

about every 10 feet of rock. The rock was much harder as the shaft descended, and alternated red and white. The rock is not laid in horizontal layers, but is what well-sinkers call *Eddy-Rock*; and not all inclining one way, but crossing one another with great irregularity, and at various angles of descent."

Three of these pits have been formed in the memory of persons now living. The one marked *a* fell in about six or seven years ago. A clergyman, who happened to be near at the time, told me that he was standing by the river side with some boys watching two men, who were fishing, when they heard a noise like thunder; and looking round in the direction of the noise, they saw a mass of earth and stones rising into the air, and then falling down again. One of the men went near, and found that the rock had fallen in, and a pit had been formed about 30 feet in depth, at the bottom of which there was a quantity of water in a state of ebullition. The water continued in this agitated state during the following day, and afterwards gradually sunk. At present the pit is dry, and partially filled up by the falling in of one side.

Another pit, *b*, fell in about twenty-two years ago with a considerable noise, alarming the inmates of a neighbouring house, from which it is only separated by a road, but otherwise doing no harm. It is crater-like, having occurred beneath the gravel, and is now planted as an orchard. The pit marked *c*, mentioned above, fell in about forty years ago. It contains water, but in dry seasons this is nearly all drained away, and the rock is laid bare at the bottom.

These pits are also of frequent occurrence in the parish of Hutton Conyers; there are several in Sharrow, and one in Bishop Monkton, three miles south of Ripon, which was formed between thirty and forty years ago, near the Old Hall. Some men had been engaged in making a stack, and had left it for some purpose, when suddenly the ground gave way beneath the stack, and it disappeared. The place still exists, a receptacle for rubbish.

Perhaps some of the readers of the *GEOLOGICAL MAGAZINE* will be able throw a little light upon the manner in which these singular pits have been probably formed.

NOTICES OF MEMOIRS.

ON *LESKIA MIRABILIS* (Gray). By Prof. S. LOVÉN.

Communicated by Dr. CHRISTIAN LÜTKEN, Assistant Zoologist in the Museum of the University, Copenhagen.

THIS little paper, inserted in the "Proceedings of the Royal Swedish Academy" for 1867, well deserves the attention of palæontologists, though its principal aim is to re-describe a little-known recent Sea-Urchin from the Eastern Seas, because this animal throws a peculiar light on certain important points in the morphology of *Cystidea*. It is, moreover, distinguished by all the ingenuity,

accuracy, and profound knowledge which is peculiar to the works of the celebrated Scandinavian zoologist.

The genus *Leskia* is described, in 1851, by Dr. J. E. Gray, in the "Annals," and subsequently, in 1855, in the "Catalogue of Recent Echinida," from specimens from Lugard, in Mr. Cummings' collection. It is most intimately allied to the *Spatangidæ*, of which it has the general stamp, but is distinguished from them, and therefore the type of a peculiar family (*Leskiadæ* Gray) or tribe (*Palæostomata* Lovén) by the peristome and periproct being closed up with a few "triangular converging valves," those of the vent with some small "spicula" in the centre. Dr. Gray has already remarked that "in the form of the mouth and vent it has considerable affinity with the fossil *Cystidea*, especially the genus *Echinospherites*." The detailed description given by Prof. Löven quite confirms this remarkable combination of features; the characters assigned to the "*Palæostomata*" are as follows: *testa oviformis, peristonium non labiatum, pentagonum, æquilaterale, ore quinqueralis, anus intra periproctium centralis, valvis clausur quinque-octo; aperturæ genitales binæ; semita unica peripetala.* *Leskia* is a true *Spatangoid*, save the mouth and the vent; the latter, instead of being surrounded by a threefold circle of minute plates, the greater and outermost, has only 5, 7, or 8 great triangular outer plates, and an equal number of minute inner papillæ. The peristome is not bilabiate with a prominent under-lip, nor is it formed principally by the ambulacral plates; it is *pentagonal*, and bordered almost exclusively by the interambulacralia; there is no buccal membrane covered with three to five series of irregular plates, decreasing inwards, but the mouth is closed up by five equal triangular plates, inserted on the five sides of the peristome. "No living Echinid has such a mouth;" but the author thinks that the genus *Toxaster* of the "Neocromien Inférieur," whose peristome was pentangular, not labiate might possibly—though the configuration of its mouth somewhat more approaches to that of the true *Spatangidæ*—have had a similar organization.

In the Silurian *Cystidea* again, we find precisely the same structure as in the recent East Indian Sea-urchin, viz., in the commonly so-termed "ovarian pyramid," which, after the opinions of Gyllenhal, Wallenberg, Pander, Hisinger, de Koninck, and Billings, is really the mouth, whilst von Buch, with some inconsequence, makes it the mouth of *Caryocrinus*, but the genital outlet in the other *Cystidea*, and Joh. Müller and Volborth sought the mouth in the centre of the converging ambulacral furrows. The remarkable observations on *Sphæronites pomum* and *Echinoycherites aurantium*, by means of which Prof. Löven draws the conclusion that *Leskia* is a *Spatangoid* with the mouth of a *Cystidean*, we will give with his own words.

"Good specimens of *Sphæronites pomum* Gyll., collected by Prof. Angelin, show its organization more distinctly than usual. He had observed that this animal had *no stalk*, but adhered immediately to rocks or other objects through a part of its lower surface, which is without pores, and surrounded by a ridge formed of the somewhat thickened, free, smooth border of the undermost plates. This sur-

face of attachment is of a very variable form and extension in different specimens,—round and but little excavated in some, oblong and deep in others,—depending upon the nature of the object to which it adhered. On the point opposite to this basal surface lies the apex with the ambulacral apparatus. In the middle a somewhat deepened area *d*, through which five delicate but distinct ambulacral furrows pass towards five arms, whose bases form a circle, which however is broken at *i*, one-fifth of its circumference. Where the furrows reach the arms, they will be seen to pass into an oblong hole *e*, which is the lumen of the broken furrow of the lost arm; in every remaining arm-base you will see an indication of the branching of the arms and of the central channels of the branches. Close up to the ambulacral circle lies the “pyramid” or mouth *a*, closed by its five valves of unequal dimensions, two of them are emarginate on one side in order to give space to the two adjoining outermost arms, which are less than the others, and, as it were, crippled, the right by its vicinity to an oral valve, the left by an apparatus *b*, that cannot be interpreted otherwise than as an external genital organ. When it is tolerably well preserved, it is conical, with a rounded apex, without any terminal aperture; for vestiges of valves I have sought in vain, but in two specimens I found the two pores indicated in the figure. From this organ a ridge *c* runs towards the next arm, suggesting the idea of the possible existence of a “madreporite.” The centre of the brachial apparatus forms with the genital organ, and the oral orifice a compressed but only slightly inequilateral triangle. In *Echinosphærites aurantium* the relative position of these parts is the same, but the triangle, which they form with each other, is much larger, longer, and more inequilateral, because the distances are greater, especially that of the mouth from the ambulacral apparatus, which is correctly described and delineated by Volborth and Joh. Müller. Close to this is seen the other “orifice,” viz., the external genital organ. All specimens that I have examined have this so-termed “orifice” in such a condition that it most likely is the remnant of a prominent broken part, and it must be assumed that in this species also it had a conical form, but remained mainly in the surrounding stone-matrix. Volborth’s figure (Ueber die Russischen Sphæroniten, x. ix. f. 9) appears to be correct, but gives no complete evidence as to the presence of the three valves.” That the “pyramid,” which in *Leskia* is the armature and covering of the mouth, is the same thing in *Cystidea*, is now quite certain; in the last-named group it was, doubtless, also the vent. The mouth does not lie where J. Müller and Volborth sought for it, viz., in the centre of the ambulacral furrows; and the organ, interpreted as the vent by Volborth and von Buch, is more correctly regarded as an external sexual organ.”

It is not my intention to criticise the various interpretations of the morphology of *Cystidea* given by different authors, or to trespass on the space here allowed me by a detailed examination of all the questions entangled with them. But should I venture to express any humble opinion of my own on this important

point in the morphology of *Echinodermata*, I must first confess that *hitherto* I have been very sceptical as to the theory advocated so very ingeniously by Mr. Billings and now upheld by Mr. Lovén. The concordance between these two authorities is nevertheless not so great as would be supposed—that the “pyramid” was the mouth of the *Cystidea*, and that this orifice accordingly would lie elsewhere than in the centre of the ambulacral system, where it lies in *all living* Echinoderms and (I may add, where it did lie, I have no doubt, also in the Palæozoic Crinoids, where no superficial ambulacral channels are to be seen, but where they pursued their way on the *inferior* surface of the “vault” through the “ambulacral orifices” at the base of the arms,—as shown by Mr. Billings, with whose researches [see *Decades Geol. Survey of Canada*] I was, I regret, unacquainted when I wrote my paper on *Pentacrinus*, etc.) I know no other exception to this rule, and would it not be a dangerous thing—not be done without very strong arguments—to give up the leading principle of Palæontology, viz., that only from the organization of the *living* form can we learn to understand that of the *extinct*? Might we not thus too often run the risk of giving up ourselves to the delusions of fancy. When we remember how minute and concealed the mouth often is in *recent* Crinoids, we should not be puzzled at its being almost or quite invisible in *fossils*; and if we should search for the interpretation of an orifice, closed by a definite low number of triangular valves, will not several recent *Echinidæ* (*Echinocidaris*, *Echinometra arbacia*; *Leskia* itself.) give us the answer, that such an aperture *could* (at least) be a *vent*? Nor can I well conceive that an aperture should altogether fail to exist in the centre of the ambulacral system of *Cystidea*. How otherwise could the ambulacral vessels communicate with the interior? And if such an orifice *must* be assumed (though it be often obliterated and hidden in the fossils), why should not this “apical” or “ambulacral orifice” be also the mouth as in *Asteridæ* and recent *Crinoids*, and the valvular orifice be the vent, analogous to the “proboscis” of the Palæolithic Crinoids¹ or the “oral tube” of the living? The superiority of size of the presumed mouth is not, as Mr. Billings thinks, a very good argument. Has not the oral tube in many of our recent Crinoids (*Anteden*, *Actinometra*, *Pentacrinus*) the same preponderance over the minute buccal orifice? Nor has the repeated revision of the published descriptions of other *Cystidea*, accessible to me, convinced me of the correctness of a theory, according to which the mouth would, in many instances, lie very far from the arms, sometimes nearer to the base (the stalk or point of attachment) than to the apex of the calyx. The argument deduced in later times from the presumed existence of five similar peristomatic valves in the recent *Pentacrinini*, I have elsewhere had the opportunity of refuting²; no such hard “clapets” are to be seen in *P. Mülleri*, and until their

¹ The analogy between the valvular aperture of *Caryocrinus* and the “proboscis” of Crinoids is also argued by Mr. Billings (*Dec. No.* p. 14).

² Om Vestindiens Pentacinen, p. 205 (Vidempel. Meddel. f. d. Naturhist Forening, 1864).

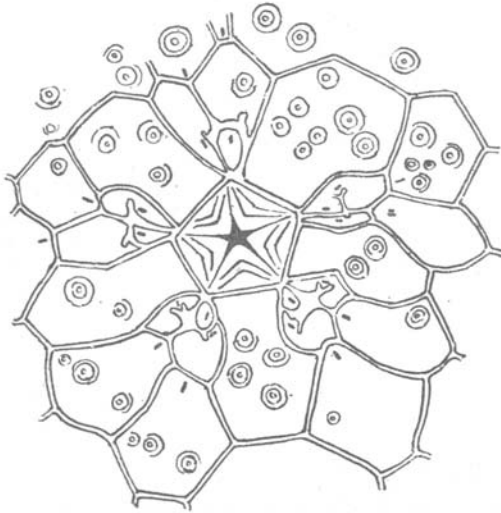


Fig. 1.

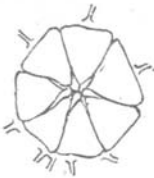


Fig. 2.



Fig. 3.



Fig. 4.

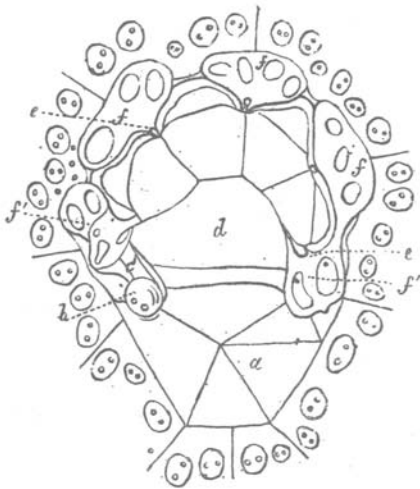


Fig. 5.

Fig. 1. Mouth, and adjoining parts of *Leskia mirabilis*, Gray. Fig. 2. Vent of the same. Figs. 3. and 4. The mouth of *Echinospharites aurantium*, Gyll. Fig. 5. The apex of *Sphaeronites pomum*, Gyll. (a.) The mouth. (b.) The genital process. (c.) Its ridge. (d.) The ambulacral area with its furrows. (e.) The lumen of the furrows. (f.) The base of the five arms.

existence is *proved* in other recent *Pentacrini*, I must doubt, or rather deny, their existence at all!¹ On the other hand, I must confess that matters are considerably altered by these highly valuable investigations of Prof. Lovén, who, for the first time, supports this theory with strong (perhaps convincing) arguments. It is *now* no longer a mere hypothetical supposition—hitherto it was in reality no more—but a real scientific explanation, borne out by well-established facts and undeniable analogies from living forms.² To Dr. Gray we certainly owe the first intimation of this analogy between *Leskia* and *Cystidea*, but while the knowledge of that genus rested on a single examination, there might still linger some doubt whether its importance in this respect had not possibly been overrated. Science, therefore, must be highly indebted to Prof. Löven for his small but valuable memoir, and for the excellent observations laid down in it. The absolute denying of the existence of an apical orifice in that place where, in other *Cystidea* at least, such an orifice was always believed to exist, is particularly recommended to the attention of future investigators of *Cystidea*, as bearing upon the very heart of the question. *Adhuc sub iudice lissit!*

[NOTE.—For a very able account of the internal structure and passages in *Actinocrinus*, *Amphoracrinus*, *Cyathocrinus*, *Rhodocrinus*, *Pentremites*, and *Codonaster*, see Memoir, by John Rofe, Esq., F.G.S., in *GEOL. MAG.*, Vol. II. p. 245, Plate VIII. 1865.]—H. W.

NEW AMERICAN FOSSIL FISH FROM THE DEVONIAN.

(Communicated by Professor C. H. HITCHCOCK, of Lafayette College, Geologist to the State of Maine, etc.)

AT the late meeting of the American Association for the Advancement of Science, Professor J. S. Newberry, LL.D., described a new genus of fossil fishes. The specimens were obtained from the Devonian Black shales of Delaware, Ohio, by the Rev. H. Herzer, and named *Dinichthys Herzeri*, inasmuch as the animal deserved the same distinction among fishes as the *Dinotherium* and *Dinornis* among mammals and birds. Most of the bones obtained belong to the head, which was over three feet long by one and a half broad, and wonderfully strong and massive. All parts of the head were represented, and there were several individuals among the specimens. The cranium is composed of a number of plates firmly anchylosed together, and strengthened near the occiput by internal ribs or ridges nearly as large as one's arm. The external surface is covered with a very fine vermicular ornamentation. The most

¹ Prof. Lovén told me himself that during his last stay in Paris he succeeded in getting access to the original specimen of Mr. Dushascaing, in the collection of the late Mr. Michelin. It did not show the five valves, because it had no peristome at all!

² To these analogies might be added, that between the valves of *Cystidea* and those of the young (larval) *Antedon*.

marked peculiarity in the anatomical structure relates to the form and texture of the jaws and teeth, best understood by the annexed figures.

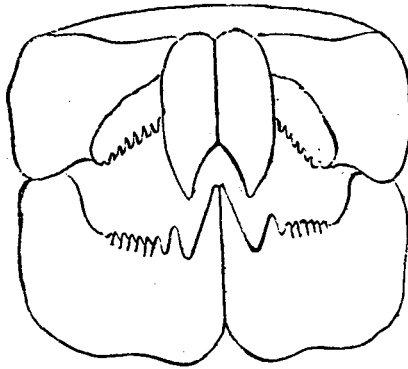


Fig. 1. Anterior aspect of head of *Dinichthys Herzeri*, one-eighth nat. size.



Fig. 2. Mandible of *Dinichthys Herzeri*, one-eighth nat. size.

The head terminated anteriorly and above in two great incisors, representing the premaxillary, behind which on either side are the maxillaries, broad, flattened, dense bones, along the lower edge of which is set one row of small robust teeth, formed by the consolidation and prolongation of the jaw-tissue. The mandibles are over two feet long by six inches deep, laterally flattened and very massive. The anterior extremity was turned up in a huge triangular tooth composed of dense ivory-like tissue, which locked in with the divergent incisors of the upper jaw. Behind this, in some specimens, is another triangular summit, and posterior to it a row of small teeth, corresponding with those of the maxillaries. Such was the power of this tremendous dental apparatus, that the bodies of our largest living fishes would be instantly pierced and crushed by it, if exposed to its action. Behind the head are large thick plates, one of them corresponding to the *os medium dorsi* of the *Heterosteus* of Pander, and being at least of equal size. These bones occur exclusively in concretions.

III.—NEW CARBONIFEROUS REPTILES AND FISHES FROM OHIO, KENTUCKY, AND ILLINOIS.

(Communicated by Professor C. H. HITCHCOCK, of Lafayette College; Geologist to the State of Maine, etc.)

AT the late meeting of the American Association for the advancement of Science, Professor J. S. Newberry exhibited and described specimens of reptiles and fishes from the Cannel stratum beneath the principal coal bed at Linton, Ohio; fishes from the Coal Measures of Illinois, collected by the State Geologist; and fishes from bituminous shale in the *Waverly group*, 125 feet above its base at Vanceburg, Ky., collected by Dr. Patterson. Of these the first series included *Raniceps Lyelli*, Wyman, and others undescribed, partly related to Prof. Huxley's new genera *Ophiderpeton* and *Urocordylus*. Twenty species of fish accompanied these reptiles, among which are eight species of *Eurylepis*, Newb., small Lepidoids allied to *Palæoniscus*, distinguished by having the scales of the sides much broader than long. The scales on several of the species are very highly ornamented. These specimens were gilded by iron pyrites. Some specimens of *Cælacanthus*—two species—indicated the presence of a supplementary caudal fin, as in *Undina*.

This is an interesting fact, confirmatory of Huxley's view of the relations of *Undina*, *Macropoma*, and *Cælacanthus*. The numerous and very complete specimens of *Cælacanthus*, exhibited supply much that was wanting to a perfect knowledge of the anatomy of the genus. The bones of the head are similar in form to those of *Macropoma*, highly ornamented with tubercles above and thread-like lines below. The jugular plates are double, and oblong-elliptical in outline, as in *Undina* and *Macropoma*. The position and form of the fins is the same as in *Undina*, but the anterior dorsal is stronger. The fins are supported on palmated interspinous bones, similar to those of the other genera of the family. The paired fins are slightly lobed; the supplemental caudal has been referred to. The scales are ornamented with curved and converging raised lines. In many specimens the otolites are distinctly visible.

Besides the fishes found at Linton already enumerated, there are scales and teeth of two species of *Rhizodus*—one at least of which (*R. angustus*) has teeth of two forms, the one large and flattened, the other smaller, more numerous, slender, striated, and conical, with a circular section throughout: two species of *Diplodus*, consisting of bony base and enamelled crown, the latter distinctly and beautifully serrated—so that there can scarcely be a question that they were teeth, and not as claimed by Mr. Atthey, of Newcastle, England, to be dermal tubercles. There are also examples of *Palæoniscus scutigera*, Newb., one species of *Pygopterus*, one of *Megalichthys* represented by scales, and numerous species of placoid fishes of the genera *Compsacanthus* and *Pleuracanthus*.

The fish remains from Illinois consisted of a splendid specimen of *Edestes vorax*, Leidy, from the coal at Belleville, opposite St. Louis, and of several individuals of a new species of *Platysomus* from Mason

Creek. The *Edestes* is allied to a fine specimen from Indiana, figured in Owen's Palæontology, p. 124, 2nd ed., and there properly referred to the spine of a Plagiostome. *Platysomus* has not been found in America before.

The fish remains from the Waverly sandstone are from a new horizon, having furnished a single species in Northern Ohio, *Palæoniscus Brainerdi*. The new specimens consist of teeth of *Cladodus* and *Orodus*, with spines of *Ctenacanthus*, and the tail of one of these Selachians distinctly preserved. This is a great rarity, as the soft and even the cartilaginous parts of plagiostomous fishes are usually decomposed, leaving only the detached teeth, spines, and dermal tubercles. The only other similar cases known to the author, are the tail and fins of a *Chondrosteus* from the Lias of Lyme Regis, and the preservation of the form of *Thydina* in the Solenhofen slates. These specimens are from the base of the Carboniferous series, and therefore much older than the European examples. This tail is very heterocercal, like the caudal fin of some living sharks, and indicates an animal seven or eight feet long. The author hopes to be able to gather from this collection the data for uniting many teeth and spines, now described as distinct genera, into the same species.

REVIEWS.

RECHERCHES GÉOLOGIQUES DANS LES PARTIES DE LA SAVOIE, DU PIÉMONT ET DE LA SUISSE VOISINES DU MONT-BLANC. Avec un Atlas de 32 Planches. Par ALPHONSE FAVRE, Professeur de Géologie à l'Académie de Genève. Paris, Victor Masson, 1867.

THIS work, by M. Alphonse Favre, upon the geological structure of the mountains and valleys surrounding Mont Blanc, consists of three volumes, containing in all 1,488 pages, and is the result of the labours of a large portion of the life of a praiseworthy follower of his distinguished countryman de Saussure, and is a full illustration of his previously published remarkable Geological Map of this region. By exhibiting numerous features and structural details in sections, and other illustrations of the physical relations of the rocks, and by bringing to bear on them those lights of palæontology, which were unknown to de Saussure, and in which his contemporaries and countrymen Pictet and Loriol have been so distinguished, he has vastly extended and improved the original sketch by his great master.

Any geologist, who, leaving for the first time the shores of Lake Lemman, may have attempted to reduce to anything approaching classified order the various broken rock-masses which surround Mont Blanc, must have found, to his discomfiture, that they were composed of countless fragments of different sorts, thus presenting a confused assemblage, which seemed to defy methodical arrangement. But, with time and patience, and through a succession of researches in the eastern parts of the great chain where the natural formations,