediary granular zones wide but the beads that surround the tubercles appear less protruding, and the tubercles themselves are less spaced than in *C. scdptrifera*. The spines are not pointed at their end and their granules are less fine.
Cr. chlor. of Villiers-sur-Mer and le Have, Essen on the Ruhr. — D'Orbigny. Mus. Paris and Bonn.
Cr. bl. of Ruyan, Talmont, Kent, Beauvais. — D'Archiac, Michelin, Graves.

Vendocinensis Agass. Large species with dense tubercles, very constricted and sub-crenulated mamelons.
Cretaceous regions of Vendôme.

hirsuta Marcou. Species near to *C. Hystrix*, but granules cover the intermediary spaces between the large tubercles are small and arranged in horizontal rows. Cylindrical spines armed with strong barbs.

venulosa Desor. — T. 16. Large species near *C. maxima* but without grooves and with ambulacra a little narrower. The miliary space between the interambulacral plates is finely granulated. The granules are arranged in a way that looks like horizontal veins.
Dan. (north of Europe). Mus. Copenhagen and Paris.

Forehammeri Desor. — Hising. Letg. suec. Tab. 20, fig. 2. — Distinguished by the irregular and elongated granules that surround the tubercles.

Dan. (Calc..of Feroe), Pisolic de Vigny. — Mus. Copenhagen. École des Mines, École normal de Paris.

subsimilis Münster. — Beytr. p. 40, Tab. 3, fig. 2.
Saint Cassian. — Münster.

Liagora. Münster. Beytr. 1841, p. 41, Tab. 3, fig. 3.
Saint Cassian. — Münster.

venusta Münster. Beytr. 1841, p. 41, Tab. 3, fkg. 4.
Saint Cassian. — Münster.

Gerana Bronn in Münster. Beytr. 1841. p. 42 Taab. 3, fig. 7.
Saint Cassian. — Münster.

pentagona Bronn in Münster. Beytr. 1841. P.42, Tab. 3, fig. 6.
Saint Cassian. — Münster.

subpentagona Bronn in Münster. Beytr. 1841. p. 42, Tab. 3, fig. 2.
Saint Cassian. — Münster.

subnobilis Münster. Beytr. 1841. p. 12, Tab. 3, fig. 10.

Münsteriana Kon, An. foss. p. 35, Tab. E, fig. 2
Calc. carboniferous from Visé. — Koninck.

*Spines with a smooth articulating facet, whose test is unknown*¹⁰.

Colocynda Agass. — 89. 91. Cat. Syst. p. 10. — Spine very swollen, in the form of a small egg, with a very thin stalk. Surface covered with very fine, hardly visible striations.
Cr. bl. from Mendon. — Michelin.

pteracantha Agass. — N 74 — Cat. syst. p. 10. — Very close to *C. Colocynda*, but less swollen. Perhaps it is only a variety.
Cr. bl. of Mendon. — Deshayes.

velifea Bronn. — 84 — *C. pisifera* Agass. Cat. syst. p. 10. — Small size of the same form as the preceding, but the surface is covered with asperities that, seen with a magnifying glass, has barbs in a row.

Cydonifea Agass. Near to *C. Colocynda*, but shorter and more rounded. Very fine granular and sinuous striations.
Néoc. of Saint Auban (Var). — D'Orbigny.

gibberula Agass. Near *C. cucumifera*, but with more irregular mamelons.
Cr. of Cassis (Bouoches-du-Rhône). — Michelin.

coranifera Agass. Near *C. clunifea* and *C. C. ovifera*, but shorter.
Néoc. of Orgon, Salève. — Mus. Of Avignon. Favre.

cyathifera Agass. — 909. S 72. — Cat. syst. p. 10. — Cylindrical spine, flared at the top, covered with very small granules in vertical rows, that are confluent in the form of protruding folds at the top.
Cr. of Saint Aignan and Tours. — Michelin.

¹⁰ Some of these spines correspond without doubt to known and described tests under other names. It is convenient nevertheless to distinguish them under a particular name as long as we do not know their true relation.

clunifera Agass. — S 33, S 35, S 40. P. 33. — Foss. Crét. in Mém. Soc. Neuch. I, p. 112, Tab. 14, fig. 16–18. — Echin. Suiss. II, p. 68, Tab. 21, fig. 20–23. — Cat. syst. p. 10. — Desml. Tabl. syn. p. 336.
Néoc. of canton of Neuchâtel, Grasse, Lattes (Var), Malle, Saint Anhan (Var). — Dubois.
Mus. Neuchâtel.

Neocomensis Marcon. Spine strongly channeled, generally compressed with small denticulations on the lower surface.
Néoc. Of Censeau. — Marcon.

catenifera Agass. — S 19. — Cat. syst. p. 10. — Echin. Suiss, II, p. 79, Tab. 21a, fig. 23.
Calcare alpin, Surenen. — Mus. Berne.

Strobitus Agass. — M 10. X 100. — Cat. syst. p. 10. — The spines resemble fir cones, the collar is short and smooth. The surface has a very dense granulation, meandering in form and sometime largely linear.
Cr. of the Pyrenees. — Deshayes.

sobunda Agass. — S 50. — Cat. syst. p. 10. — Spine smooth and pleated only at the top. Articulating ring distinct.
Terr. Crét. Of Gap. — Deshayes.

Johannetii Desml. — X 73. — Tabl. syn. P. 336. — *Cidaris euryracantha* Agass. Cat. sys. p. 10. — Spine cylindrical, enlarged toward the end, covered with irregular granules. No collarette.
Cr. — Michelin.

spinosissima Agass. Spine cylindrical, with strong barbs on the exterior side. The barbs are up to 2 millimeters in length. The internal surface lacks them.
Cr. chlor. — Deshayes.

leptacantha Agass. Small cylindrical spine, slender, covered with strong barbs, denser than in *C. spinosissima*.
Tert. Crét, Hauteville. — Michelin.

spinulosa Agass. Near *C. septrifera*; but the barbs of the spines are less confluent.
Cr. chlor. of Le Mans. — Mus. Pais (gal. geol.). Michelin.

Hiamentosa Agass. R 21. — Spine near in form to *C. sceptrifera*. But the granules are larger, less dense and rounder.
Crét. Formation — Mus. Bâle.

punctatissima Agass. — X 18. — Cat. sys. p. 10. — Recalls by its form *C. Blumenbachii*, but the granules are smaller and the neck less thin.
Néoc. of Grass (Var). — Mus. Berne, Avignon.

Huchii Münster. in Gold. Petref. p. 121, Tab. 1, fig. 3.
Saint Cassian. — Münster.

remifera Münster. Beytr. 1841, p. 43. Tab. 3. Fig. 12.
Saint Cassian. — Münster.

Hausmanni Wissm. in Münster. Beytr. 1841. p. 44, Tab. 3, fig. 14.
Saint Cassian. — Münster.

Wissmanni Desor. — *Cidaris spinosa* Münster. Beytr. 1841, p. 44, Tab. 3, fig. 16.
Saint Cassian. — Münster.

cingulata Münster. Beytr. 1841. P. 44, Tab. 3, fig. 17.
Saint Cassian. — Münster.

semirostatata Münster. Beytr. p. 43, Tab. 3, fig. 29.

Saint Cassian. — Münster.

serobientata Braun in Münstr. Beytr. 1841. p. 46, Tab 3, fig. 21.
Saint Cassian. — Münster.

dorsata Braun in Münstr. Beytr. 1841. Tab. 4, fig. 1.
Saint Cassian. — Münster.

alata Agass. — X 7, X 8 S X11, X 14, X 22, X 23, X 26. Echin. Suiss. II, p. 74, Tab. 21a, fig. 5. — Ca. syst. p. 10.
— *Cidaris dosatus* Bronn.
Saint Cassian, Buchenstein (Alps). — Mus. Berne.

Rœmeri Wissm. in Münstr. Beytr. 1841, p. 47, Tab. 4, fig. 3.
Saint Cassian. — Münster.

Wächteri Wissm. in Münstr. Beytr. 1841, p. 48, Tab. 3, fig. 22.
Saint Cassian. — Münster.

SECOND TYPE. — *Tubercles crenulated at the base, containing species from the oolitic and Triassic deposits.*

Blumenbachii Münst. — S 27, S 32, S 39, S 97. — in Golf. Petref. p. 117, Tab. 30, fig. 4. — Agass. Cat. syst. p. 9.
— Echin. Suiss. II, p. 37, Tab. 20, fig. 2–7.
Coral. Fringeli, etc. (Jurassic Soleurois), Chagnes, Verdun, Saint Mihiel, Vaches-Noires, Franville. — Gessly. Michelin, Deslongechamps.
Coral, blanc of Hoggerwald. — Gressly.
Var. *Cidaritis Parandieri* Agass. — S 24. — Cat. syst. p. 10. Echin. suiss Münst p. 38, Tab. 20, fig. I.
Coral of Besançon. — Parandier. Mus. Neuchâtel.
Var. minor: *Cidaritis crucifera* Agass. — S 23, S 34. — Cat. syst. p. 10. — Echin. Suiss. II, p. 61, fig. 1–5.
Coral of Besançon. — Dudressier.

marginata Goldf. — M 60, — Petref. p. 118, Tab. 39 fig. 7. — Agass. Cat. syst. p. 9.
Coral, of Angoulin, near Rocohelle, Upper Jurassic of Heidenheim. — D'Orbigny. Mus. Bonn.

coronnata Goldf. — 83. — Petref. p. 119, Tab. 39, fig. 8. — Agass. Cat. syst. p. 9. — Echin. Suiss. II, p. 59, Tab. 20, fig. 8–17.
Coral. Fringeli (Jurassic soleurois). Caine, la La Rochelle, Puiseux (Ardennes) — Michelin, d'Obrigny. — Mus. Neuchâtel and Berne.
Syn.: *Cidarites monilifera* Goldf. — 37. — Petref. p. 118, Tab. 39, fig. 6. — Agass. Cat. syst. p. 6.
Coral. Sirchingen. Jurassic formation of the Valley of the Birse. — Mandelslohe.
Var. minor: *Cidarites propinqua* Münare. — R. 29. — in Goldf. Petref. p. 118. Tab. 4, fig. 1. — Agass. Echin. Suiss. II, p. 62, Tab. 21, fig. 3–10.
Coral. about Besançon, Bishopric of BääRanden, Sirchingen. Cale. of Friederichshall. — Dudressier, Mandelslohe, Waichuer. Mus. Bäle and Bonn.

hæulifera Agass. Echin. suiss. II, p. 80, Tab. 21a, fig. 12. — Test near to *C. Blumenbachii*, but the tubercles are less sunken. Spines pointed.
Séquanieu of Rædersdurf, Salns, Besançon, Porrcutruy. — Gressly, Marcou.

gigantea Agass. Echin. suiss. II, p. 66, Tab. 21a, fig. 22.
Coral, environs Besançon. — Dudressier.

copeoides Agass. 92, 93, 95. X 62. RA 93. R 94. — Cat. syst. p. 10, — Tubercles strongly crenelated. Spines very wide in the form of large oars that differ from the oars of *C. spatula* by the absence of strong spikes at the base. The species is very near *C. gigantea*.

Oxford, Latrency (Haute-Marne), Kellov, Châtillon-sur-Seine. — Deshayes Michelin.

maxima Münster. In Goldf. Petref. p. 116, Tab. 39, fig. 1.

Deposits of Upper Jurassic of Bayreuth. Coral. of Saint Mihiel. — D'Archiac. Münster.

Orbignyana Agass. — 10. P. 21, P 22. P 23. M 66. — Cat. syst. P. 19.

Var. *Cidaritis tripterygia* Agass. Cat. syst. p. 10. This species is extremely near *C. maxima*, and perhaps identical. However, the spines that Goldfuss assigned to his species are different.

Kimmer, La Rochelle, Villersville, Montfacon (Meuse), Lavoncour (Haute-Saône). — D'Orbigny, Marcou. Mus. Paris. (gal. geol.)

miranda Desor. T 61. — Recalls a little *C. coronata* its form and is very large tubercles obtusely crenelated. But the ambulacra are composed of only two rows of contiguous granules. The intermediary granular space between the large tubercles is wide and the granules very apparent.

Coral. of Angoulin. — D'Orbigny.

occulata Agass. Echi. Siss. II, p. 63, Tab. 21a, fig. 13–17.

Coral. lower of Sallins (Jura) environs of Metz. Coal. Of the valley of Birse, Randen near Schaffouse. Coral. of Spitzthut, Hannover. — Marcou, Gessly, Rømer. Mus. Bâle.

elegans Münster. In Goldf. Petref. p. 118, Tab. 30, fig. 3.

Var. *C. leviuscula* Agass. Echin. suiss II. p. 64, Tab. 21a, fig. 18–20.

Jurassic formation. Bayreuth. Coral. of Bishopric of Bâle and of Randen, near Schaffouse. — Münster. Mus. Bâle.

nobilis Münster. In Goldf. Petref. p. 117, Tab. 39, fig. 4. — Desml. Tabl.syn. p. 328. — Agass. Echin. suiss. II, p. 63, Tab. 21a, fig. 21.

From the Randen, canton of Schaffouse, probably of Coral. — Mus. Bâle.

grandævus Goldf. In Alberti Monogr. p. 96. — Tubercles strongly crenelated at the base of the mamelons. Spines cylindrical, slender and smooth.

Musselchalk of Wurtemberg. — Alberti.

subcoronata Münster. Beytr. 1841, p. 40, Tab. 3, fig. 1.

Saint Cassian. — Münster.

Blainvillei Desmar. — V 27. — Species with small, numerous tubercles, with wide granulose zone. Very near in aspect to *C. baculosa* but differing by its crenelated tubercles.

Jurassic formation. — Brongniart.

*Spines with crenelated articulating facets, whose test is unknown*¹¹.

Schmiedelii Münster. — P 40. Goldf. Petref. p. 120. Tab. 40, fig. 4. — Agass. Cat. syst. p. 10. —

Terr. Jurass. Duchingen. — Münster.

spatula Agass. P 41. — Cat. syst. p. 10. — Echin. suiss. II, p. 79, Tab. 21a, fig 24.

Coral, environs of Besançon, Châtillon-sur-Seine, Dijon, Upper Oxford. of Champagnol, Lower Oxford. of Percy le-Grand (High-Saône). — Dudesmier, Michelin, Defrance, Macou.

Var. *Cyphacantha* Agass. — S. 77.

Oxford. of Normandy. Arg. Of Honfleur.

Coral. of Sirchingen (Jura wurtemb.). — Mandelslohe, Destongechamps, Dlué.

¹¹ Some of the spines below will doubtless one day be related to their true species.

- heteropleura** Agass. — X 19. — Cat. syst. p. 10. — Spine cylindrical, spiky, very near to that Goldfuss attributed to *C. nobilis*, Tab. 39, fig. 4 *k*.
Terr. Jurass. ? of Switzerland.
- pustlifera** Agass. — X 15. X 17. — Cat. syst. p. 10. — Echin. suiss. II, p. 75, Tab. 21*a*, fig. 7.
Coral. of Besançon, Salins. — Salins. — Dudressier, Marcou.
- cucumifera** Agass. — X 13. — Cat. syst. p. 10. — Echin. suiss. II, p. 70, Tab. 21, fig. 27.
Coral. of Besançon, La Rochelle, Arnay-le-Duc (Côte-d'Or), Montmédy, Châtillon-sur-Seine. —
Dudressier, Michelin. Mus. Bâle.
- subspinosa** Marcou. Spine with the form of *C. cucumifera*, but covered with swellings in the form of barbs, forming very dense rows. The granules are not connected by nets.
Coral. lower Salins. — Marcou.
- cinamomea** Agass. — P 65. — Cat. syst. p. 10. Echin. suiss. II, p. 78, Tab. 21*a*, fig. 13.
Terr. Jurass. Around Besançon. — Dudressier.
- filograna** Agass. — 94, 96. X 9. — Cat. syst. p. 10. Echin. suiss. II, p. 77, Tab 21*a*, fig. 11.
Oxford. Of Switzerland, Nantua and Saint Maixent. Coral. of the Bishorpric of Bâle. — Mus Bâle.
- cladifera** Agass. — M 75. — Cat. syst. p. 10. — Echin. suiss. II, p. 75 Tab. 21*a*, fig. 8.
Coral of Besançon, Salins, Sonderuch (Able wurtembergeoise). — Dudressier, Marcon, Mandelslohe.
- megalacantha** Agass. — M 71. Cat. syst. p. 10. — Very large square or polygonal spine, covered with barbs in irregular rows.
Coral. of the island of Ré. — d'Orbigny.
- trigonacantha** Agass. — P 66. — Cat. syst. p. 10. — Echin. suiss. p. 74, Tab. 21*a*, fig. 6.
Terr. jurass. of Besançon. — Dudressier.
- meandrina** Agass. X 12. — Cat. syst. p. 10. — Echin. suiss. II, p. 70, Tab. 21, fig. 28.
- cristata** Agass. P 64. Cat. syst. p. 10. — Goldf. Tab. 39, fig. 4 *f*. — Spine cylindrical, keeled
Coral of Besançon. — Dudressier.
- tricarinata** Agass. P. 67. — Cat. syst. p. 10. — Cat/ syst. p. 10. — Goldf. Tab. 39, fig. 4 *e*. — Distinguished by the very sharp triangular form.
Coral. of Besançon. — Dudressier.
- Orobus** Agass. — M 46. — Cat. syst. p. 10. — Very swollen small spine with a smooth appearance, although finely striated with the magnifying glass.
Calc. with polyp. Ranville. — E. Deslongchamps.
- hastalis** Desor. — T 92. — Lage spine with fine wavy lines composed of small burbs.
Oxford of Latrerey (Haute Marne), Keilov, Perry-le-Grand (Haute Saône), Châtillon-sur-Seine (Côte d'Or).
— Deshayes, d'Orbigny, d'Archiac. Mus. Paris.
- aspersa** Agass. Echin. suiss. II, p. 69. Tab. 21, fig. 29–30.
Coral. of French and Swiss Jura, Fringeli, Wahien (canton of Soleure). — Gessly.
- spinosa** Agass. Echin. suiss. II. p. 73, p. 71, Tab. 21*a* fig. 1.
Coral. of Fringeli (canton of Soleure), Normandy, Roc of Trois-Monts and Amoyé, northern Germany. —
Gressly, E. Deslongchamps.

- horrida** Mer. Agass. Echin. suiss. II, p. 72, Tab. 21*a*, fig. 2.
Ool. ferr. of cantons of Bâle, Soleure and Argovie, Albe wurtembergeoise, Roche, near Salins. — Gressly, Marcou. Mus. Bâle.
- Hasina** Marcou. Slender spine, cylindrical, covered with very strong barbs, but uniform.
Middle Lias (marls with *Gryphea cymbium*) of Salins. — Marcou.
- Phillipsii** Agass. Species near *C. spinosa*, figured in Phillips Geol. of York. Tab. 2, fig. 3.
Clay of Speeton. — Phillipa.
- constrieta** Agass. Echin. suiss. II, p. 72, Ta.21*a*, fig. 3.
Cora. Environs of Besançon and of La Rochelle. — d'Orbigny.
- glandifera** Goldf. — V 23. — Petref. p. 120, Tab. 49, fig. 3. — Agass. Echin. suiss. II. p. 76, Tab.2*a*, fig. 9.
Coral. of Mount Terrible, at Randen, near Schaffouse, Germany Jura, enivons Bâle, Salins, county of Nice.
— Marcou. Mus. Neuchâtel, Bâle and Turin.
- carinifera** Agass. — S 74 — Very large spines, of the form of *C. glandifera*, with large pleats at the top.
Terr. Jurass.? de Salève. — Delue.
- acuminifera** Agass. Near *C. glandifera*, but the pleats are more spaced.
Oxford. from depart. of Meuse. — Mus. of Paris (gal. geol.).
- cervicalis** Agass. Echin. suiss. II, p. 77, Tab. 21*a*, fig. 10. — Probably only a variety of *C. Blumenbachii*, with a very tall collarete.
Coral. of the chains of the Jura (Sirchingen. — Gressly, Mandelslohe.
- alsatica** Aagass. Echin. suiss. II. p, 78, Tab 21*a*, fig. 14.
Séquan. from Ræderdorf. — Gressly.
- biformis** Münstr. Beytr. 1841. p. 43, Tab. 3, fig. 13.
Saint Cassian. — Münster.
- trigona** Münstr. Beytr. 1841. P. 41, Tab. 41, Tqb. 3, fig. 15.
Saint Cassian. — Münster.
- decorata** — Münstr. Beytr. 1841, p. 4 3, Tab. 3, fig. 22.
Saint Cassian. — Münster.
- flexnosa** Münstr, Beytr, 1841, p. 41, Tab. 3, fig. 18.
Saint Cassian. — Münster.
- Brannii** Desor. — *Cidaris catenifera* Münst. Beytr, 1841, p. 45, Tab, 3, fig. 23.
Var. *Cidais baculifera* Münst, Beytr. P. 46, Tab. 3, fig. 24.
Saint Cassian. — Münster.

Tertiary species of which we know only the spines.

- Aveniouiensis** Desml. — S 14. S 22. — Tabl. syn. p,336. — *Cidaris stemmacantha* Agass. Cag. Syst. p. 10. Echin. Suiss. II, p. 73, Tab. 21*a*, fig. 4.
Molasse of the Chaux-de-Fonods, the Angles, near Avignon (Vaucluse, environs of Rennes, Saint-Paul-Trois-Chateaux. — Nicolet, Mus. Bâle and Paris (gal. geol).

serraria Bronn Ital. Spine cylindrical, compressed, with strong denticulation on the sides. The surface of the spine is sometimes furrowed, sometimes smooth.

Terr. pisol. ? of Castel-Arquata. —Bronn.

Belone X 61, — Cat, syst. p. 10. Spine subilliform, smooth appearance but finely striated with the magnifying glass. No collarette.

Valmondois region. — Deshayes.

rosaria Bronn. Spine cylindrical, covered with sporadic, very strong denticulations, distributed on all the surface of the test. Collerette very long. Articulating facet crenelated.

Terr. pisol. of Castel-Arquato. — Bronn.

prionata Agass. Spine slender, covered with proportionally very strong crenelations, forming seven or eight longitudinal rows.

Terr. numm. of Biaritz. — D'Archiae, Deshayes.

liminaria Bronn. Spine cylindrical, covered with very small granules in longitudinal series.

Terre. pisol. of Castel-Arquato. — Bronn.

acicularis d'Arch. Spine near to those of *C. coronata*, but the collarette is very narrow.

Terr. numm. of Biaritz. — D'Archiae.

serrrata d'Arch. Spine flat as in *C. Schmiedelii*, with crenelations on the border.

Terr. numm. of Biaritz. — D'Archiae.

semiaspera d'Arch. Mém Soc. géol. Fr. Vol. II, p. 201, Tab. 7, fig. 18. — Spine short, of the type of *C. Blumenbachii*, but with more protruding barbs. Collerete very narrow.

Terr. numm. of Biaritz. — D'Archiae.

subularis d'Arch. Mém Soc. géol. Fr. Vol. II, p. 201, Tab. 7, fig. 17. — Spine pointed, with finely striated pearls.

Terr. numm. of Biaritz. — D'Archiae.

lucurvata E. Sism. App. Ech. foss. Piem. — *Cidarites vesiculoso* E. Sism. (non Goldf.) Ech. foss. Piem. P. 30, fig. 10. — Type of *C. Hystrix*.

Region of the hills of Turin. — Mus. Turin.

Münsteri E. Sism. App. Ech. foss. Piem. — *Cidarites marginata* E. Sism. (non Goldf.) Ech. Fos. Piem. P. 49, Tab. 3, fig. 8. — Type of *C. septifera*.

Tertiary of Turin. — Mus. Turin.

Desmoulinsii E. Sism. App. Ech. Foss. Piem. — *Cidarites Blumenbachii* E. Sism. (non Münst.) Ech. foss. Piem. P. 40, Tab. 3, fig. 11. — Ech. foss. Piem. P. 49, Tab. 3, fig. 11. Near *C. metularia*.

Tertiary of Asti. — Mus. Turin.

Zea-Mays Sism. App. Ech. Foss. Piem. — Appears to be the same as *C. Desmoulinsii*.

Tertiary of Turin. — Mus. Turin.

hirta E. Sism. App. Ech. foss. Piem. — *Cidarites nobilis* E. Sism. (non Münst.) Ech. foss. Piem. P. 48, Tab. 3, fig. 7. — Very beautiful species with rare spines, near to *C. serraria* Br.

Upper Tertiary of Astésan. Middle Tertiary of Turin. — Mus. Turin.

signata E. Sism. App. Ech. foss. Piem. — *Cidarites nobilis* E. Sism. (non Münst.) Ech. foss. Piem. P. 48, Tab. 3, fig. 6. Very beautiful species with little protruding barbs and united by a net.

Upper Tertiary of the hills of Turin. — Mus. Turin.

variola E. Sism. App. Ech. foss. Piem. — *Cidarites pustulifera* E. Sism. (non Agass.) Ech. foss, Piem. p 50, Tab. 3, fig. 9.
Tertiary of Turin. — Mus. Turin.

II. GONIOCIDARIS DESOR.

(Pl. 15, fig. 1.)

This genus has all the characters of the true *Cidaris*, but it differs by the presence of depressions or pointed hollows in the corners of the ambulacral and interambulacral plates. It is to *Cidaris* as *Temnopleurus* is to *Echinus*. We still know only two living species.

geranioides Desor. — *Cidaris geranioides* Lamk. — Encycl. méth. Zooph. Pl. 136, fig. 1. — Small sharp depressions at the junction of the plates. Spines rugose, pointed; those that surround the anus are cup-shaped.
Port Western, New Island and Australia. — Mus. Paris.

Quoyi Val. (Mus.) The corner depressions are larger than in *C. geranioides*. Spines with barbs.

III. HEMICIDARIS AGASS.

Circular form, dorsal surface generally flat, rarely subconical. Ambulacral pores arranged in single pairs. Ambulacra narrow with tubercles smaller than the interambulacrals, and sometimes with simple granules. Large interambulacral tubercles perforated and crenelated, with strong clavelated and smooth spines. Mouth large, with deep notches on its periphery. Differs from true *Cidaris* by the tubercles that are at the base of the ambulacral areas and by the notches of the mouth. All the species are fossil, from oolitic and neocomian deposits.

crenularis Agass. — 6b, M 14. M. 31. M 36. P 63. — Cat. syst. p. 8. — Echin. suiss. p. 44, Tab. 19, fig. 10–12, and Tab. 18, fig. 23 and 24. — *Cidaris crenularis* Lamk, III, p. 39. — Goldf. Petref. p. 122, Tab. 40, fig. 6 — *Diadema crenularis* Desml. Tabl. syn. p. 312.

Coral. from the Swiss and French Jura, Châtelcensoir, Canmere, England, etc. Coral. of La Rochelle. Forest marble of Spitzhut (Hannover), Ranville. — Gressly, Dudressier, Rœmer. Michelin, d'Orbigny, Deslongchamps. Mus. Neuchâtel and Lausanne.

mitra Agass. — M 13. M 15. X 97. Q 30. — Cat. syst. p. 8. — Echin. suiss. II, p. 48, Tab. 17, fig. 7–9/
Portl. of Saint Nicolas, near Soleure (Tortues calcaire) — Gressly.

Kœnigii Agass. — R 37. — *Diadema Kœnigii* Desml. Tabl. syn. p. 312. — Species very close to *H. mitra*, but a little taller and of larger size.
Kimmer. of Boulogne-sur-Mer. — Desmoulins, Michilin.

alpina Agass. — 100 — Cat. syst. p. 9. — Echin. suiss. II, p. 52, Tab. 18, fig. 19–22.
Upper calc. jurass. of Gesué and Ormonds (canton of Vaud), — Escher de la Linth, Mus. Berne.

stramioniom Agass. — M 4. X 21. X 98. — Cat. syst. p. 8. Echin. suiss. II. p. 47, Tab. 19, fig. 13 and 14. *Cidaris Hofmanni*. Rœm.
Séquan. of Rædersdorf (Soleure), of the valley of Birse, Pfeffingen. Portl. de Haheneggisen (Hanover). — Gressly, Rœmer. Mus. Zurich.

mammosa Agass. — M 61. — Cat. syst. p. 8. — Swollen barbs with very large tubercles. Ambulacra very flexuous.
Coral. of La Rochelle. — D'Orbigny.

- Thurmanni** Agass. — M 33. M 34. X 82. — Cat. syst. p. 8. — Echin. suiss. II, p. 50, Tab. 19, fig. 1–3. — *Diadema Requierii* ? Desmol Tabl. syn. p. 314.
 Kimmer. of Bannénear Portentruy environs of Salins, Jura soleurois. Calc. alp to the wet of Simmenthal. — Gressly, Marcou, Thurmann, Escher de la Linth, Michelin. Mus. Avignon.
 Spines: *Cidaris pyrifera* Agass. — N 6. P 30, — Cat. syst. p. 10. — Echin. suiss. II, p. 71. Tab. 21, fig. 24–2.
 Kimmer. of the canton of Soleure, from Bannénear Porentruy. — Gresly. Mus. Bâle,
- ovifera** Agass. — X 73. P 32. P 34. P 51. P 35. P 37. — Cat. syst. p. 10. Barbs ner the preceding, but the spine are a little larger.
 Coral. of La Rochelle (lower Charente), Pouilly en Auxois. — D'Orbgny.
- angularis** Agass. — M 43, M 52. M 53. — Cat. syst. p. 8. — Echin. suiss. II, p. 51, Tab. 19, fig. 4–6.
 Séquan. From Jura soleurois, valley of Lauffou. — Gressly.
- depressa** Agass. — N 35. R 14. — Cat. syst. p. 8. Species flat, subconical, with non-flexuous ambuolacra.
 Forest marble of Ranville. — Deshayes.
- pustulosa** Agass. — 99. M. 9. M. 51. — Cat. syst. p. 8. — Large species, subconical, dorsal surface very granulose.
 Lower oolitic of Langrune. — Deslongchamps.
- diademata** Aagas. — 83. M 5. — Cat. syst. p. 8. Echin. suiss. II, p. 40, Tab. 19, fig. 13–17.
 Séquan, of the valley of the Bire, soleurois Jura, Besançon, Salins. — Gressly, Dudressier, Marcouo. Mus. Lausanne.
- Lamarckii** Agass. — R 46. S 83. — *Diadema Lamarckii* Desml. Tabl. syn. 316. — *Diadema Meriani* Agass. Echin. suiss. II, p. 19, 0Tab. 17, fig. 41–48. — Tubercles proportionally small. Ambulacra swollen on the ventral surface. with distinct tubercles to the top.
 Oxford ? of Boulonnais. Swiss Jura. — Michelin. Mus. Avignon and Bâle.
- laevis** Desor. Species very close to *D. Lamarckii*, but the ambulacra ae less apparent and less swollen on the ventral surface.
 Chalk of Gabillon (Oise). — Graves.
- Lybien** Desor. Species very near *D. Lamarckii*. But the interambulacral tubercles are however smaller on the dorsal surface.
 Var. *inflata*.
 Chalk of Martigues. — Michelin. Mus. Avignon.
- radians** Agass. — T 66. — Species near *D. Lamarckii*. The tubercles are however more protruding. The ambulacra are narrower and have larger tubercles. The mouth is sensibly larger.
 Kellov. Chauffour and Courgaius. — Roualt, Michelin.
- minor** Agass. — M 77. — Cat. sys. P. 9. — It is distinguished from all Hemicidarid by it very spaced tubercles, of which there are two or three in each row.
 Terr. Juras. of France. — Michelin.
- Patella** Agass. — S 28. — Cat. syst. p. 9. — Cat. syst. p. 9. — Echin. suiss. II. p. 53, Tab. 18, fig. 15–18.
 Néoc. environs Chaux-de-Fonds (canon of Neuchâtel), Néoc. inf. of Fauteuil near Grenoble. — Renand-Comte. Mus. Chaut-de-Fonds.
- undulata** Agass. — X. 1. — Cat. syst. p. 9. — Cat. syst. p. 9. Echin. suiss. II, p. 52, Tab. 18, fig. 25 and 26. — The spines alone are known.
 Coral. of Fringeli, Jura soleurois. — Gressly. Mus. Soleure.

granulata Mérian, — R 47. — Small species, very distinct from all the others. The ambulacral tubercles are so small that they hardly differ from the miliary tubercles. The tubercles of the interambulacral areas are very spaced.
Terr. Juras. — Mus. Bâle.

graciosa Desor. The ambulacral tubercles are excessively small and do not increase on the ventral surface.
Oxford. of Boulonnais. — Marcou.

buccalis Agass. — T 65. — Mouth very large. Pores split into three pairs on the ventral surface. Tubercles in two single rows, with four small accessory rows at the base. Pores complexly single on the dorsal surface.
Infra-Lias of Berrias (Ardèche). — Mus. Avignon.

Admeto Desor. — *Cidaris Admeto* Bronn in Münstr. Beytr. 1841. Tab. 3, fig. 3.
Saint Cassian. — Münster.

regularis Desor. — *Cidaris regularis* Münstr. Beytr. 1841, p. 41. Tab. 3, fig. 6.
Saint Cassian. — Münster.

linearis Desor. — *Cidaris linearis* Münstr. Beytr. 1841. P. 45. Tab. 3, fig. 19.
Saint Cassian. — Münster.

IV. ACROCIDARIS AGASS.

Form subconical. Test thick. Ambulacral areas nearly as wide as the interambulacral, and in all their length with large perforated and crenelated perforations. Single pores. One large perforated tubercle on each of the paired genital plates. Mouth very large, slightly notched. Cylindrical spines, plain. Differs from Hemicidaris by its wide ambulacral areas, from diademids by its thick test and large mouth, and from both by its genital plates. All the species are fossils, from oolitic deposits..

nobilis Agass. — X 2. X 3. — Cat. syst. p. 9. Echin. syst. II. p. 32. Tab. 14, fig. 16 and 17.
Coral. of Angoulin near Rocohelle, from Hoggewald (canton of Soleure). — D'Orbigny, Gressly.

formosa Agass. — Q 90. — Cat. syst. p. 9. — Echin. suiss. II. p. 29, Tab. 14, fig. 10–12.
Sèquan. Of Saint Sulpice (canton of Neuchâtel), valley Saint Pons near Nice. — Lesquereux.
Var. *minor* — Q 85. — *Acrocidaris minor* Agass. Cat. syst. p. 9. — Cat. syst. p. 9. — Ech. Suiss. II p. 30, Tab. 11, fig. 7–9.
Upper Jura environs Chaux de-Fonds. — Renaud Comte.
Sèquan. of Jura neuchâtelois. Salins. — Marcou. Mus. Neuchâtel.

sirlata Agass. — X 4. — Cat. syst. p. 9. — Subconical species, less swollen than the preceding, but the rest is very close.
Lower oolitic of Langrune (Normandy).

tuberosa Agass. — Q 91. — Cat. syst. p. 9. — Echin. suiss. II, p. 31. Tab. 14, fig. 13–15.
Upper Terr. Jurss. of the canton of Neuchâtel; — Mus. Neuchâtel.

V. ACROPELTIS AGASS.

(Pl. 15, fig. 7–8)

This genus has all the exterior characters of *Acrocidaris*, up to and including the structure of the genital pates. It differs by only one character. It is that the tubercles, instead of being perforated and crenelated, have a smooth, non-perforated neck. We still know only one species that is fossil.

æquituberculata Agass. — Q 99 — Cat. syst. p. 12. — The tubercles of the ambulacral area are nearly as large as those of the interambulacral areas.

Coral. of Angoulin near La Rochelle. — D'Orbigny.

VI. PALEOCIDARIS DESOR

This genus, which we still know only by its isolated plates and spines, differs from the true *Cidaris* in that the mamelons of the tubercles have at their base a second swollen ring. There are no crenelations at the base of the mamelon. Striated or barbed spines. The known species belong to deposits in transition.

Nerei Desor. — *Cidaris Nerei* Münster. Beytr. 1841. P. 40, Tab. 3, fig. 6. — Konk. Au. foss. p. 34, Tab. E fig. 1.
Anthraxifere clay of Tournay, Regnitzlosau. — Koninck.

Protei Desor. — *Cidaris Protei* Münster. Beytr. 1841, p. 10.
Anthraxifere clay of Tournay. — Münster, Koninck.

prisea Desor. — *Cidais prisea* Münster. Beytr. 1841, p. 41. — Very large tubercles. Spines with six keels.
Anthraxiferous clay of Tournay. — Münster.

GROUP OF SALENIANS

This group is comprised of urchins in general small, having the appearance of cidarids strictly speaking, but that are distinguished by a shield of a particular structure placed at the top of the disc and composed of genital plates, ocular plates and sometimes a unpaired plate that I call the suranal plate. Ambulacra narrow. Tubercles very large, sometimes perforated, sometimes unperforated, Ambulacral pores arranged by single pairs.

VII. SALENIA GRAY

Urchin of small size, ordinarily swollen. Test thick. Apical system large, circular, wavy periphery, composed of five genital plates, five ocular plates and a suranal plate placed at the border of the anal opening in a way to make the anus eccentrically anterior. Interambulacral areas very wide with a small number of large crenelated tubercles, but unperforated. Ambulacral areas very narrow, with numerous very dense tubercles. Mouth round, with notched periphery. Single pores. All species are fossils of the Cretaceous formation.

- personata** Agass. — P 70. X 48. — Monogr. des Salénies. p. 7, Tab. 1, fig. 2–8. — Cat. syst. p. 11. — *Cidaris pesonata* Defr.
 Var. *petalifera* Agass. — P 71. P 73. — Monogr. des Salé. p. 9, Tab. 1, fig. 17–24. — Cat. syst. p. 11. — *Echinus petaliferus* Desml. Etud. Echin. p. 304. — Defr. Dict. Sc. nat. Vol. xxxvii, p. 101.
 Cr. chl. of Le Mans, Minorca, Cape Hève, Longleat, Taiment. — Gal. geol. of the Mus. Paris, Deshayes, Brunguiart, Defrance.
- scutigera** Gray. — 36. — Agass. Monogr. des Salén, p. 12, Tab. 2, fig. 1–8. — Cat. syst. p. 11. — Echin. suiss p. 89, Tab. 23, fig. 1–3. — *Cidaris scutiger*. Münt. In Gold. Petref. Tab. 40, fig. 4a and b.
 Gault of England, of Kehlheim. — Brongniart, Deshayes, Defrance, Münster.
- gibba** Agass. — Q 79. — Monogr. des Salén. P. 43. Tab. 2. Fig. 9–16. — Cat. syst. p. 11.
 Cr. chlor. of the island of Aix (mouth of the Char.). — Michelin, d'Orbigny.
- geometrica** Agass. — P 68. P 72. — Monogr. des Salén. p. 11, Tab. 1, fig. 23–32. — Cat. syst. p. 11.
 Lower chalk of Saints (Char. Inf.). — D'Orbigny Deshayes.
- areolata** Desor. — *Cidarites areolatus* Wahib, Act. Soc. Ups. VIII. Tab. 3, fig. 4 and 5. — Hising. Leth. Suec. Tab. 26, fig. 1. — species with a wide disc.
 Cr. bl. of Balsberg (Scanie). — Hisinger.
- trigonata** Agass. — X 35. X 38. Monogr. des Salén. p. 14. Tab/ 2. Fig. 17–21. Cat. syst. p. 11.
 Chalk environs Tours. — Michelin.
- scripta** Agass. — P 74. — Monogr. des Salén. p. 8. Tab. 1. Fig. 9–16. — Cat. syst. p. 11.
 Chalk. — Mus. Paris.
- folium-querei** Desor. Species very near *S. scutigera*, but the secondary tubercles that surround the large tubercles are less numerous and more protruding. The genital plates resemble oak leaves because of the imprints of their sutures.
 Néoc. of Billecul (Jura). — Marcou.
- rugosa** d'Arch. — T 91. — Differs from *S. personata* by its larger tubercles.
 Porous chalk of Tourtia. — Soc. géol. De Fr., Deshayes.
- minima** Desor. — Very small species with a large plain disc. Smooth sutures.
 Chalk of Ciply. — Michelin.
- Studeri** Agass. — X 5. — Cat. syst. p. 11. — Swollen species. Three or four tubercles in a row.
 Gault of Perte-du-Rhone. — Mus. Berne.
- heliophora** Desor. — V 18. — Distinguished by the particular ornaments of its disc that are arranged like rays around several centers.
 Chalk of Maéstricht, Ciply. — Deshayes.

VIII. PELTASTES AGASS.

Apical disc circular with a wavy border, composed, like those of the salenids, of eleven plates, five of which are genitals, five oculars and a suranal, but the latter, instead of being placed behind, as in the salenids, is before. This makes the anus eccentric behind. The other details of the test are the same as in the salenids. Fossils are found in the areas of Cretaceous deposits.

acanthoides Agass. — X 57. — *Peltastes pulchellus* Agass. Monogr. des Salén. P. 27. Tab. .5, fig. 1–8. — Cat. syst. p. 11. — *Echinus acanthodes* Desml. Tabl. ayn. 302.

Chalk of Grasse (Var). Cr. chlor. of Maus. — Studer, Deshayes. Galeries geol. of the Museum.

marginalis Agass. — X 17b. — Monogr. des Salén. P. 29, Tab. 5, fig. 9–16. — Cat/ syst. p. 11.

Chalk of Caussols (Var). Cr. chlor. of Fouras. — Michelin.

stellulata Agass. — X 47. Q 64. — *Salenia stellulata* Agass. Monogr. des Salén. P. 15, Tab. 2, fig. 25–32. — Cat. syst. p. .4. — Echin. suiss. II, p. 90. Tab. 23, fig. 6–10.

Néoc. environs Chaux-de-Fonds, Gault of Wiltshire. — C. Nicolet, Defrance

punctata Desor. — Q 65. — *Salenia aereolata* Agass. (non *Cidarites areolatus* (Wahlenb.) Monographie des Salén. p. 16. Tab. 3, fig. 1–8. — Cat. syst. p. 11. — Echin. suiss. II. p. 90. Tab. 23, fig. 11–13.

Néoc. of Roc (Colon). Maru. Néoc. of Haute-Rive near Neuchâtel (Suisse), Censeau (Jua). — Mus. Neuchâtel. Dubois de Monatpéreux, Marcou.

IX. GONIOPHORUS AGASS.

Swollen form, flat on the dorsal and ventral surfaces. Apical disk pentagonal, composed as in the salenids, of five genital plates, five ocular plates and a suranal plate, but decorated, in addition, with angular sides that extend onto a considerable part of the disc. Interambulacral tubercles very large and not numerous, crenelated and unperforated. Ambulacral tubercles small and very dense. Differs from the salenids only by the angular sides of its disc. Contains only fossil species of the Cretaceous deposits.

lunulatus Agass. Monogr. des Salén. p. 30, Tab 5, fig. 17–24.

apiculatus Agassiz. — X 37. — Monogr des Salén. p. 32, Tab. 5, fig. 25–32. — Cat. syst. p. 11. — It is probably only a variety of the preceding.

Cr. chlor. environs du Hare. — Mus. Paris.

X. ACROSALENIA AGASS.

Apical disc smaller than in the salenids, but composed of the same elements, i.e., five genital plates, five ocular plates and a suranal plate that is sometimes double. Differs from salenids in that the tubercles are crenelated and perforated. All the species are fossil, from oolitic deposits.

FIRST TYPE. — *Ambulacral areas very narrow and flexuous, composed of small, very dense tubercles.*

tuberculosa Agass. — X 45. X 56. — Cat. syst. p. 9. — Large tubercles and not numerous, three or four in a row. Ambulacral areas composed of two flexuous rows of small, very dense granules.

Coral of Saint Mihiel. — D'Orbigny, Deshayes.

aspera Agass. — M. 78. — Cat. syst. p. 9, Tab. 18, fig. 6–10.

Portlandian marl of Courtedoux, near Purreutruy (Bernois Jura). — Gressly, Thurmann.

SECOND TYPE. Ambulacral areas very wide, with less dense tubercles, not contiguous.

spinosa Agass. — M 84. M 87. — cat. syst. p. 9. — Echin. suiss. II, p. 39, Tab. 18, fig. 1–5. — Interambulacral tubercles very apparent, decreasing very rapidly in size on the dorsal surface.

Forest marble of Ranville. Oxford. of Vravelette near Metz.— Michelin.

Var. major: R 30. —

Var. *lævis*. — P 12. — *Acrosalenia lævis* Agass. Cat. syst. p. 9.

Kellov. of Marolles near Mamers. — Deslonchamps.

complanata Agass. — M 73. — Species flatter than *A. spinosa*. The large tubercles extend to the top.

Marn. vésul. of Poligny (Jura). — Deshayes, Marcou.

XI. GONIOPYGUS AGASS.

Circular form, sub-conical. Apical disc very solid, with an angular periphery composed of ten plates, of which five are genital and five, ocular. No suranal plate. Mouth very large. Tubercles unperforated, without crenulations at the base. Clavelate spines. Pores arranged as single pairs for all their length. All the species are fossil of the Cretaceous deposits.

peltatus Agass. — Q 50. Q 66. — Monogr. des Saléns. P. 20. Tab. 3. Fig 9–18. — Cat. syst. p. 11. — Echin. suiss. II. p. 92, Tab 23, fig. 17–22. — *Salenia peltate* Agass. Foss. crét. In Mém. Soc. Neuch. I, p. 140. Tab. 14, fig. 13–15. — *Echinus peltatus* Desml. Tab. Syn. p. 304.

Néoc. Neuchâtel Jura. — Mus. Neuchâtel.

Var. minor: Q 38. — *Goniopygus intricatus* Agass. Monogr. des Saléns. P. 21, Tab. 3, fig. 19–28. — Cat. syst. p. 11. — Echin. suiss. II, p. 93, Tab. Fig. 23–31. This is the young age of *G. peltatus*.

Néoc. Of the canton of Neuchâtel. — Dubois of Montpéreux.

I am certain only that the more or less strong impressions that exist in the sutures of the plates and that I have taken for specific characters, vary or disappear with age.

Menardi Agass. — X 31. Q 62. — Monogr. des Saléns. p. 22, Tab. 23. Fig. 29–36. — Cat. syst. p. 11. — *Echinus menardi* Desmar. In Defr. Dict. Sci. Sc. nat. Tom. XXXVII, p. 101.

Cr. chlor. of the island of Ax, at the mouth of the Charente. — D'Orbigny, DeFrance, Brongniart.

Var. major: — Q 63. — *Goniopygus globosus* Agass. Monogr. des Salén. p. 24, Tab. 4, fig. 9–16. — Cat. syst. p. 11.

Cr. chlor. of Le Mans. Michelin.

Bronnii Agass. — S 29. — Cat. syst. p. 11. — Species near to *G. Menardi*, but more depressed.

Cr. marn. of Essen on the Ruhr.

heteropygus Agass.— X 49. — Monogr. des Salén. p. 23, Tab. 4, fig. 1–8. Cat. syst.. p. 11.

Cr. environs Tours. Deshayes.

major Agass. — X 29. — Monogr. des Salén. p. 23, Tab. 4, fig. 17–22. — Cat. syst. p. 11¹².

GROUP OF ECHINIDS

Test thin. Tubercles numerous, sometimes perforated, sometimes unperforated. Spines thin and pointed. Pores arranged sometimes in single pairs, sometimes in multiple pairs, oblique or in arcs. Teeth tri-keeled with a protruding keel at the internal surface. Jaws less massive than in the cidarids. The branches of the pyramids are connected by an arc at the top.

XII. ASTROPYGA GRAY.

¹² Chalk inf. of the port of Barques, near the Charente. — D'Orbigny.

Circular or sub-pentagonal form, flat on the ventral surface. Test thin. Ambulacra swollen, narrow, having very long, fine bristles instead of spines. At least four rows of large perforated and crenelated tubercles in the interambulacral area. Spines slender and ringed. Ambulacral pores arranged in single pairs. Mouth large without notches. Auricles composed of two pillars not united. Lantern very developed. The pyramids are strongly indented between their branches. The teeth have a keel on the internal surface. All the species are living. It differs from *Echinocidaris* by its flat form and by the crenelated and perforated tubercles.

radiata Gray. — *Cidaris radiata* Leske p. 1116, Tab. 44, fig. 1. — Lamk. Encycl. méth. Zooph. Pl. 140, fig. 6 and 8.
— Large flat species, with swollen ambulacra. Smooth, zigzag zones to the top of interambulacral areas.
Origin unknown. — Mus. Paris.

pulvinata Agass. — *Cidaris pulvinata* Lamk. — Species near *A. radiata*, but the ambulacra are less swollen, and the interambulacral areas very much narrower.
Origin unknown. — Mus. Paris, École des Mines.

calamaria Agass. — *Cidaris calamaria* Lamk. — *Diadema calamarium* Gray. — Species smaller and less flat than the two preceding. Spines ringed in brown and white.
Amboine (Hombron and Jacquinot). Mus. Paris.

Desorii Agass. — Very large, swollen species, with very projecting ambulacra. Covered with numerous granules with regular arrangement. Poriferous zones very wide. Spines pointed.
Red Sea (Botta). — Mus. Paris.

spinosissima Agass. — *Diadema spiinosissimum* Mich. — Species near the preceding. The ambulacra are slightly swollen. The tubercles are very dense. The poriferous zones are less wide and the tubercles denser than in *A. Desorii*.
Mauritius, Zanzibar (Rousseau). — Michelin. Mus. Paris.

subularis Agass. — *Diadema subulare* Agass. Prodr. — *Diadema Desjardinsii* Mich. In Guér. Mag. Zool. Vol. II, Pl. 7. — Species remarkable for its very large tubercles that go up to the top of the interambulacral areas.
Mauritius (Desjardins), Seychelles and Zanzibar (Rousseau). — Michelin. Mus. Paris.

XIII. DIADEMA GRAY.

Circular form. Test thin. Large tubercles, crenelated and perforated in the ambulacral areas, as in the interambulacral areas. Spines cylindrical, ringed and very long. Mouth large, without notches. Auricles disjointed. Lantern like that in *Astropyga*. Interambulacral tubercles form sometimes two, sometimes four rows. Differs from *Astropyga* by the large tubercles of the ambulacral areas. Found in all the deposits from the Lias to the present epoch.

FIRST TYPE. — *Two rows of interambulacral tubercles without secondary rows.*

europæum Agass. The ambulacral tubercles are as large as the interambulacral tubercles. They are very spaced. Spines very slender, patches of violet and white, with a border fringe at the collarette.
Palermo. — Michelin. Mus. Paris.

Fossil species.

rotulare Agass. Foss. crét. in Mém. Soc. Neuch. I, p. 139. Tab. 14, fig. 10–12. Echin. suiss. II, p. 4, Tab. 16, Fig. 1–5.

Néoc. of Neuchâtel, Salève, Censeau, Nozeroy (Jura), Mouthe (Doubs). — Mus. Neuchâtel. A. Favre, Marcou.

Bourgneti Agass. — Q 84. — Echin. suiss. II, p. 6, Tab. 17, fig. 6–10. — *Diadema ornatum* Agass. Foss. crét. etc. p. 130 (non *Cidaris ornatus* Goldf.). — Cat. syst. p. 8. — Bourguet, Traité Pétrif. Pl. LII, n 340 and 345.
Marn. néoc, of Neuchâtel, Moreau, Ceseu, Tchieffrain (Aube). — Mus. Neuchâtel. Marcou, Michelin.

Lucaë — X 27. M 88. — Echin. suiss. II, p. 8, Tab. 16, fig. 11–15. — Cat. syst. p. 8.
Gault of Perte-du-Rhone. Molasse of Chaux-de-Fonds (renamed of the Gault), Balerm (Orne). — Michelin, Nicolet.

Rhodani Agass. — S 73. S 90. — Echin. suiss. II, p. 9, Tab. 16, fig. 16–18.
Gault of Pere-du-Rhone. — Mus. Genève. Mayor of Genève.

dilatatum Agass. — 97. 98. — Echin. suiss. II, p. 9, Tab. 16, fig. 19–2.
Urachhorn (Oberland Bernois). Castel Gombiarto. — Mus. Berne. Beaumont.

æquale Agass. — S 80. — Echin. suiss. II, p. 18, Tab. 17, fig. 36–38.
Ool. inf. environs of Aurau ? Kellov environs Quingey. — Mus. Bâle. Zschokke, Marcou.

priscum Agass. — P 6 — Echin. suiss. II, p. 21, Tab. 17, fig. 11–15. — Cat. syst. p. 8.
Coral. of Fringeli (canton of Soleure), Nantua and environs of Salins. — Mus. Neuchâtel. Bernard, Marcou.

Placenta Agass. — Echin. suiss. II. p. 22, Tab. 17, fig. 16–20.
Coral. of Fringeli (Soleure), Lagern (Argovie). — Gressly.

mamillatum Agass. — M 70. — *Cidaris mamillata* Rœm. — *Diadema spinosum* Agass. Cat. syst. p. 8. —
Distinguished by its very protruding tubercles.
Coral. of Rocohelle and Hildenheim.. Kimmer, of Verdun. — Deshayes, Rœmer.

superbum Agass. — M 92. — Echin. suiss. II, p. 23, Tab. 17, fig. 6–10.
Oxford. of Switzerland, Vaches-Noires (Normandy), Mont Vohayes (range of Mount Terrible). — Mus. Paris (Gal. geol.). Gressly, Michelin, Deshayes.

macrostoma Agass. Echin. suiss. II, p. 10, Tab. 16, fig. 22–26.
Néoc. of Chaux-dde-Fonds, Censeau (Jura). — C. Nicolet, Marcou.

floreseens Agass. — 52. M 98. — Echin. suiss. II, p. 17, Tab. 17, fig. 26–30. — Cat. syst. p. 8.
Coral. of Besançon, Normandy. — Dudressier, Deshayes.

ornatum Agass. — M 80. — *Diadema indifferens* Agass. — Cat. syst., p. 8. — *Cidarites ornatus* Goldf. Petref. p. 123, Tab. 40, fig. 10.
Cr. marn. of Essen, on the Ruhr, Villers-sur-Mer, Longleat. — Mus. Bonn. Michelin, D'Archia.

Micheleni Agass. — P 37. Cat. syst. p. 8. — Swollen species. Tubercles equal but denser than in *D. ornatum*.
Cr. chlor. of Villers-sur-Mer. — Michelin.

affine Agass, Echin. suiss. II p. 14, Tab. 17, fig. 54–58.
Terr. jurass. (Doubs). — Renaud-Comte.

pusillum Agass. — *Echinus pusillus* Münster. in Goldf. Petref. p. 125, Tab. 40, fig. 14.
Tertiary marl sand of Asgrupp, near Osnabrück. — Mus. Bonn.

complanatum Agass. — M 91. — Echin. suiss. II, p. 16, Tab. 17, fig. 31–33.
Kellov. of Ranville, Marolles, Balernie (Orne), Coral. of Urach, Oxford. of Alençon, — Micheleni, Mandelslohe, Deshayes.

conformis Agass. — *Acrosalennia conformis* Agass. Echin. suiss. II, p. 40, Tab. 18, fig. 11–14.
Portl. environs Porrentruy, — Gressly.

tenue Agass. — X 51. — Cat. syst. p. 8. — Circular form. Test thin. Very few miliary tubercles between the principal tubercles.
Cr. chlor. of Villes-sur-Mer. — Deshayes.

inaequale Agass. — X 44. — Cat. syst. p. 8. — Form angular. Tubercles small, uniform and numerous. Intermediary spaces between the tubercles smooth. Differs from *D. superbum* by its denser tubercles.
Kelloy. of Marolles-les Baux (Sarihe), Lifol (Vosges). — Michelin, d'Orbigny, d'Archier.

textum Agass. — M 86. — Cat. syst. p. 8. — Cat. syst. p. 8. — Form sub-cylindrical. Tubercles little protruding. A very small number of miliary tubercles. Near, in addition, to *D. inaequales*.
Oxford. of Normandy. — Deslongchamps.

distinctum Agass. — X 13, — Cat. syst. p. 8. — The tubercles are surround by very fine and very dense granulations. The sutures of the plate are very distinct.
Terr. crét ? France. — Deshayes.

humile Agass. — M 89. — Cat. syst. p. 8. — Species very compressed, with large tubercles.
Chalk of Normandy. — Mus. Neuchâtel.

seriale Agass. — Q 53. — Cat. syst. p. 8. — Leym. Mém. Soc. géol de France. Tom. III, p. 378, Pl. 24, fig. 1.
Infra-lias. Châtillon-sur-Chessy (Rhône). — Micheleni.

globulus Agass. — Q 54. — Cat. syst. p. 8. — Leym. Mém. Soc. géol de France, Tom. III, Pl. 24, fig. 3.
Infra-lias of Mount d'Or near Lyon (Rhône). — Michelin.

minimum Agass. — Q 59. — Cat. syst. p. 8. — Leym. Mém. Soc. géol de France. Tom. III, Pl. 24, fig. 4.
Lias of France.

microporum Agass. — M 76. — Cat. syst. p. 8. — Leym. Mém. Soc. géol. De France. Tom. III, Pl. 24, fig. 2.
Lias de Pouilly in Auxois, Stenay (Meuse).

Bruntrutana Desor. Species with small tubercles, uniform and not dense. Some secondary tubercles between the principal rows of the interambulacral areas.
Kimmer. of Banne (Porrentruy). — Marcou.

annulare Agass. Small flat species with very large mouth.
Cr. chlor. of Le Mans. — Mus. Paris. (gal. geol.), Michelin.

arenatum d'Arch. Two rows of very small interambulacral tubercles on the dorsal surface. Base of the tubercles strongly pleated. Confluent miliary tubercles.
Terr. numm. of Biaritz. — D'Archiaei.

subangulare Agass. — M 91. S 81. — Echin. suiss. II, p. 19, Tab. 17, fig. 21–23. Cat. syst. p. 8. — Rœm. Ool. p. 26.
Var. *Diadema sulcatum* Agas. — X 16. — Cat. syst. p. 8.
Coral. of the valley of Burse (Switzerland), Blochmann, Weissenstein, Muggendorf, Salins, Normandy, Sirchengen, Able wurtenbergeoise, Sulce-aux-Bois, Forest-marble of Normandy. — Mus. Bâle. Gressly, Dubois, Marcou, Deslongchamps, Mandelslohe.

Archiaei Desor. — T 62. — Species near *D. subangulare*, but circular. The tubers are also sensibly smaller.
Cr. chlor. of Beaumont near Angoulême. — Michelin, d'Archiaei.

Sinaicum Desor. Species near *D. Archiaei*, but flatter. The tubercles are also smaller. No trace of secondary rows.

Terr. Crét. of Sinai. — Mus. Paris.

depressum Agass. — Q 56. — Cat. syst. p. 8. — Ambulacral and interambulacral tubercles of equal size. Dorsal surface flat. No secondary tubercles.

Ool. inf. of Sainte Honorine. Banville. — D'Orbigny.

Beherti Desor. The tubercles are very elongated and consequently not numerous. Those of the interambulacra are sensibly smaller than those of the ambulacral areas.

Tertiary of Orglande, Valognes. — DeFrance, Michelin.

SECOND TYPE. — *Intermediary tubercles arranged in multiple series, of which two principal rows flank the secondary rows.*

Turcarum Rumph. Tab. 14, fig. 8. — *Cidaris diadema* Lamk. — swollen species with protruding interambulacral tubercles. Spines ringed in brown and yellow.

Antilles (M. Plée). Ile de France. — Ecole des Mines, Mus. Paris.

Savignyii Mich. In Guér. Mag. Zool. — Descript. Egypt. Zool. Pl. 6. — Differs from *D. Turcarum* in that the interambulacral areas are sunken at the top. The tubercles are less projecting and the spines, very long and black, are nearly a foot in length.

Red Sea (Botta), Seychelles (Rousseau), Zanzibar (Rousseau), Bombay (Roux), Madagascar (Vilmorin). — Mus. Paris.

Lamarckii Rouss. Small species near *D. Savignyii*, with very long, greenish spines. It could be only the young age of *D. Savignyii*. — Mus. Paris.

Fossil species

pseudodiadema Agass. — M 69, S 31, — Echin. suiss. II, p. 11, Tab. 17, fig. 49, 50 and 52. — *Cidarites pseudodiadema* Lamk. Anim. s. vert. III, p. 59. — E. Desl. Encycl. II, p. 197. — ? *Echinus geminans* Phill. Geol. Yorks. Tab. 3, fig. 13. — *Diadema ambiguum* Desml. Tab. Syn. p. 316.

hemisphericum Agass. — X 25. — Cat. syst. p. 8. — Echin. suiss. II, Tab. 17, fig. 51 and 53. — *Diadema transversum* Agass. Desml. Tabl. syn. p. 316. — Differs from *D. pseudodiadema* by the secondary rows of tubercles that are less developed in the interambulacral areas.

Séquan. of Bædersdorf (Haut Rhine), environs Salins, Jura Neuchâtelois of Vieux Saint Remy (Ardennes). — Mus. Neuchâtel. Marcou, Deshayes.

Ruppelli Desor. — T 13. — Species near *D. pseudodiadema*, but the tubercles are smaller and more equal.

Terr. crét. of Egypt. — Mus. Paris.

Nysti Desor. — R 48. — Like the type of *D. pseudodiadema* but the tubercles are of equal size in the secondary rows, like in the principal rows.

Chalk of Belgium. — Keniurk.

tetragramma Agass. — P 20. — Echin. suiss. II, p. 15, Tab. 17, fig. 39–43. — Cat. syst. p. 8.

Terr. jurass. of Besançon. — Dudressier.

Kleinii Desor. — X 31, R 25, R 33, — Tabl. syn. p. 314. — *Cidarites Kleinii* Desmar. — *Diadema polystigma* Agass. Cat. syst. p. 8. — *Cidaris miliaris* d'Arch. Mém. Soc. géol. Fr. II.

Cr. sup. at Hippurites of Royau (Gironde), Périgord, Soulaye (Aude), Chalk of Cognac, of Goudon (Lot). — Desmoulins, Michelin.

granulare Agass. Species near *D. Kleinii*, having the same laganoid form, but only two rows of principal tubercles without accessory rows.

Cr. chor. of Le Mans. — Mus. Paris. (gal. geol.). Michelin.

THIRD TYPE. — Sub-genus TETRAGRAMMA. — *At least four rows of principal tubercles in the interambulacral areas. The pores double frequently on the dorsal surface.*

planissimum Agass. — M 62. — Cat. syst. p. 9. — Echin. suiss. II, p. 26, Tab. 14, fig. 1–3.

Portl. (calc. at Tortues) of Sulenre. — Gressly.

variolare Agass. — X 35. M 68. — Cat. syst. p. 9. — *Cidarites variolaris* Brongn. *Diadema variolare* Agass. Prodr. — The interambulacral tubercles extend to the anus. The pores double near the top.

Gault of Grandpré (Ardennes). Chalk of the Alps. Fahlen. Chalk inf. of Saintes (Charente). Mus. Paris, Zurich, Neuchâtel.

Brongniarti Agass. — X 33. — Cat. syst. p. 9. — Echin. suiss. II, p. 25, Tab. 14, fig. 4–6. ? *Cidarites variolaris* Al. Brongn. in Cuv. Oss. Foss. Pl. M, fig. 9.

Gault of Perte-du-Rhone, Clar, Eseragnolles. — Mus. Neuchâtel. D'Orbigny.

subnudum — R 27. — The interambulacral tubercles disappear in part near the top. Doubled pores.

Cr. chl. of Havre, Saintes (Lower Charente). — Mus. Paris (gal. geol.).

Mathosii Agass. — T 63. — Four rows of tubercles on the ventral surface, but whose internals alone go to the top. The externals reach a little above the middle.

Chalk at Hippurites of the Corbieres, of Soulaye, South America (Roulin). — Mus. Avignon, Michelin, Deshayes.

Roissyi Desor. — T 21. — Large, flat species, with six rows of tubercles in the interambulacral areas.

Cr. chlor. of Gacé, — Mus. Paris. D'Archiac.

Pieteti Desor. Flat species. At least four rows of tubercles. The internal rows alone go to the top. The tubercles are perforated, but hardly crenelated.

Néoc. of Censeau. — Marcou.

XIV. HEMIDIADEMA AGASS.

This genus differs from the diademids by a single character. It is that the ambulacral areas are composed of only a single row of tubercles.

rugosum Agass. Very small species. The ambulacral tubercles are as large and even larger than the interambulacral tubercles.

Green chalk of Grandpré (Ardennes). — Deshayes.

XV. CYPHOSOMA AGASS.

Test circular, equally flat on the dorsal surface and the ventral surface. Pores arranged in single pairs forming a wavy series. Ambulacral areas have tubercles as large as the interambulacral areas. The tubercles are crenelated, but not perforated. They form two rows of tubercles in each area. Mouth round and very slightly notched. It differs from diademids in that its tubercles are unperforated. All the species are fossil and limited thus far to Cretaceous deposits.

- Milleri** Agass. — M 56. — Cat. syst. p. 11. — Park. Org. Rem. III, Tab. 3, fig. 10. — *Echinus Milleri* Desmar. — *Cidaris granulatus* Gold. Peref. p. 122, Tab. 10, fig. 7. — *Diadema granulosa* Agass. Prodr. — It is notable for its relatively very large tubercles.
Cr. bl. Kent, Have, Westphalia, Montolieu (Drôme), Rugen. — Mus. Bonn and Copenhagen. Michelin, Hagenow.
- corollare** Agass. — Park. Org. Rem. III. Pl. 1, fig. 7. *Echinus corollaris* Lamk. — Mant. Tab. 17, fig. 2. — *Echinus tuberculosus* Defr. Dict. — Flat species with uniform tubercles. Frequently found in the state of an interior mould.
Cr. of Périgord, Talmont, Royau. — Desmoulins, Defrance, d'Orbigny, Michelin. Mus. Paris.
- Tiara** Agass. — X 26^b, M 6 — *Cidaris Tiara* Hagenow. — *C. magnificum* Agass. Cat. syst. p. 11. — Very beautiful species with equal tubercles. Very few miliary tubercles between the principal tubercles.
Cr. bl. of Kent, Meudon, Rügen. — Michelin, Mus. Paris, Brongniari, Hagenow.
- rugosum** Agass. — M 67. — Cat. syst. p. 11. — Distinguished by its very apparent tubercles that diminish sensibly near the anus. Form sub-pentagonal.
Cr. bl. inf. of Fleche, Saints (depart. of Charente), Vendôme. — D'Orbigny.
- circinatum** Agass. — M 74, R 43. Cat. syst. p. 11. — *Echinus circinatus* Lamk. — Distinguished from *C. Tiara* by its more swollen form and its larger miliary tubercles.
Chalk of Périgord, Royau, Tours. — Mus. Paris. Desmoullins, Michelin, d'Orbigny.
- Beaunonti** Agass. — X 91. S 82. — Cat. syst. p. 14. — Species near *C. Tiara*, but flatter. Protruding tubercles.
Chalk of Plaisance. — Elie de Beaumont.
- suleatum** Agass. — T 64. — The tubercles of the dorsal surface are sensibly smaller than those of the ventral surface. Transverse grooves between the plates, as in *Temnopleurus*. A flared vertical groove in the middle of the interambulacral area. Apart from that, near to the form of *C. circinatum*.
Cr. chlor. of Saint Christophe (Indre-et-Loire). — d'Orbigny.
- Delamarrei** Desh. Exp. Alg. — Near *C. circinatum*, but subconical. Interambulacral areas slightly depressed.
Chalk at Hippur. From Bishta in Algeria, between Betna and Alcanera (prov. of Constantine. — Elie de Beaumont, Deshayes.
- perfectum** Agass. — X 77. — Cat. syst. p. 11. — Very flat species. Distinguished from its congeners by the extreme fineness of the dense miliary tubercles.
Cr. bl. of Flèche, Strechla. — D'Orbigny, Deshayes, Michelin, Geinitz.
- ornatissimum** Agass. — R 28. — ? *Cidaris variolaris* Goldf. (non Brogn.) Petref. p. 123, Tab. 40, fig. 9. — Differs from *C. Tiara* by the doubling of the pores of the dorsal surface and by the presence of very developed secondary tubercles on the ventral surface.
Cr. bl. of England, Plaener. — Deluc, Mus. Bonn and Paris (gal. geol.).
- tennistriatum** Agass. — M 72. — Cat. syst. p. 11. — Species with very small tubercles that give it a very rugose appearance.
Cr. bl. of Flèche (Sarthe). — Mus. Paris (gal. geol.), d'Orbigny.
- regulare** Agass. — P 69. — Cat. syst. p. 11. — The ambulacral tubercles are exactly as large as the interambulacral tubercles that gives this species a very homogenous appearance. Mouth large.
Cr. bl. of Flèche, Tours, Chalk of Vendôme. — Mus. Paris. D'Orbigny, d'Archia.
- difficile** Agass. — X 78. — Cat. syst. p. 11. — Very swollen species, with relative very small tubercles, especially in the ambulacral areas. The coronal plates are very separated because of the linear arrangement of the miliary tubercles.
Chalk of France. — Michelin.

cribrum Agass. — M 29. M 30. — Cat. syst. 11. — E. Sism. Ech. foss. Nizza, p. 62, Tab. 2, fig. 14–16. — Species sub-conical with a very large mouth. Very flexuous poriferous zones.

Chalk of Plaisance. Upper chalk of the county of Nice. — Elie de Beaumont, Mus. Turin.

subgranulatum Agass. M 50. — Cat. syst. p. 11 (under the name of *C. regulare*). — Near, by its form, to *C. regulare*, but it differs by the small number of miliary tubercles.

Chalk. — Mus. Neuchâtel.

radiatum Agass. — *Cidarites radiatus* Høenigh. In Goldf. P. 125, Tab. 40, fig. 13.

Cr. marn. of Essen on the Ruhr. — Mus. Bonn.

dimidiatum Agass. Small, pointed spines, smooth, some fusiform, others compressed, having a kind of ring above the collarette.

Cr. chlor. of Le Mans. (Sarthe). — Michelin.

XVI. ECHINOCIDARIS DESOR.

(Pl. 15, fig. 3)

Form sub-conical, little elevated. Test thin. Tubercles with a smooth base, unperforated at the top. Pores arranged in single pairs the entire length of the ambulacra. Anus covered with four plates of equal size. Two rows of tubercles in the ambulacral areas and at least four in the interambulacral areas. But often the external rows alone extend to the top, while the internals disappear on the dorsal surface. Spines cylindrical, finely striated. Mouth very large. Buccal membrane naked except for the ten plates of the buccal tubes. Auricles disjointed. Dental apparatus as in the diademids. A keel on the internal surface of the teeth. Differs from the diademids by its four anal plates, by the smooth spines and in the unperforated tubercles instead of being crenelated and perforated.

FIRST TYPE. — Sub-genus ACARITES Agass. — *Tubercles in the interambulacral regions disappearing in part on the dorsal surface.*

punctulata Desml. — *Echinus punctulatus* Lamk. — At least four rows of large tubercles in the interambulacral areas. Only the externals reach the top. Color pink.

Antilles, Senegal. — Mus. Paris. Schmidt, Michelin.

stellata Desml. — *Echinus stellatus* Bl. — Small depressed species that is distinguished by a star at the top of the disk, whose rays are prolonged on the interambulacral areas. Very large tubercles as in the preceding species, but which persist further on the dorsal surface.

Galapagos Islands (Stocks). — Mus. Paris and Neuchâtel.

Dufresnii Desml. — *Echinus Dufresnii* Bl. — Species sub-conical. The tubercles are smaller than in the preceding species. Color green.

Cumana (Antilles). — Mus. Paris. Michelin.

spatuligera Agassiz. — *Echinus spatuliger* Val. Voy. Vénus. Zool. Pl. 5, fig. 2. — Large sub-conical species. At least eight rows of interambulacral tubercles on the ventral surface that decrease and disappear in large part on the dorsal surface. Spatulate spines around the mouth.

Coquimbo (Gaudichaud). — Mus. Paris.

loculata Desml. — *Echinus loculatus* Bl. — Small, flat species, near *E. stellata*.

Channel, La Rochelle. — Michelin, Desmoulins, Mus. Paris.

SECOND TYPE. — Sub-genus TETRAPHYGUS Agass. — *Interambulacral tubercles covering all the test surface.*

nigra Agass. — *Echinus niger* Molina. Hist. nat. du chili. P. 173, — *Echinus purpurascens* Val. Voy. Vénus. Zool. Pl. 5, fig. 1. — *Echinus pustulosus* Desml. (non Lamk.). — Tubercles very large. The external row of interambulacral tubercles is maintained to the top.

Coquimbo, Paita (Gaudichaud). — Mus. Paris, d'Orbigny, Mus. Neuchâtel.

æquituberculata Desml. — *Echinus æquituberculatus* Bl. — *Echinus neapolitanus* Delle Chiaje. — Large sub-conical species, remarkable for its tubercles of equal size.

Palermo and Algeria. — Mus. Paris and Neuchâtel.

pustulosa Agass. — *Echinus pustulosus* Lamk. — Species very near *E. æquituberculata*, more depressed. The tubercles are less protruding.

Brazil. — Mus. Paris.

grandinosa Agass. — *Echinus grandinosus* Val. Vénus Zool. Pl. II, fig. 1. — Very near *E. æquituberculata*, however, the tubercles are more protruding and the ambulacra slightly costules.

Caratgena (Anerica), Peru (Gaudichaud). — Mus. Paris.

XVII. ECHINOPSIS. AGASS.

(PL. 15, FIG. 5–6)

Small, swollen urchins, sub-conical. Ambulacral areas nearly as wide as the interambulacrals, and ornamented, like them, with perforated tubercles, but not crenelated. Mouth small with weak notches. Differs from diademids by the absence of crenelations on the tubercles. Found as fossils in the chalk of Tertiary regions.

FIRST TYPE. — *Pores arranged in single pairs.*

elegans Agass. — X 28. — Cat. syst. p. 9. — *Echinus elegans* Desml. Tab. Syn. p. 300. — Species swollen. Tubercles dense and very apparent, although small.

Terr. numm. of Royau (Gironde). Saint Maure-sur-Loire. Calc. gr. Inf. of Saint Estéphe (Médoc). — Desmoulins.

latipora Agass. — X 40. P 19. — Cat. syst. p. 9. — The poriferous zones are wide, the tubercles small, and the miliary granules relatively small. The separation of the plates is very distinct.

Chalk of Villers (Orne). — Mus. Avignon.

contexta Agass. — M 64. — Cat. syst. p. 9. — Species a little more swollen than the preceding, of which it perhaps a variety.

Chalk of the department of Orne. — Deshayes.

depressa Agass. M 49. M 63, — Cat. syst. p. 9. — Species flatter than the preceding. The principal tubercles are less dense in the ambulacral areas. The miliary tubercles are also less numerous. In addition, very near *E. latipora*.

Chalk of Peilly (in Auxois). — Michelin.

pusillus Rœm. Kr. Form. — Very near *E. contexta*, if not identical.

Chalk of Gehrden (Hannover). — Rœmer.

SECOND TYPE. — *Pores arranged in three oblique pairs.*

Gacheti Agass. — V 12. — *Echinus Gacheti* Desml. Tabl. syn. p. 300. Large, very tall species. Tubercles small and very dense, forming two rows in ambulacral areas and in the interambulacral areas.

Tertiary of Blaye. — Desmoulins.

XVIII. ARBACIA GRAY.

(Pl. 15, fig. 11)

Small, subspherical urchins. Test covered with numerous small tubercles, with a smooth base and without perforation, forming multiple rows in the interambulacral areas, and sometimes also in the ambulacral areas. Pores are arranged in single pairs. Mouth circular without deep notches. Genital system narrow, in the form of a ring. Differs from the genus *Echinopsis*, of which it has the general form, by its tubercles with a smooth base. The species are fossils in the Cretaceous and Tertiary deposits.

FIRST TYPE. — *Two rows or principal tubercles accompanied by smaller tubercles.*

monilis Agass. — X 68, — *Echinus monilis* Desmar. in Defr. Dict. Sc. nat. XXXVII, p. 100. — *Arbacia globosa* Agass. Cat. syst. p. 12. — The tubercles are not all the same size, but there are two rows of principal tubercles in the ambulacral and interambulacral areas.

Tertiary Saint George-la-Mine near Doué (Maine-et-Loire), Broys (Oise), from the faluniers of Sainte Maure (Touraine). — Michelin, Mus. Paris. Deshayes.

conjuncta Agass. — Q 98. — Cat. syst. p. 12. — Differs from *A. monilis* by its tubercles that are a little elongated in the vertical direction.

Chalk of the department of Orne. — Deshayes.

Spadæ Desor. Small species near *A. conjuncta*, with very dense miliary tubercles. Two rows of principal tubercles.

Pliocene of Monte Mario, near Rome. — Verneuil.

depressa Agass. — N 38. — Cat. syst. p. 12. — Species flatter than *A. monilis*. There are two rows of principal tubercles next to the secondary rows in the interambulacral areas.

Néoc. of Neuchâtel. — Beyrich.

alutacea Agass. — *Echinus alutaceus* Goldf. Petrel. p. 125, Tab. 40, fig. 15.

From sand marl environs Essen. — Mus. Bonn.

SECOND TYPE. — *Uniform tubercles on all the surface of the test.*

granulosa Agass. — N 39. — Cat. syst. p. 12 — *Echinus granulatus* Münster. in Goldf. Petref. p. 123, Tab. 49, fig. 5. — The tubercles form horizontal rows that have up to sixteen tubercles in an interambulacral area and four or six in an ambulacral area.

Cr. chlor. of the island of Aix, Chute Farm, Le Mans, Kehlheim south of the Danube. — D'Orbigny, d'Archier, Mus. Bonn.

conica Agass. — P 52^b. — Cat. sys. p. 12. — Species near *A. granulosa* but taller and more conical.

Cr. chlor. de Villers (Calvados). — Deshayes.

Pilos Agass. — Q 47. — Cat. sys. p. 12. — *Echin. suiss.* II, p. 94, Tab. 23, fig. 32–36.

Néoc. of the canton of Neuchâtel. — Mus. Neuchâtel.

globulus Desor. — Species globulous with equal tubercles, arranged as in *A. granulosa* but less numerous. There are hardly twelve rows in the interambulacral areas.

Terr. crét. — Alb. Gras.

XIX. EUCOSMUS AGASS.

(Pl. 15, fig. 12–13.)

This genus has all the characters of *Arbacia* of the first type, the same swollen form and even the fine granular appearance. It differs by a single character. It is that the ambulacral areas are extremely narrow and has only a single row of tubercles. The pores are arranged in single pairs. We still know only a single species that is fossil.

decoratus Agass. Small urchin with a sub-conical form.

Upper Jura of Laegern. — Mus. Neuchâtel.

XX. CÆLOPLEURUS AGASS.

Form depressed, generally elongated, nearly like in the echinometrids. Test thin. Pores single in all their extent. The tubercles of the interambulacral areas do not pass the middle of the test. The upper part lacks them except in some species where the secondary rows of tubercles go up to the top and take sometimes the form of spines. Differs from *Echinocidaris* by its form and by its spiniform tubercles. All the species are fossil, from tertiary deposits.

equis Agass. — N 41. — Cat. syst. p. 12. — *Echinus equis* Val. — Encyl. méth. Zooph. Pl. 140, fig. 7 and 8. *Echinus stellatus* DeFr., Dict. sc. nat. — *Cidaris coronalis* Kl. — The secondary interambulacral tubercles are as developed as the principal series. Their form is regular.

Tert. numm. of Biaritz, Spain. — Michelin, Deshayes.

radiatus Agass. — X 12. — Cat. syst. p. 12. — The row of secondary interambulacral tubercles are as developed as the principal series.

Calc. gr. of France. — Deshayes.

Agassizii d'Arach. Mém. Soc. géol. Fr. 2^e sér. Tom. II, p. 205, Tab. 7, fig. 2. — Species near to *C. equis*. The spaces of the interambulacral areas of ornamented with zigzag lines.

Tert. numm. of Biaritz. — d'Archiaë.

spinosissimus Agass. — Between the principal rows and secondary rows of interambulacral tubercles is intercalated a row of very sharp spines.

Calc. gr. of Paris. — Deshayes.

XXI. CODIOPSIS AGASS.

(Pl. 15, fig. 14 and 15.)

Test swollen, very elevated, sub-circular or sub-pentagonal. Pores arranged in single pairs. Tubercles sporadically perforate, but with a smooth base, protruding only on the ventral surface.

The rest of the test is smooth and has a finely pleated structure when examined with the magnifying glass. Mouth average without deep notches. Only known in the fossil state in Cretaceous deposits.

Doma Agass. — X 31. N 71. — Cat. syst. p. 13. — *Codiopsis simplex* Agass. Cat. syst. p. 13 (Example used for *Codiopsis Doma*). — *Echinus Doma* Desmar. in Deffr. Dict. Sc. nat. XXXVII, p. 101.

Cr. inf. of Tourtia and Tournay (Belgium), Coudrecieux (Sarthe), Cr. chlor. Le Mans (small form). — Michelin. Mus. Paris (gal. geol.).

I have not been able to assure myself that the small *Codiopsis* of Le Mans are identical with the *Doma* of Tourtia nor to find sufficient differences to distinguish them. Other than the size, which is very small in the examples from Le Mans, I find the form a little higher and the tubercles isolated on all the test. But it appears that they are lost with age.

XXII. MESPILIA DESOR

(Pl. 15, fig. 17.)

The ambulacral and interambulacral areas are naked in their median part and only have tubercles on the sides, with the exception of the ventral surface that is very tuberculose. Tubercles small. Pores angular, with the junction of the coronal plates as in *Temnopleurus*. Ambulacral pores arranged in multiple vertical rows. Auricles closed. Auricular circle little elevated. Buccal membrane naked, very strongly pleated. Masticatory apparatus conforms to that of *Echinus*, but more slender.

globulus Agass. — *Echinus globulus* Linn. — *Echinus versicolor* Val. — *Cidaris ganulata* Leske, p. 152. Tab. II, fig. E. F. — Form swollen. Naked part of the interambulacral areas green in color. Tubercle zone of the same areas is red as well as the ambulacra. Genital and anal tubercles as small. Spines ringed with white and red.

Tonga-Tabou (Quoy and Gaimard). — Mus. Paris.

XXIII. MICROCYPHUS AGASS.

(Pl. 15, fig. 10.)

Pores arranged in oblique double pairs. Sporadic tubercles all of equal size and limited to the middle of the coronal plates while the border of these same plates is naked. Angular small pores at the junction of the plates in the ambulacra as well as in the interambulacral, larger around the anus than lower.

maculatus Agass. — Species swollen. Tall coronal plates. The naked spaces are larger than the tubercular spaces and have a pink tint. Pores angular and excessively small, hardly visible. Pink color.

Origin unknown. — Mus. Paris, Michelin, Ecole des Mines.

Rousseaui Agass. — Large swollen species. Naked spaces between the interambulacral plates, of a beautiful violet. Muscat (Rousseau). — Mus. Paris and Frankfurt.

zigzag Agass. — Small swollen species. The naked spaces are narrower and more numerous than in *M. Rousseaui*.

Origin unknown (Quoy and Gaimard). — Mus. Paris.

XXIV. SALMACIS AGASS.

(Pl. 15, fig. 4.)

Circular form, sub-conical. Ambulacral pores arranged in double pairs. Tubercles crenelated, but unperforated, forming several vertical rows that take the form of regular horizontal series on each interambulacral plate. Small holes or pores (angular pores) at the junction of coronal plates. Four anal plates, finely granulated as well as the genital and ocular plates. Small mouth. Buccal membrane naked. Auricles small, sharp, touching at their base and closed at the top. Masticatory apparatus constructed as in the diademids and echinocidarids, with the exception of the compass that ends in a truncated spatula. Spines short, cylindrical and finely striated. There are living species and fossil species.

bicolor Agass. — Test swollen. At least ten rows of tubercles in the interambulacral areas forming regular horizontal lines. Sutures of the plates distinct. Small angular pores. Spines very bright, of an orange tint, ringed with white on the ventral surface.

Bombay (Roux), Red Sea. — Mus. Paris.

sulcatus Agass. — Some very distinct transverse lines indicate the sutures of the coronal plates. At last six rows of tubercles in the interambulacral areas and four in the ambulacral areas. Very marked angular pores of triangular form. Spines very fine, rings in white and green.

Philippines. Mus. Paris, Deshayes, Michelin.

virgulatus Agass. — Species near to *S. sulcatus*, but smaller and with less numerous tubercles. Spines violet (it is perhaps only the young of *S. sulcatus*).

Ceylon (Renaud). — Mus. Paris.

rarispinus Agass. — Form sub-conical. Tubercles very small. Sutures of the plates little apparent. Very small angular pores. Few spines, rings of white and red,

Malacca Strait (Eydoux and Souleyet), Singapore (Hambron and Jacquinot). — Mus. Paris.

varius Agass. — Species very near *S. rarispinus*, but less conical. The tubercles are also less numerous. Very small angular pores, hardly visible.

Singapore (Hambron and Jacquinot). — Mus. Paris.

Dussumieri Agass. — Form depressed. Tubercles more protruding and denser than in the other species. Mouth sunken.

Seas of China (Dussumier), Singapore. — Mus. Paris

globator Agass. — Very swollen small species. Very small angular pores. Two rows of tubercles in the ambulacral areas and in the interambulacral areas.

Origin unknown. — Deshayes.

Fossil species.

Pepo Agass. — T 33. — Very swollen large species, near, by its structure, to *S. varius*. The middle of the interambulacral areas lacks tubercles.

Tert. Palermo. — Agassiz.

Vandeneckei Agass. — Intermediate species, as to its form, between *S. rarispinus* and *S. sulcatus*.

Terr. numm. Fontaine-du-Jarrier, mountain of Palarea. — Vandenecke.

XXV. TEMNOPLEURUS AGASS.

(Pl. 15, fig. 9.)

Circular and sub-conical form. Two principal rows of crenelated interambulacral tubercles, but not perforated. Deep impressions correspond to the sutures of the plates in the ambulacral areas, as well as in the interambulacral areas, but only on the dorsal surface. Ambulacral pores arranged in three pairs. Masticatory apparatus vigorous. Auricles low and thin. The genus differs from salmacids by its depressions that give it a sculpted appearance. We know it only in living species.

toreumaticus Agass. — *Cidaris toreumaticus* Klein. — *Echinus sculptus* Lamk. — Voy. Venus Zooph. Pl. 1, fig. 1. — Form sub-conical. Strong transverse impressions separating the coronal plates.

Bombay (Roux). In a state of petrification in the Red Sea (Reynaud). Karak Island, Persian Gulf (Leclancher). — Mus. Paris (gal. geol.).

Reynaudi Agass. Differs from *T. toreumaticus* by its transverse incisions that are much more marked on the internal side than the external side of the areas. Spines finely striated, rings of white and pink.

Ceylon (Reynaud). Malacca (Eydoux and Sonoleyet). — Mus. Paris.

Woodii Agass. Very small species remarkable for the extension in the form of a proboscis of the anal system that is surrounded by a star whose rays encroach on the interambulacral areas.

Crag of England. — Agassiz.

bothryoides Agass. — *Cidaris bothryoides* Leske. Pl. 11, fig. 11. — Depressions very deep, separated by the tubercles in the interambulacral areas in a way that there are four rows of them in the interambulacral areas and two only in the ambulacral areas.

Galapagos. — Michelin, Mus. Paris.

XXVI. GLYPTICUS AGASS.

Circular, depressed form. Pores single in all their length. The interambulacral areas, instead of having large tubercles, have irregular asperities that give the test a sculptured appearance. The tubercles of the ambulacral areas are regularly conformed, but unperforated and without crenelations at their base. The very large genital system is very regular. The mouth is ample with small notches. The species are fossils, of oolitic and Cretaceous deposits.

sulcatus Agass. — T 27. *Echinus sulcatus* Gold. Petref. Germ. P. 126, Tab. 40, fig. 18. — *Echinus rotularis* Lamk.

Coral. of Engelhardsberg, Franconia, environs Vendôme. — Mandelslohe, county of Münster, Michelin.

hieroglyphicus Agass. — Q 86. Q 96. — Cat. syst. p. 13. — Echin. suiss. II, p. 96. Tab. 23, fig. 37–39. *Echinus hieroglyphicus* Münster. in Goldf. Petref. p. 126. Tab. 40. Fig. 17, — *Arbacia hieroglyphica* Ag. Prodr. P. 23.

Coral. of the canton of Soleure, Besançon, Salins (Jura), Puiseux (Ardennes), Sirchingen. — Mus. Neuchâtel and Bâle, Mandelslohe.

Var. *Quercinus* Agass. — N 95. — Cat. syst. p. 13.

Terr. jurass. of France. — Mus. Neuchâtel.

Koninckii Desor. — T 30. — Differs from *G. hieroglyphicus* in that the sculptures, instead of being vertical, are transversal. There are several large tubercles at the base.

Chalk of Ciply. — From Koninek.

affinis Agass. Echin. suiss. II. p. 97. Tab. 2, fig. 40–42.

Kimmer. of Olten (canton of Soleure), Obergœsgen. — Gressly, Strohmeier.

XXVII. POLYCYPHIS AGASS.

Urchins of small size, with uniform tubercles on all the surface of the test. Mouth large, pentagonal. Pores arranged in three oblique pairs. It is the only character that distinguishes them from *Arbacia*. All the species are fossils, from oolitic and Cretaceous deposits.

nodulosus Agass. — X 70. M 43. M 63. S 1. — *Echinus nodulosus* Mstr. In Goldf. P. 123 Tab. 40, fig. 16. — Agass.

Ca. syst. p. 12. — *Arbaciai nodulosus* Agass. Prodr.

Calc. with polyps from Ranville (Normandy), Luc, Bayreuth. — Deslongchamps, Michelin, Münster.

stellatus Agass. Near, by its form, to *P. nodulosus*, but there are only four rows of interambulacral tubercles.

Cal. With polyps ? from Normandy. — Deslongchamps.

textilis Agass. — R 96. — *Echinus textilis* Münster. — The tubercles are smaller than those of *E. nodulosus*. Form sub-conical. Mouth very large. Kellogg. of Marolles near Maners. — Michelin.

aracnatus Desor. — Very near *P. nodulosus* from which it differs however by the way in which the rows of the tubercles are arranged. There are fourteen of them. The second internal row goes up to the top. The others join successively. The ambulacrals have four rows of tubercles.

Cr. bl. of Martigues near Quiévrain. — De Koninck.

Buchii Agass. — *Echinus Buchii* Steinig. Mém. Soc. géol. Tom I, p. 349; Pl. 21.

XVIII. AMBLYPNEUSTES AGASS.

Form swollen, sometimes higher than long. Test thin. Ambulacral pores arranged in three vertical rows. Mouth small, without notches. Teeth pointed with an internal truncated spine before the end. Transverse arc of the pyramids thin with a slight groove for the tooth. Compass very small, truncated, and a little swollen at its anterior end. Auricles closed, small. Auricular circle low. Genital and anal plates small, tubercular. Pores at the corners of the plates as in the genus *Salmacis*. This character distinguishes at first glance *Amblypneustes* from *Echinus*. Spines end in a truncated club. We know only living species.

Ovum Agass. — *Echinus ovum* Lamk. — Species very tall, nearly ovoid. The height is greater than the transverse diameter,

Australia ? — Mus. Paris.

griseus Agass. — *Echinus griseus* Bl. — Species very near *A. Ovum* by its structure, but less tall. Ambulacrals wide, having six rows of spaced tubercles.

Vanikoro (Quoy and Gaimard, Péron and Lesueur). — Mus. Paris.

pallidus Agass. — *Echinus pallidus* Lamk. — Val. Voy. Vénus. Zool. Pl. 2, fig. 1. — Species less tall than the preceding and more tubercular. Ambulacrals proportionally narrower. The auricles are larger and the circle taller than in the other species. Spines very short and very thick.

Australia (Quoy and Gaimard), Vanikoro, Galapagos Islands. — Mus. Paris.

textilis Agass. There are only two rows of principal tubercles in the ambulacral and interambulacral areas, with the lines of the very small tubercles going from the principal tubercle to the corners of each plate, alternating with those of the adjacent plates. In addition, near *A. Ovum*.

Origin unknown. — Mus. Paris.

scalaris Agass. The tubercles are more numerous than in the preceding species and the lines formed from larger mamelons. The poriferous zones are white. The base of the ambulacral and interambulacral zones is brown with more or less smooth spaces between the plates that are greenish.

Australia (Verreaux). — Mus. Paris.

serialis Agass. Near *A. textilis*, from which it differs however by larger tubercles, very near the ambulacral areas.

Origin unknown. — Deshayes.

XXIX. BOLETIA DESOR.

Urchins of large size, depressed and sub-conical. Tubercles, small, numerous un-perforated, non-crenelated, forming multiple series. Spines short and very thick. Poriferous zones wide, composed of three vertical rows of pores. The internal row is separated from the two externals by a vertical series of small tubercles. Mouth very large with very deep notches. Auricles small, touching at the top without being united by an arc. All the species are living.

Pileolus Desor. — *Echinus Pileolus* Lamk. — *Echinus obtusangulus* Lamk. — *Echinus polyzonalis* Lamk. (young). — Voy. Vénus. Zool. Pl. 8 and 9. Very large species, depressed, sub-conical. Mouth very large. Very deep notches.

Seychelles, sea of the Indies (Rosseau). — Mus. Paris.

heteropora Desor. Species very near *B. Pileolus*, from which it differs however in that in each pair of pores, the exterior pore is larger than the interior.

Sea of the Indies. — Mus. Paris., Roissy.

maculata Desor. — *Echinus maculatus* Lamk. — *Echinus depessus* Bl. — Voy. Vénus, Zool. Pl. 3, fig. 1. — species near *B. Pileolus*, but more tubercles and more conical. The sutures of the plates are very sharp.

Indian Ocean. — Mus. Paris.

bizonata Desor. — *Echinus bizonatus* and *Ech. trizonatis* Bl. — Small species that we have taken for young *B. Pileolus* but differs by its much more numerous miliary tubercles.

Unknown origin. — Desmoulins, Paris, Mus. Michelin.

XXX. TRIPNEUSTES AGASS.

Urchins of large size, swollen, with slightly protruding tubercles having small spines. Pores forming three vertical, well-separated double rows. The two exterior rows are straight and regular. The middle row is irregular. Mouth small, circular, moderately notched. Powerful masticatory apparatus. Teeth with three keels. Compass very forked, raised, without transverse muscles. The species are living and fossil, from Tertiary deposits.

sardicus Agass. — *Echinus sardicus* Agass. *Cidaris sardica* Leske. Tab. 9, fig. A, B. — Encycl. méth. Zooph. Pl. 133, fig. 7.

Var. *Echinus fasciatus* Lamk.

Seychelles, Bombay (Rousseau and Botta). Ile de France (Mattiéu). — Mus. Paris.

pentagonus Agass. — *Cidaris angulosa* Leske. Tab. 2, fig. F. — *Echinus pentagonus* Lamk. — It is perhaps only a variety of the preceding. The swollen form of the ambulacra makes it pentagonal.

Indian Ocean. — Mus. Paris.

ventricosus Agass. — *Echinus vntricosus* Lamk. — *Echinus Peronii* Blainv. — Very near *T. sardicus*, from which it differs only by its more irregular pore rows.

Martinique (Pléd, Richard, Rousseau), Yucatan. — Mus. Paris, Michelin.

subcæruleus Agass. — *Echinus subcæruleus* Lamk. — Forme more conical than *T. sardicius*. The ambulacra are narrower, the pores less irregular. The interambulacra are smooth at the top. Color violet.

Zanzibar (Rousseau). — Mus. Paris.

planus Agass. — X 63. — *Echinus planus* Agass. Cat. syst. p. 12. — Species near *T. sardicus*, but with larger tubercles.

Tert. of Foz near the mouths of the Rhone. — Deluc.

XXXI. HOLOPNEUSTES AGASS.

(Pl. 15, fig. 16.)

This genus is distinguished from all the echinids in that the ambulacral areas are wider than the interambulacral areas, which leads to the extraordinary development of the poriferous zones. Each zone is limited by a double row of very regular pores, while the space between these rows has a multitude of scattered pores. It is an exaggeration of the genus *Tripneustes*, where the pores of the intermediary row begin to be irregular. Mouth small, without deep notches. Auricles composed of two pillars fused at the top.

porosissimus Agass. Urchin swollen, nearly spherical. Tubercles small and dense. About forty tubercles in a vertical row.

Origin unknown. — Deshayes.

XXXII. ECHINUS LINN.

Test swollen. Ambulacral areas equal in width to half the interambulacral areas. Tubercles the same size in the two areas, forming a vertical series more or less distinct according to the species. Pores numerous, arranged in transverse rows, oblique or arched. Mouth circular with more or less deep notches. Buccal membrane sometimes naked, sometimes covered with imbricated scales, with ten shields for the buccal tube feet. Genital system composed of four equal even plates and one larger unpaired plate, of which the madreporite indicates the antero-posterior axis. Anus formed by a number of irregular small plates. Masticatory apparatus (lantern) composed of the same pieces as in *Cidaris*. But the pyramids are concave in their upper part, and the two branches are united by an arc at the top. Teeth with three keels.

FIRST TYPE. — *Pores arranged in three oblique pairs. Buccal membrane naked, with ten calcareous shields corresponding to the ambulacra.*

esculentus L. — *E. sphæra* O. F. Müll. — *E. globiformis* Lamk. — *E. pseudomelo* Bl. — *E. violaceus* Bl. — *E. auratiacus* Bl. — One of us confirmed, by comparing the specimens of the Museum of Stockholm, that the *E. esculentus* of Linné is not at all the species common to the Channel and the Mediterranean. The latter, which is *E. granularis*,

differs by the pores arranged in irregular arcs of five pairs. Its tint is violet, while that of the true *E. esculentus* is orange.

Channel, Lorient, seas of the North. — Mus. Paris and Stockholm.

Melo Lamk. It is the largest known species. It is distinguished by rare tubercles and by its short spines. Its tint is a paler orange than *E. esculentus*.

Mediterranean, Oran, Alger. — Mus. Paris and Avignon.

acutus Lamk. This species differs from *E. Melo* by its conical form. Perhaps it is only a variety.

North Sea. — Mus. Paris.

Flemingii Ball, in Forbes, p. 161. — Düb. And Kor. Zool. Bidr. p. 266, Tab. 9, fig. 31 and 32.

Seas of the North. — Mus. Stockholm and Paris.

elegans Düb. And Kor. Zool. Bidr. P. 272, Tab. 10, fig. 40–42.

Coast of Norway. — Mus. Christiania.

Fossil species.

bigrannularis Lamk. — M 83. — Agass. Cat. syst. p. 12. — *Echinus antiquus* Deifr. Dict. — Species depressed, sub-conical with very dense tubercles.

Kellov. of Nantua. — Mus. Paris, Michelin.

Var. minor: — M 79. Q 94, *Echinus serratus* Agass. Cat. syst. p. 12. — *Echinus cadomensis* Agass. Cat. syst. p. 12.

Kellov. of Marolles near Mamers, Caen. — Michelin, d'Orbigny, Deslongchamps.

Var. major: — M 23: — *Echinus intermedius* Agass. Cat. syst. p. 12.

Calc. with polyps of Croisille, Ranville. — Michelin.

perlatus Desmar — 60 b — in Deifr. Dict. Sc. n. XXXVII, p. 110, — Bl. Zooph. p. 210. — Desml. Tabl. syn. p. 294. — Agass. Prodr. p. 23. — Cat. Syst. p. 12. — Echin. suiss. II, p. 82. Tab. 22, fig. 13–15. — *Echinus lineatus* Goldf. Petrel. p. 124, Tab. 40, fig. 11. — Desml. Tabl. syn. p. 292. — Knorr, Petrel. II, Tab. E, fig. 1 and 2.

Coral. of the vale of Moutiers, Ile de Ré, Salins, Besançon. — Mus. Berne and Bâle, Thurmann, Marcou.

Var. minor: — Q 93. — *Echinus psammophorus* Agass. Echin. suiss. II, p. 84, Tab. 22, fig. 1–3. — Cat. syst. p. 12.

Coral. of Besançon, Soleurian Jura. — Dudreissier, Gressly, Dubois.

Canmonti Desor. — T 26. — Species near to *E. perlatus*, but more conical and lower. The middle of the interambulacral areas is naked.

Calc. with polyps of Ranville, Oxford. of Châtillon-sur-Seine. — Michelin.

gyratus Agass. — M 51. — Echin. suiss. II, p. 87. Tab. 23. Fig. 43–46. — Cat. syst. p. 42.

Coarse calc. of Bétheuil (Aisne). — Graves.

Gravesii Desor. Species near *E. gyratus*. The middle of the interambulacral areas is depressed and lacks tubercles.

Coarse calc. of Rétheuio (Aisne). — Graves.

excavatus Leske. — M 18. — Goldf. p. 124, Tab. 40, fig. 12. — Agass. cat. syst. p. 12.

Kellov. environs Ratisbonne, Courgains, Marolles. — Mus. Bonn, Michelin, Deshayes.

Var. — *angustipora*.

Coral. de La Rochelle. — d'Orbigny.

distinctus Agass. — P 18. — Cat. syst. p. 212. — Small species near *E. excavatus*, but the notches are not as deep and the tubercles more homogeneous.

Coral. of Angoulin near Rochelle. — D'Orbigny.

arenatus Lamk. — M 81. — Anim. s. vert. III. — Agass. Cat. syst. p. 12. — Near *E. bigranularis*, but the ambulacral tubercles are denser, to the point of touching.
Terr. jurass. ? of France. — Mus. Paris.

laevis Agass. — P 17. Q 80. — Cat. syst. p. 12. — Swollen species different from *E. bigranularis* by its very large secondary tubercles.
Ool. inf. of Normandy, Sainte Honorine. — Deshayes, d'Archiar, Michelin.

polyporus Agass. — M. 93. — Cat. syst. p. 12. — Differs from *E. bigranularis* and *E. laevis* in that there are four rows of tubercles in the ambulacral areas.
Terr. jurass. of France. — Deshayes.

pulcher Agass. — Q 87. — Cat. syst. p. 12. — Near *E. polyporus*, but the tubercles are even more numerous. There are six rows in the ambulacral areas.
Terr. jurass. — Mus. Geneva.

serialis Agass. — Q 87. — Echin. suiss. II. p. 85, Tab. 22, fig. 10–12/ — Cat. syst. p. 12.
Coral. of Fringeli (canton of Solere). — Gessly.

semiplacenta Agass. — S 68. — Near *E. perlatus*, but the miliary tubercles are more apparent.
Environs of La Havre? — Mus. Genève.

SECOND TYPE. — Sub-genus *Toxopneustes* Agass. — *Pores arranged in more or less regular transverse arcs, of at least four pairs. Mouth decagonal with more or less deep notches.*

brevispinus Risso. — Valentin, Anatomie des Echin. Tab. 1. — *Echinus esculentus* Auct. — This species incorrectly has the name of *E. esculentus* in most authors.
Mediterranean, coasts of Africa. — Mus. Paris.

granularis Lamk. — *Echinus subglobiformis* Blainv. — The test is more depressed and thicker than in *E. brevispinosus*. The external pairs of pores are more separated from the internals. It is perhaps only a variety of *E. brevispinosus*.
Channel. — Mus. Paris.

Drobachensis Müll. — *Echinus neglectus* Düb. and Kor. Zool. Bidr. — There are always five pairs of pores that form a more regular arc than in the preceding species.
Coasts of Scandinavia. — Mus. Stockholm.

albidus Agass. Very tall species, with tubercles slightly protruding and very spaced. Test violet; spines whitish.
Channel. Michelin.

lividus Lamk.. — *Echinus vulgaris* Bl. — *Echinus longispina* Bl. (young). — *Echinus purpureus* Risso. — *Echinus saxitilis* Tiedem. — *Echinus lithophagus* Leach. — *Cidaris Basteri* Leske. — Five pairs of pores in a regular arc.
Mediterranean, Canary Islands, England. — Mus. Paris, Deshayes.

concavus Agass. Species remarkable for the depression of the dorsal surface. However, this may be the result of an accident. Apart from that, this urchin has all the characters of *E. lividus*.
Mediterranean ? — Michelin.

gibbosus Val. (Mus.). Irregular species, near *E. lividus* by the details of its test; Four pairs of pores slightly arced.

Delalandi Val. (Museum). The tubercles are very apparent and not dense. The arcs of the pores are very regular.
Australia (Verreaux). — Mus. Paris.

tuberculatus Lamk. Large, very tubercular species. The tubercles are even more apparent than in *D. Delalandi*. Southern seas (Périn and Lesueur). — Mus. Paris.

neglectus Lamk. Forbes, Brit. Starfishes, p. 172. — Tubercles sparse and small. Arcs not apparent, composed of five or six pairs of pores. Iceland (Gaimard). — Mus. Paris.

complanatus Val. (Museum). Remarkable for its flat dorsal surface. The pores are arced around the tubercles. Origin unknown. — Mus. Paris.

Dubenii Agass. Tubercles uniform, forming two rows in the ambulacra. Five pairs of pores transversally arced only at the external end. Seas of the North (Gaimard and Robert). — Mus. Paris.

Marii Desor. Large shortened species, near *E. brevispinosus*, but the tubercles are smaller and denser. Pliocene of Monfe-Marin, near Rome. — Veneuil.

THIRD TYPE. — *Arcs of pores are nearly transverse and separated by parallel rows of tubercles.*

albus Molina. Hist. nat. du chili, p. 175. — *Echinus porosus* Val. Voy. Vénus. Zool. Pl. 4. — The poriferous arcs have up to nine and ten pairs of pores. Tubercles very small and dense. Spines short and dense. Chili (Gay), Callao (Gaudichaud). — Mus. Paris, d'Orvigny.

FOURTH TYPE. Sub-genus *Psammechinus* Agass. — *Three pairs of oblique pores. Tubercles very dense. Buccal membrane covered with imbricated plates. No strong buccal notches.*

variegatus Lamk. Upper part of the interambulacral areas naked. Groove of the arc of the pyramids surrounded by protruding points. A beautiful green. Yucatan, Gulf of Mexico. — Michelin.

semituberculatus Val. (Mus.). Species near *E. variegatus*, but the tubercles are more numerous on the ventral surface in the interambulacral areas. Color green. Galapagos. — Mus. Paris.

subangulosus Lamk. Encycl. méth. Zooph. Pl. 133, fig. 5 and 6. — The pores are strongly transverse. The first series is separated from the other two by a row of small tubercles. Cape of Good Hope (Reynaud, Quoy and Gaimard, Wahlberg). — Mus. Paris and Stockholm

Norvegiens Düb. and Kor. Zool. Bidr. p. 268, Tab. 9, fig. 33–36 (non fig. 37). Coasts of Norway. — Mus. Stockholm.

miliaris Leske, Lamk. — Forbes, Brit. Starfishes, p. 161. — *Echinus minutus* Bl. (young age). — *Echinus virens* Düb. and Kor. Zool. Bidr. p. 274, Tab. 10, fig. 43–45. — Small, depressed species with very dense tubercles. Very common in collections. Channel. Seas of the North. — Mus. Paris and Stockholm.

microtuberculatus Blain. Dict. Sc. n. XXXVII, p. 88. — *Echinus parvituberculatus* Bl. Man. d'act. P. 228. — *Echinus decoratus* Agass. Introd. à l'anat. de l'Echinus, p. VI — *Echinus miliaris* Risso (non Lin.). — Differs from *E. miliaris* by its less dense tubercles that never touch at the base. Mediterranean and Red Sea? — Mus. Paris, Michelin.

Koreni Desor. Species very tubercular, near *E. microtuberculatus*. The genital plates are covered with small granules. The tubercles, while spaced as in *E. microtuberculatus*, are however larger. The spines are shorter and less slender. Seas of the North (la Recherche). — Mus. Paris.

excavatus Blainv. Man. d'act. p. 227. — Smaller than *E. variegatus* and a larger number of interambulacral tubercles.

Brazil, Martinique (Alex. Rousseau). — Mus. Paris.

dubius Agass. — M 58. — Echin. suiss. II, p. 84. Tab. 22, fig. 4–6. — Cat. syst. p. 12.

Tert. (Molasses) of Chaux-de-Fonds, Villeneuve in Provence. — Mus. ls Chaux-de-Fonds, Paris. (gal. geol.).

Var. *obliqua* — M 57. Q 33. Q 44. — *Echinometra margaritifera* Nie. — Agass. Cat. syst. p. 12.

Chaux-de-Fonds, Saint-Paul-Trois-Châteaux, the Martigues. — Mus. Avignon and Neuchâtel.

Serresii Desml. Tabl. syn. p. 200. — *Echinus delphinus* Defr. Dict. Sc. n. — Differs from *E. dubius* in that it has four rows of tubercles in the ambulacral areas.

Tert. OMllasses) of the Martigues and Clausayes (Drôme)... — Mus. Avignon.

astensis E. Sism. — R 64. App. Echin. foss. Piem. — *Echinus lineatus* E. Sism. (non Goldf.) Ech. foss. Piem. P. 31. Species near *E. miliaris*.

Tert. recent (Pliocene) of Asesan. — Mus. Turin, Deshayes.

carantonianus Agass. — P 13. — Species flatter than *E. dubius*. The coronal plates are less high. The pores are very slightly oblique. The dorsal surface is little tubercular.

Cr. inf. of Saintes (Charente), Cognac. — D'Orbigny.

homocyphus Agass. — M. 82. — Cat. syst. p. 12. — Four rows of tubercles in the ambulacral areas. Tubercles very homogenous.

Terr. of Italy. — Deshayes. Mus. Paris (gal. geol.).

Caillaud Desor. — R 83. — Four rows of ambulacral tubercles, larger than in *E. homocyphus*.

Gault ? — Caillaud, Mus. Avignon.

Woodwardi Desor. Three pairs of pores. The internal pair is more separated from the second than that it is from the third.

Crag. — Michelin.

fallax Agass. — S 30. — Echin. suiss. II, p. 86, Tab. 22, fig. 7–9. — Cat. syst. p. 12.

Néoc. of the department of Doubs. — Nicolet.

catenatus Desor. — T 69. — Small species, near *E. fallax*, but the miliary tubercles are even smaller. The principal tubercles are small and very dense.

Deposit ? — Mus. Avignon.

FIFTH TYPE. — *Three pairs of oblique pores. Dorsal surface flat, in a way that the genital system is found level with the surface of the test. At least six rows of tubercles in the interambulacral areas. Those of the dorsal surface are larger and have spines much longer than those of the ventral surface.*

longispinus Blainv. Ambulacral areas very narrow, with two rows of tubercles separated only by some very small miliary tubercles. With a very beautiful green tint with violet spines.

Origin unknown. — Museum Paris, Michelin.

laganoides Desor. Very small species. Differs from the preceding by its relatively larger tubercles, separated by a very small number of miliary tubercles. Color green.

Origin unknown. — Mus. Paris.

SIXTH TYPE. — Ambulacral plates very tall. Principal tubercles very apparent, forming two rows only in the interambulacral areas. As there are only three pairs of pores for each ambulacral plate and they are very tall, the pores are less dense than in the other Echinus.

costatus Agass. — V 26. Very tall species. The ambulacral plates are nearly as high as the interambulacrals. Tubercles forming projecting rows. The separation of the plates is very distinct.

patagonensis d'Orbl — T. 67. — Two ambulacral rows and two interambulacrals of very large tubercles. Form swollen, sub-conical.
Tert. of Patagonia. — d'Orbigny.

XXXIII. PEDINA AGASS.

Compressed urchins with a thin test, small mouth that is little notched. Three pairs of oblique pores. Tubercles perforated and crenelated, as in the diademids. All the species are fossil, from oolitic and Cretaceous deposits.

sublævis Agass. — P 14. V 30. — Cat. syst. p. 9. — Echin. suiss. p. 34. Tab. 15, fig. 8–13. — *Diadema microcon*. Desml. Tabl. syn. p. 314.

Oxford. of Neuchâtel Jura. — Aug. Montmollin, Desmoulins.

Var. *aspera* Agass. — X 35b. Q 88. Q 100. — Cat. syst. p. 9. — Echin. suiss. p. 36, Tab. 15, fig. 8–13. — *Pedina ornata* Agass. Caf. syst. p. 9. — Echin. suiss. p. 36, Tab. 1, fig. 7. — *Pedina rotata* Agass. Cat. syst. p. 9. Echin. suiss. p. 36, Tab. 15, fig. 4–6.

Oxford. of France. Coral. of the bishopric of Bâle. Oxford. of Doulis. — Deshayes. Mus. Berne and Bâle, Renand-Comte.

granulosa Agass. — M 55. — Cat. syst. p. 9. — Very near the preceding but taller.
Calc. with polyps of Ranville. — Deslonchamps.

Gervillii Agass. — Q 25. — *Diadema Gervillii* Desml. Tabl. syn. p. 316. — *Pedina subnuda* Agass. Cat. syst. p. 9. — Small, flat species with small and very spaced tubercles.
Kellog. of Chauour. — Michelin, Rousault, Desmoulins.

gigas Agass. — P 24. — Cat. syst. p. 9. — Very large hemispherical species with tubercles little protruding and sparse.
Terr. jurass. ? of France. — Deshayes.

arenata Agass. — Q 92. — Cat. syst. p. 9. — Echin. suiss. p. 37, Tab. 15, fig. 1–3.
Ool. inf. of Goldenthal, canton of Soleure. — Gressly.

sinaica Desor. — T 25. — Swollen species, near *P. granulosa*, but differs by its sub-conical form.
Terr. crét. of Sinai (Lefebvre). — Mus. Paris.

XXXIV. HELIOCIDARIS DESML.

Form depressed. Tubercles protruding, unperforated, without crenelations. Pores numerous, irregularly distributed the length of the ambulacra, except at the ventral surface where they form three parallel rows that fill all the ambulacral area. Test thick. Mouth markedly notched. Auricles

very small, with two pillars that touch at the top. Lantern small, with non-closed pyramids. Compass forked. Teeth with a keel on the ventral surface. Spines finely striated, longer and more massive than those of *Echinus*.

variolaris Desml. — *Echinus variolaris* Lamk. — *Echinus anguifer* Desml. Tabl. syn. p. 276. — *Echinometra Leschenautti* Blainv. — Large species with thick test, with very large tubercles.

Ile de France (Desjardins), southern seas (Péron and Laseur), California, Vera Cruz. — Michelin. Mus. Paris and Stockholm.

paucituberculata Desml. — *Echinus paucituberculatus* Blainv. — Species with very few tubercles. Perhaps only the young age of the preceding

Origin unknown. — Mus. Paris.

chlorotica Desml. — *Echinus chloroticus* Val. Voy. Venus Zool. Pl. 7, fig. 2. — The tubercles are not as large and more numerous than in *H. variolaris*.

New Zealand (Quoy and Gaimard). — Mus. Paris.

margaritacea Lamk. — *Echinus margaritaceus* Val. Voy. Vénus. Zool. Pl. 1, fig. 1. — Depressed species, remarkable for its large miliary tubercles.

Southern seas (Péron and Laseur). — Mus. Paris.

eurythrogramma Desor. — *Echinus eurythrogrammus* Val. Voy. Vénus. Zool. Pl. 7, fig. 1. — Principal tubercles few and not dense.

Chili (Gay). — Mus. Paris.

omalostoma Desor. — *Echinus omalostoma* Val. Voy. Vénus. Pl. 6, fig. 2. — The secondary interambulacral tubercles are more numerous than the preceding species. Poriferous pores strongly enlarged on the ventral surface that is very flat.

New Zealand, China (Eydoux), Galapagos. — Mus. Paris.

mexicana Agass. Species with large, very dense tubercles in the ambulacral areas. Ventral surface less flat than in *H. omalostoma*. Pores slightly arced. Spines smooth, fairly long. This species forms the transition to echinometrids.

Vera Cruz. — Mus. Paris and Stockholm.

mirabilis Agass. — X 30. X 32. M.59. — *Echinus mirabilis* Agass. Cat. syst. p. 12. — Tubercles very protruding, same size in the ambulacral and interambulacral areas, doubled toward the top.

Coral. of Clamecy (Nièvre), Sauce-aux-Bois, environs Méziérid, from Wagnen (Ardennes). — Mus. Paris and Strasbourg, Duval.

GROUP OF ECHIOMETRIDS

This group is distinguished by a particular character. It is that the test, instead of being circular, is elongated. But this elongation is not in the direction of the antero-posterior axis. It is oblique. The pores are arranged in oblique pairs, forming transverse arcs.

XXXV. ECHINOMETRA KLEIN.

Test elongated, generally swollen. Tubercles protruding, nearly as large in the ambulacral areas as in the interambulacral, unperforated and without crenulations at the base. Spines pointed, smooth in appearance, although finely striated when examined with a magnifying glass. Pores arranged in arcs around the ambulacral tubercles. Mouth large, distinctly notched on its periphery. Auricles very developed, fused at the top. Buccal membrane smooth. Lantern robust with notched

pyramids, the two arms uniting by means of an arc. Teeth with three keels. The known species are all of the present epoch.

lucunter Lamk. Species swollen, very tubercular, consequently covered with very dense spines. Four or five pairs of pores in an arc.

Torres Strait (Hombron and Jacquinot), Samar (Jacq.), Cochinchina (Eydeux and Souleyet), Antilles, Trinity, Ile de France (Desjardins), Island of Cuba. — Mus. Paris, Michelin, D'Orbigny.

heteropora Agass. Large species, with four or five pairs of unequal angled pores. Tubercles very numerous and small. Zanzibar (Rousseau), Red Sea (petrified) (Botta). — Mus. Paris.

acufera Bl. Species very large, oval, wide and flat. Tubercles numerous. Five or six pairs of arced pores. Genital plates large. Near *E. heteropora*. A wavy smooth groove at the junction of the ambulacral and interambulacral areas.

Martinique (Richard), Vera Cruz, Mexico, Trinity, Ascension (Quoy and Gaymard). — Mus. Paris.

Maugei Bl. Differs from *E. lucunter* by its very dense and shorter spines. It is probably only a variety of *E. lucunter*. Seychelles (Rousseau), Ile de France. — Mus. Paris.

Mathæi Bl. — *Echinometra oblonga* Bl. Small species less tubucular than *E. lucunter*, but the pores are arranged in the same manner in four arced pairs.

From Solomon (Hombron nd Jacquinot), Zanzibar (Rousseau), Waigiou island. — Mus. Paris.

lobata Bl. Species more or less depressed. Pores arranged in arcs of six or seven pairs. Two rows of principal tubercles in the interambulacral areas.

Red Sea (Botta), Gorée (Robert). — Mus. Paris.

XXXVI. ACROCLADIA AGASS.

Form elongated. Test very thick, with very large tubercles, unperforated and without crenelations. Spines very large, of smooth appearance although finely striated, of variable form according to the region of the test. Those that surround the mouth are generally flat and much shorter than the others. Pores arranged in arcs. Mouth large, without deep notches Buccal membrane smooth. Auricles closed. The lantern is weak relative to the considerable thickness of the test. Its structure is the same as in the genus *Echinometra*. The pyramids are strongly notched. Teeth with three keels. The known species are all of the present epoch.

trigonaria Agass. — *Echinometra trigonaria* Lamk. — Gualtieri Tab. 108, fig. C. — Rumphius Tab. XII, fig. 1. — Encycl. méth. Zooph. Pl. 139, fig. 2. — *Echinometra caronata* Bl. (young age). — The ambulacral tubercles are very large up to the top. Spines short and flat around the month, lone and with three keels on the dorsal surface. Var. *Echinometra pugionifera* Desml. Tabl. syn. p. 266.

Solomon Islands (Hombron and Jacquinot), Ile de France (Desjardins). — Mus. Paris.

hastifera Agass. Differs from *Acrocl. trigonaria*, which has spines with keels, by the naked ambulacral areas.

Hawaii (Eydeux and Souleyet). — Mus. Paris.

mammillata Agass. — *Echinometra mammillata* Lamk. — Gualtieri Tab. 108, fig. a, — Encycl. méth. Zooph. Pl. 138. — The ambulacral areas do not have large tubercles on the dorsal surface. Spines large, short and cylindrical. — *Echinometra violacea* Bl. Variety with dark spines.

Seychelles (Quoy and Gaymard), Ile de France (Desjardins), Guam, Philippines. — Mus. Paris, Michelin.

Var. minor: *Echinometra depessa* Bl.

Solomon Islands (Hombron and Jacquinot). Michelin.

Blainvillei Agass. *Echinometra Blainvillei* (Dsm. Tabl. syn. 264. Small, flat species that differs from *Acrocl. mammillata* by ambulacral areas even more naked and by the length of the spines that are cylindrical or slightly flattened at the end.

Red Sea, Hawaiian Islands. —Mus. Paris.

XXXVII. PODOPHORA AGASS.

Form elongated. Test thick. Spines in the form of juxtaposed polyhedral shields, as in mosaics, on the dorsal surface of the test. They are in the form of more or less compressed clubs on the lower surface. Ambulacrals are very wide, especially on the ventral surface. Tubercles imperfect mamelons. There are only two rows of them in the ambulacral areas, while the interambulacral rows are numerous. Pores are arranged in arcs of nine to ten or even twelve pairs that curve around the ambulacral tubercles. Mouth large and not notched. Buccal membrane naked, with the exception of the end of the ten calcareous shields of the buccal ambulacral tubes. Auricles thin, hardly fused. Masticatory apparatus of average size. The compasses are transversely truncated. The transverse arcs leave a small groove for the tooth. The teeth themselves are truncated squarely with an interior keel.

atrata Agass. — *Echinus atratus* Lamk. — Encycl. méth. Zoph. Pl. 140, fig. 1–4. — *Echinometra Quoyi* Bl. (young).

Violet tint. The spines of the lower periphery are cylindrical or subcylindrical.

Seychelles (L. Rousseau). — Mus. Paris.

pedifera Agass. — *Echinometra pedifera* Bl. — The tubercles are larger than in *P. atrata*. Tint greenish. Spines of the lower periphery are flat.

Valparaiso (Favarger). — Mus. Paris, Neuchâtel.