have a striking general resemblance to those of the orbit of Biela's comet, in the descending node of which body the earth was precisely situated at the time.

FOSSIL CALCAREOUS ALGÆ

THE very important memoir of M. Munier-Chalmas, "Sur les Algues calcaires appartenant au groupe des Dasycladées Harv. et confondues avec les Foraminifères," which was published in the *Comptes Rendus Hebdomadaires* of the French Academy of Science for October 29, 1877, opens up quite a new or almost a new field of research, which has been followed up by the same author in a note presented last month to the Geological Society of France, "On the genus Ovulites." Though regarded by some of the most eminent palæontologists as a monothalmic foraminifer related to Lagena, the genus Ovulites is herein clearly demonstrated to be neither more nor less than an articulation of a siphonaceous alga having very close affinities to Penicellus.

Ovulites margaritula is described by Messrs. Parker and Jones "as a common Foraminifer of the 'Calcaire grossier.' Shaped like an egg, and when full grown about the size of a mustard-seed, it is one of the most elegant of the fossil forms. The large terminal apertures, moreover, curiously impress upon the mind its resemblance to a 'blown' bird's egg. [Written in 1860; nowadays bird's eggs are not thus blown.] It is the largest of the monothalamous Foraminifera. As a species it appears to have been short-lived. Fully developed in the deposits of Hauteville and Grignon it breaks in at once in the Eocene period. It lingers as an attenuated form in the Miocene beds of San Domingo. A recent Ovulite has not been met with. Scarcely another Foraminifer presents us with a similarly brief history—an undescribed form allied to Dactylopora affording almost the only parallel (namely, *Acicularia pavantina*, d'Arch.)."

In passing it may be noted that without doubt this last-mentioned form is also only a portion of a calcareous alga.

The earlier memoir, of which the *Comptes Rendus* publishes only an abstract, reminds us that it is not so very long ago (1842) since Prof. Decaisne demonstrated that a number of marine forms known as zoophytes, Corallina, Cymopolia, Neomeris, Penicellus, Udotea, Halimeda, &c., were in reality veritable algæ. But we may remark that Prof. Schweigger, of Königsberg, had, from actual observation of living specimens of several species of these calcareous algæ at Villefranche, come to the same conclusion in 1818 ("Beobachtungen auf naturhistorischen Reisen. Anat.-phys. Untersuchungen über Corallen," Berlin, 1818). To go back to the pre-Linnean times, Ray (1690) described Corallina as "plantæ genus in aquis nascens," and Spallanzani, Carolini, and Olivi even maintained the same against the peculiar reasonings of Ellis, the authority of Linneus, and despite the conversion of Pallas; but so influenced by authority were, apparently, the botanists down to 1842, that a Professor of Botany in the Edinburgh University (Graham) once politely requested the zoologists to keep *their* cryptogamia to themselves, and a Professor of Botany in the Dublin University (Harvey), in the first edition of his "Manual of British Algæ" (1841), did not include any of the Corallines. Since the memoirs of Decaisne and Chauvin, all this has changed, and we imagine that there is now no difference of opinion existing among botanists as to the general affinities of the living forms of calcareous algæ.

M. Munier-Chalmas in his memoir demonstrates that there must be also added to this group a numerous series of fossil forms which the old authors placed among the polyps, and which most of the modern writers on the subject have ranked among the foraminifera. Bosc in 1806 described and figured (*Journal de Physique*, Juin 1806) some fossil organised bodies under the name of *Rétéporites ovoides*, for which bodies Lamarck in 1816 established the genus Dactylopora. "The most singular varieties of opinion have existed," writes Dr. Carpenter in his well-known "Introduction to the Study of the Foraminifera," "as to the true character of these fossil organisms. In separating them generally from Retepora Lamarck still associated them in the same group of supposed zoophytes; this position was also accepted for the genus by De Blainville and Defranc." [It is but justice to De Blainville to point out that he quotes without disapproval the statement of Schweigger, "que les dactylopores et les ovulites ne sont rien autre chose que des articulations d'une grande espèce de cellaire, analogue à la cellaire salicorne"]. "In 1852 Dactylopora was included among the Foraminifera by D'Orbigny, who showed, notwithstanding, by the place he assigned to it, a misapprehension of the real nature scarcely less complete than that under which his predecessors had lain; for he ranks it in his order Monostègues, next to the unilocular Ovulites, and says of it: 'C'est une Ovulite également percée des deux bouts, pourvue des larges pores placés par lignes transverses.' How utterly erroneous is this description will appear from the details to be presently given, yet D'Orbigny's authority has given it currency enough to cause it to be accepted by such intelligent palæontologists as Pictet and Bronn, who in the latest editions of their respective treatises have transferred Dactylopora to the place indicated by him, not, however, without the expression of a doubt on the part of Bronn as to whether the true place of the genus is not among the Fistulidæ in alliance with Synapta and Holothuria—a suggestion that indicates a perversion of ideas on the subject for which it is not easy to account. The complex structure of the organism in question was first described and the interpretation of that structure on the basis of an extended comparison with simpler forms was first given, by Messrs. Parker and Jones in so unobtrusive a manner as scarcely to challenge the attention which their investigations deserve, and I gladly avail myself of the opportunity which the present publication affords to give a fuller account, with the requisite illustrations of this remarkable type, the elucidation of which seems to me not unlikely to lead to a reconsideration of the place assigned to many other organisms at present ranked among Zoophytes or Polyzoa;" and then follow nine pages of a most elaborate description of every ridge and furrow, of every elevation and depression to be met with in any of the so-called species, so that probably no single vegetable cell was ever before so minutely described.

The genus is placed the eleventh in order of the family Miliolida, a family which contains some of the most typical of Foraminifers. "It may be conjectured without much improbability," writes Dr. Carpenter, "that Dactylopora is only the single representative of a group whose various forms filled up the hiatus which at present intervenes between itself and its nearest allies among the ordinary Foraminifera." But, writes M. Munier-Chalmas, "the study and comparison of species of Dasycladus, Cymopolia, Acetabularia, Neomeris, &c., in the herbarium of the museum, and in that of M. Ed. Bornet, who placed without reserve at my disposal his library and collections of these plants, proved to me that the species of Dactylopora, Acicularia, Polytrypa, &c., are decidedly Algæ, very nearly allied to species of the recent genera just quoted, if not identical therewith. The accompanying figures show plainly, for example, that the genera Cymopolia and Polytrypa may be united; for the typical species thereof offer in every respect the same generic characters, and there is even a difficulty to find for them sufficiently distinct specific characters. Under the denomination of '*Siphoneæ verticillatæ*' I unite (1) Those green-spore bearing algæ arranged by Harvey in the family of the Dasycladeæ; (2) All those fossil gener related to Larvaria, Clypeina, Polytrypa, Acicularia, Dactylopora, and Uteria. This group at present contains over fifty genera, which are for the most part to be met with in the triassic, jurassic, cretaceous, and tertiary strata. In the number of those actually living there is a notable falling off, there being not more than the seven following genera :—Dasycladus, Halicoryne, Cymopolia

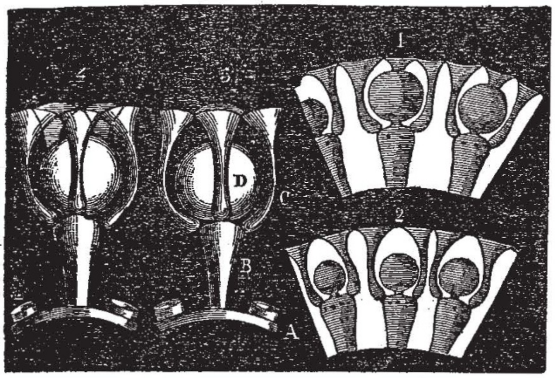

FIG. 1.—Transverse section of a morsel of the calcareous tube of *Cymopolia rosarium*, Lamr., showing the canals which receive the whorl of cellules and the central sporangial cavity. FIG. 2.—Transverse section of *Polytrypa elongata*, Defrance, showing the same portions. FIG. 3.—Part of a whorl of cellules of *Cymopolia rosarium*, separated from the calcareous tube by acid. A, wall of central cellule; B, first row of cellules; C, terminal whorl of cellules, in the centre of which is D, the axillary sporangium. FIG. 4.—Exactly the same parts in *Polytrypa elongata*, obtained from a mould.

(with two sub-genera, Polytrypa and Decaisnella,[1] g.n.), Polyphysa, Acetabularia, Neomeris, and Bornetella,[2] g.n." [Doubtless a few more genera of recent forms yet remain to be described. Thus Chloroclados, of Sonder, appears to be a good and distinct genus allied to Dasycladus.]

"The frond in the *Siphoneæ verticillatæ* is simple or dichotomous; it consists of a central tubular unicellular axis, around which are arranged the radiary and verticellate ramuli, the exact arrangement of which varies according to the genera and to the species. In most of the species carbonate of lime is found deposited in abundance in the outer walls of the main axis and its ramuli, and this forms around the plant a calcareous envelope, in which is reproduced all the details of its organisation. This mineral coating may consist of one or of two calcareous cylinders. The inner cylinder will be formed by the central axis, and the first row of cells which arise therefrom. The outer cylinder is laid down by the most external of the verticels of cells; these terminate by a splayed-out enlargement, the lateral edges of which become more or less consolidated with the similar enlargements of neighbouring cells, and by thus causing a reciprocal pressure, very regular hexagonal surface markings are produced. The organs of fructification are themselves surrounded by calcareous material, and assist in the formation of the outer cylinder, a fact easily seen in any section of Cymopolia."

The result of such an organisation is that when the organic vegetable matter becomes destroyed there still remains in those fossil species, which laid down a great deal of calcareous material, as well as in those living species—which lay down more or less of it—a skeleton permeated by canals (rays of the ramuli) and chambers (fructification). This arrangement, which permits of an exact classification of the fossil species, being wrongly interpreted, led even some most distinguished authors to see in these morsels of plants the full organisation of a Foraminifer."

Space will not permit of the table of the twenty-two genera and seven families as detailed in the *Comptes Rendus* being here given, but every botanist will look forward with interest to the promised future detailed contributions of the author on this subject. Here it seems desirable to add that his conclusions are in every particular acquiesced in by one in every way thoroughly able to judge of the facts, Dr. Ed. Bornet, and having written this I feel it almost superfluous to say that on a careful study myself of specimens prepared by M. Munier-Chalmas—for which I take this opportunity of thanking him—I cannot conceive his demonstration as admitting of a doubt.

ED. PERCEVAL WRIGHT

[1] Type, *Dactylopora eruca*, Parker.
[2] Type, *Neomeris nitida*, Harv. MS.

ELECTRICITY AND WATER DROPS[1]

IT has been known for many years that electricity has an extraordinary influence upon the behaviour of fine jets of water ascending in a nearly vertical direction. In its normal state a jet resolves itself into drops, which even before passing the summit, and still more after passing it, are scattered through a considerable width. When a feebly electrified body is brought into its neighbourhood, the jet undergoes a remarkable transformation, and appears to become coherent; but under more powerful electrical action the scattering becomes even greater than at first. The second effect is readily attributed to the mutual repulsion of the electrified drops, but the action of feeble electricity in producing apparent coherence has been a mystery hitherto.

It has been shown by Beetz that the coherence is apparent only, and that the place where the jet breaks into drops is not perceptibly shifted by the electricity. By screening various parts with metallic plates, Beetz further proved that, contrary to the opinion of earlier observers, the seat of sensitiveness is not at the root of the jet where it leaves the orifice, but at the place of resolution into drops. As in Sir W. Thomson's water-dropping apparatus for atmospheric electricity, the drops carry away with them an electric charge, which may be collected by receiving the water in an insulated vessel.

I have lately succeeded in proving that the normal scattering of a nearly vertical jet is due to the *rebound* of the drops when they come into collision with one another. Such collisions are inevitable in consequence of the different velocities acquired by the drops under the action of the capillary force, as they break away irregularly from the continuous portion of the jet. Even when the resolution is regularised by the action of external vibrations of suitable frequency, as in the beautiful experiments of Savart and Plateau, the drops must still come into contact before they reach the summit of their parabolic path. In the case of a continuous jet the "equation of continuity" shows that as the jet loses velocity in ascending, it must increase in section. When the stream consists of drops following the same path in single file, no such increase of section is possible, and then the constancy of the total stream requires a gradual approximation of the drops, which in the case of a nearly vertical direction of motion cannot stop short of actual contact. Regular vibration has, however, the effect of postponing the collisions and consequent scattering of the drops, and in the case of a direction of motion less nearly vertical may prevent them altogether.

Under moderate electrical influence there is no material change in the resolution into drops, nor in the subsequent motion of the drops up to the moment of collision. The difference begins here. Instead of rebounding after collision, as the unelectrified drops of clean water generally or always do, the electrified drops *coalesce*, and thus the jet is no longer scattered about. When the electrical influence is more powerful, the repulsion between the drops is sufficient to prevent actual contact, and then of course there is no opportunity for amalgamation.

[1] "The Influence of Electricity on Colliding Water Drops." Paper read at the Royal Society by Lord Rayleigh, F.R.S.