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PROCEEDINGS  
OF  
THE GEOLOGICAL SOCIETY.

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NOVEMBER 1, 1848.

Douglas Galton, Esq., Lieut. R.E., was elected a Fellow of the Society.

The following communications were read :—

1. *On the supposed impression in Shale of the soft parts of an ORTHOCERAS.* By JAMES HALL, F.M.G.S., State Geologist of New York. (Communicated by Sir Roderick I. Murchison, to whom the notice was sent in a letter dated Feb. 8, 1848, and whose absence from England prevented its being read last session.)

HAVING read, in the Quarterly Journal of the Geological Society for August 1847, a letter from J. G. Anthony of Cincinnati, Ohio, to C. Lyell, Esq., V.P.G.S. London, "*on an impression of the soft parts of an Orthoceras*," it occurred to me that the accompanying remarks and illustrations might not be uninteresting to the Society, and at the same time, perhaps, help towards a rational opinion relative to such bodies as are there described.

It has long been a favourite theory with some naturalists that the fossil Orthocerata are internal shells, of which the external soft parts have perished ; but no person, I believe, until the present time, has

claimed to have discovered remains of these fleshy or muscular parts of the animal. The position in which the body described was discovered, and the condition of the other fossils in the same bed, show the existence of circumstances peculiarly favourable to the preservation of the more delicate *solid* portions of all the then existing species of that immediate neighbourhood. But we have still a right to ask for more evidence as to the nature of these soft parts, and the manner of their connexion with the shell. It appears natural to suppose that the external soft parts of the animal, if any such existed, would be connected with that portion of the internal animal occupying the large outer chamber of the shell. In this example, judging from the figure, and from my recollection of the specimen, the fossilized "soft parts" are found enveloping the smaller extremity of the shell, while the outer chamber and larger extremity is broken off. This condition of the enveloping soft body seems to me an objection to such an explanation, even admitting that the "soft parts" could be petrified under the circumstances. This objection however may not be conclusive, and I would only suggest it for consideration before noticing other facts.

Bodies similar to that described by Mr. Anthony have been known to me in the shales of New York for ten years, but I have always regarded them as concretionary, though on their first discovery they were supposed by several naturalists to be the remains of the external fleshy body of the *Orthoceras*. The peculiar striated surface of Mr. Anthony's specimen corresponds with all those seen in New York, and the bilobate form is likewise the ordinary one. This character however appears to be due to previous compression, for the shell is usually flattened and broken along a central depressed line.

It is scarcely probable that such an opinion would be advanced by any one unless the mind had been pre-occupied by the belief that the *Orthocerata* were composed of an internal chambered shell, and an external soft body enveloping that shell. This prejudice is therefore strongly sustained by such a discovery, should it be proved that bodies of the kind described are found only in connection with shells of the *Orthoceras*; but this is far from being true.

To commence with the lower strata—I have found both the bivalve *acephala* and the spiral univalves with a similar sac-like attachment of what is here regarded as the "soft parts" of the animal, but which I prefer to regard as a shaly accretion with a striated surface\*.

\* Concretionary action takes place in all our shaly deposits in which animal matter exists, particularly if iron be present, to form particles or nodules, or even diffused particles of iron pyrites which aid in producing this action. Vegetable matter is sometimes a nucleus for such aggregation. Often there is no visible nucleus, and we cannot readily determine the first cause of the action. When the nucleus is organic, the concretionary masses or enclosing sacs usually assume a bilobate or bilateral form, in other cases they are of various and irregular forms. The surface of these bodies is almost always striated, and where there is only a thin coating of shaly matter around the organic body, or a harder inorganic calcareous nodule, it appears not unlike the effect produced by smearing some hard body with adhesive clay, and then removing as much as possible by hard pressure and direct motion of the palm of the hand. These surfaces have often the pecu-

These for the most part I have destroyed to procure the enclosed fossil, and have no good representatives from this period.

Fig. 1.



In the Hamilton group such appearances are quite common, and excite little attention. The accompanying figure (fig. 1) represents a *Chemnitzia* (*Loxonema*) with a concretion or sac on either side, which appears as if it may once have been a soft or pulpy mass. In another specimen the shell is nearly covered by this sac, which still preserves its proportions, corresponding to the form of the shell.

In this case there could have been no external animal or soft body to become fossilized; and had the entire soft part of the animal been protruded from the shell, it would not have been half so large as the attached concretion or sac, nor would it have assumed this position. It is evident nevertheless that the form and size of the shell, or of the animal within it, has determined the form and proportions of the adhering concretionary mass; and if it could so act in this instance, why may it not have done the same in the case of the *Orthoceras*? I am unwilling, at least, to admit the existence of such a preservation of the "soft parts" of a Cephalopod, while we have an example so similar among the Gasteropods. I regret that I have no other specimens at hand to show that these are far from being solitary examples.

Among numerous specimens of *Orthocerata*, I select the accompanying figures 3 and 4, which present some analogy with the figure of Mr. Anthony\*.

liar appearance of the "slickensides," except that the striae are finer. Such action takes place almost universally in our black carbonaceous shales of all ages in the palæozoic period; not only appearing in such concretionary masses enclosing fossils of all classes, and in distinct concretions, but also marking the plane shaly or slaty cleavages where there is no evidence of metamorphic action, and where the strata are in nearly a horizontal position. In all these cases iron pyrites, or some action dependent on its presence or production, seems to perform an important part, even to the formation of pseudo-organic forms.

\* [As these figures by Mr. Hall closely resemble that given in a former number of the Journal, from Mr. Anthony's specimen, and here repeated, fig. 2, it has not seemed necessary to engrave them. Mr. Hall also sent a drawing of the second specimen of *Chemnitzia* mentioned above, which has likewise been omitted.—ED. *Quart. Geol. Journ.*]

Fig. 2.

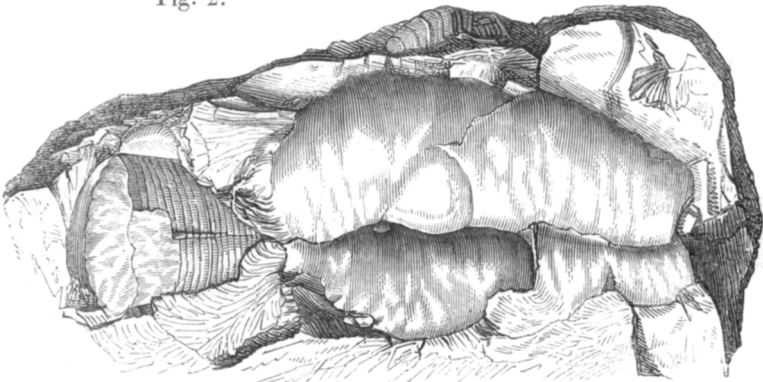


Fig. 3 is from a specimen of the smaller extremity of an *Orthoceras* which has been crushed, and broken along the centre, and where subsequent action has caused a slight accumulation of shaly matter upon the shell, showing the incipient stage of these sac-like concretions. The surface is striated after the peculiar manner of these concretions, and a few of the septa are shown in the middle of the lower part of the figure.

Fig. 4 is from a specimen where the original form of the shell of the *Orthoceras* is lost, and the accumulation of the surrounding material has assumed the aspect of a fleshy sac surrounding the tube as the external fleshy body of the *Orthoceras* is supposed to envelope the internal shell.

These peculiar results of concretionary action are seen in the greatest perfection in the soft, fine shales which are formed from a sediment of impalpable mud, which must have been deposited in the most quiet waters, as evidenced both from its character and from the perfect preservation of almost all the imbedded fossils. The perfect preservation of the fossils in such localities is used as an argument to convince us that these soft parts may be preserved; but we find similar fossils equally well preserved in calcareous deposits, while there is never any evidence of the existence of the softer parts. Again, in these examples the shell is often partially or entirely destroyed by the action of acids, apparently resulting from the decomposition of iron pyrites, leaving only a cast of the interior. In the calcareous deposits of the Trenton limestone, the *Orthocerata* preserve their delicate shell in great perfection; and yet among the multitudes thus preserved, we find no appearance of the preservation of the softer parts of the animal.

Mr. Anthony, in a letter of January 1848, called my attention to the paper cited above, and suggests that this discovery, which seems so well sustained, both by evidence and high opinion, conflicts with the views I have expressed in my 'Report on the Palæontology of New York,' vol. i. I have therefore briefly examined the facts in relation to this specimen, and the conclusions drawn therefrom; and I must leave it to naturalists to decide how far these conclusions can be sustained, or whether they are in any degree impaired by the accompanying facts and illustrations.

With regard to the opinions on the *Orthocerata* advanced in the work just cited, I am far from being anxious to sustain them at the expense of truth, or by the concealment or abridgement of any fact connected with the subject. I have there expressed, however imperfectly, the results of my observations; and I have even hesitated to insist upon conclusions which the facts seemed to warrant. While preparing that work, I examined all the authorities on this subject within my reach. I found little to assist me in regard to the peculiar forms and arrangement of parts of those species peculiar to our Lower Silurian rocks, and was forced therefore to depend on my own investigations. I have proposed a generic name (*Endoceras*), indicating a peculiarity in the mode of development and growth, simply; while I believe the facts would justify a still wider separation than that of

generic distinction. The specimens indeed reveal to us, in the clearest manner, a feature in the physiology,—a mode of growth and reproduction, which separates them widely from all the modern cephalopods; or even from the ancient forms having the usual siphuncular and septate arrangement of recent species\*. If the characters there given can be reconciled with the theory of a large external soft animal, enclosing the shell, the question may remain in its present undecided state; bearing on one side the array of facts, and on the other the theoretical views of naturalists, deduced from those modern cephalopods possessing few characters in common with these ancient forms.

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2. *On Slaty Cleavage* (second communication). By DANIEL SHARPE, Esq., F.G.S.

IN a paper read to the Geological Society on the 2nd of December 1846, on the cleavage of slate rocks†, I endeavoured to work out certain general laws relative to the compression which such rocks had undergone, to the position of the planes of cleavage, and to the connection between their direction and the elevation of the beds. The conclusions were founded upon observations chiefly made in North Wales, Devonshire and Cornwall: I have since visited parts of Westmoreland and Cumberland, with the view of enlarging the field of observation, and the result is contained in the following remarks, which are thrown into the order adopted in the former paper.

*Compression of slate-rocks in a direction perpendicular to the planes of cleavage.*—In the former paper, p. 87, I stated that in all the slaty fossiliferous rocks examined, the distortion of the fossils proved that the mass of the rocks had undergone considerable compression in a direction everywhere perpendicular to the planes of cleavage, and some expansion in the direction of the dip of the cleavage; but that there was no reason to suppose that the rocks had suffered any change of volume in the direction of the strike of the cleavage. And it was inferred that these changes must be general in all slaty rocks, although it might not be easy to find proofs that they had occurred, where organic remains were absent.

There is however more evidence of compression to be found among the beds of unfossiliferous slate than might have been expected; and the examination of their mechanical structure affords quite as strong proofs of pressure as those derived from the distortion of the organic remains.

In the neighbourhood of the roofing-slates there are frequently found beds of a brecciated structure which cleave readily, but from their irregular composition are liable to break. Such beds are

\* The modern Cephalopod, *Nautilus Pompilius*, the anatomy of which is so well known from the labours of Prof. Owen, affords little or no assistance in enabling us to form conclusions as to the physiology and habits of animals like those inhabiting the shells of *Endoceras*.

† Journal of the Geological Society, vol. ii. p. 74.