

show the hinge and respective position of the dental and socket plates or septa. Reval, Esthonia.

FIG. 10.—*Porambonites gigas*, F. Schmidt. Lower Silurian (2a of Schmidt's classification). Lychholm, Esthonia.

FIG. 11.—*Porambonites (Pentamerus) ventricosa*, Kulorga. Internal cast of ventral valve. 11a. Interior of same valve taken in gutta-percha from the same cast. Lower Silurian. From quarries near the village of Paritz, near Gatschina. This fine internal cast was found and presented to me by Prof. Inostranzew.

FIG. 12.————— Dorsal valve from same internal cast. 12a. interior.

FIG. 13.————— Interior of the rostral portion of the valves, to show hinge and respective position of dental and socket plates in each valve. Taken from the same internal cast.

III.—DESCRIPTIONS OF NEW FOSSILS FROM THE DEVONIAN FORMATION OF CANADA WEST.

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(PLATE IV.)

(Continued from page 16.)

ALVEOLITES (CŒNITES?) DISTANS, Nicholson.

Spec. char.—Corallum ramose, the branches cylindrical, of a diameter of from a line and a half to two lines, dividing dichotomously at intervals of about half an inch, but not anastomosing. Corallites oblique to the surface, with exceedingly thick walls. Calices extremely minute, about one-eighth of a line in their longest diameter, sub-circular, transversely oval, or sub-triangular, level with the surface, and having the lower lip hardly or not at all prominent. Intervals between the calices proportionately very wide—usually about half a line.

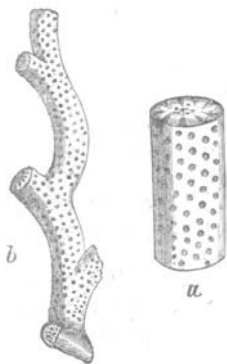


FIG. 4.—*Alveolites distans*, Nich. a. Fragment of the natural size. b. A portion of the same enlarged. From the Corniferous Limestone.

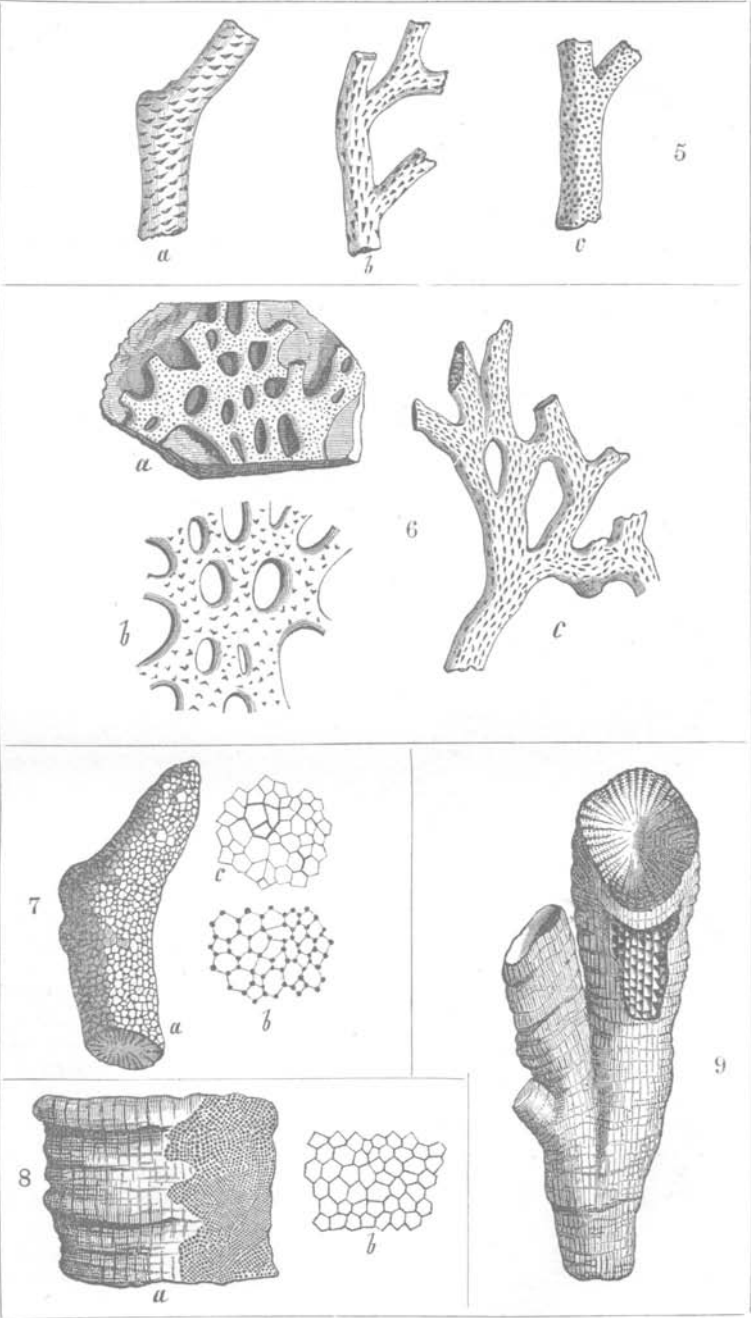
At first sight this species has very much the appearance of a *Cœnites* (such as *C. intertextus*), or of the uncertain form *Alveolites (?) seriato-poroides*, Edw. and Haime. It is, however, distinguished from the former by the non-prominent and not markedly triangular calices, and from the latter (which is almost certainly not an *Alveolites*) by the fact that the corallites are disposed obliquely to the surface.

Alveolites distans is readily distinguished from the other ramose species of the genus by the exceedingly small size of the calices and the proportionately great width between them, as well as by the fact that the calices are level with the general surface or nearly so. There is thus produced the fallacious appearance that the corallites are imbedded in an abundant cœnenchyma.

Locality and Formation.—Corniferous Limestone, Port Colborne.

ALVEOLITES CONFERTA, Nicholson. Pl. IV. Fig. 5, c.

Spec. char.—Corallum ramose, composed of cylindrical or elliptical branching stems, which bifurcate, but do not interlace. Diameter of the stems from two to three lines. Corallites minute,



To illustrate Prof. H. A. Nicholson's paper on New Devonian Fossils.

oblique to the surface, opening by calices which are arranged in irregular diagonal lines, and which have a circular, or transversely-oval, hardly sub-triangular shape. Calices oblique and excessively crowded, about one-sixth to one-eighth of a line in their longest diameter, and separated by intervals of from one-fifth to one-fourth of a line transversely, or the same distance or less measured vertically. There are thus from three to four calices, and from two to three interspaces in the space of one line, measured either diagonally across a branch or vertically.

Alveolites conferta (Fig. 5, c) is allied to the forms described by Mr. Billings under the names of *A. labiosa* and *A. cryptodens*, and especially to the former; but it appears to be decidedly distinct from these or from any other previously recorded forms. It is distinguished by the very minute and close-set corallites, and by the fact that the calices are as a rule not distinctly sub-triangular, and have not a markedly prominent lower lip. No calicine teeth are present. In some respects *A. conferta* has the aspect of a *Cœnites*, especially in the fact that the corallites at first sight appear to be surrounded by a more or less copious cœnenchyma. This appearance, however, is deceptive; and I have no doubt as to the correct reference of the species to *Alveolites*.

Locality and Formation.—Rare in the Corniferous Limestone of Port Colborne and Ridgeway.

ALVEOLITES RAMULOSA, Nicholson. Pl. IV. Fig. 6, a, b.

Spec. char.—Corallum reticulated, composed of flattened sub-cylindrical or cylindrical stems, from two-thirds of a line to two lines in diameter, commonly one line, branching with great frequency and interlacing to form a close network, the meshes of which vary from one to two lines in diameter. Corallites very minute, about three in the space of one line measured diagonally, about one-sixth to one-eighth of a line in their longest diameter, separated by intervals of rather more than one-third of a line. Calices apparently transversely oval, or sub-triangular when perfect, but commonly distinctly triangular; lower lip sharp.

This species represents in the genus *Alveolites* the anastomosing *F. reticulata* in the genus *Favosites*. It presents also a close resemblance in its external appearance to the *Cladopora reticulata* of Hall, from the Niagara group, from which, however, its structure separates it widely. It is distinguished from *Alveolites labiosa*, Billings, to which it is structurally most closely allied, not only by the reticulated form of the corallum, but also by the much more minute calices. It differs from *A. conferta*, Nich., again, in forming a network, in the corallites being much more remotely placed, and in the fact that the calices are generally distinctly sub-triangular or even triangular.

Locality and Formation.—Not uncommon in the Corniferous Limestone of Port Colborne and Lot 6, Con. 1, Wainfleet.

ALVEOLITES BILLINGSI, Nicholson.

Spec. char.—Corallum reticulated, composed of cylindrical or sub-cylindrical stems from two to three lines in diameter, which branch

dichotomously for the most part at angles of about 40° , and anastomose to form an open network, the meshes of which are oval or diamond-shaped, and vary in length from three lines to three-quarters of an inch. As in the preceding species, the network is not always in a single plane, and the branches often coalesce at the nodes of the network to form flattened sub-palmate expansions. Corallites small, crowded, with thin walls, the calices sub-triangular, or, when worn, markedly triangular, with the apex of the triangle directed towards the base of the frond. About three calices in the space of one line, measured either diagonally or vertically. The long diameter of the calices is about one-fourth of a line or rather more, and the interspaces between them, measured diagonally, are about half as much. *Alveolites Billingsi* (See Fig. 6, c, which represents a fragment of the natural size, in which the surface is somewhat worn) is allied to *A. ramulosa*, but is distinguished by the larger size of the stems, the dichotomous mode of division, the more open network, and the larger size and closer arrangement of the corallites. From *A. labiosa*, Billings, it is distinguished by its reticulated form and more closely-set calices.

Locality and Formation.—Corniferous Limestone of Port Colborne and Lot 6, Con. 1, Wainfleet.

Genus CHAETETES, Fischer.

Gen. char.—Corallum ramose, massive, or incrusting, composed of elongated basaltiform corallites, which are in close contact and are not united by any coenenchyma. Tabulæ well developed; septa absent; no mural pores.

The genus *Chaetetes* is nearly allied to *Favosites*, but is separated by the absence of mural pores. Very similar in all essential respects to *Chaetetes* is the genus *Stenopora* of Lonsdale, the differential character of which is stated to be the presence of minute styliform processes at the angles of the calices, whilst the corallites are contracted at intervals in planes parallel with the surface, and the ridges bounding the calices are granulated or tuberculated. Good authorities, however, reject the genus *Stenopora* altogether, and refer the forms placed here partly to *Favosites* and partly to *Chaetetes*. Lastly, the genus *Monticulipora* has been founded by D'Orbigny, to include species of *Chaetetes* which increase by gemmation, instead of fissiparously, as is ordinarily the case in the genus.

In the present state of our knowledge it seems almost impossible to separate these three genera; or, at any rate, it is certainly often impossible to decide positively, after the most careful examination and comparison, to which of them a given specimen may actually belong. In the Hamilton formation of Western Canada occur three small corals, which are certainly referable to one or other of these three genera, and which I shall provisionally consider as belonging to the genus *Chaetetes*. I have been unable to identify any of the three with previously described forms; and I have, therefore, been compelled, though with great reluctance, to consider them as new, though from the insufficiency of many existing descriptions it may subsequently be proved that they are some of them identical with forms already known.

CHAETETES MONILIFORMIS, Nicholson. Pl. IV. Fig. 7, a, b.

Spec. char.—Corallum ramose, the branches having a diameter of from three to five lines. Corallites polygonal, with thin walls, for the most part nearly equal in size, but having a few very small ones intercalated amongst the larger ones. The surface exhibits rounded eminences ("mamelons") placed at distances apart of rather more than a line, over which the calices are larger than in the intervals between them. About four of the ordinary calices occupy the space of one line. At each of the angles of each calice is a minute but conspicuous nodular thickening, which gives a peculiar beaded appearance to the surface, but which is not prolonged inwards into the interior of the corallite as a spine. On the contrary, well-preserved specimens show that these bead-like or moniliform thickenings of the angles of the calices are continued above the general surface in the form of short blunt spines, which communicate to the coral a roughness readily perceptible to the touch.

Chaetetes moniliformis appears to be readily distinguished from previously recorded examples of the genera *Chaetetes*, *Monticulipora*, and *Stenopora*, by the moniliform thickenings of the angles of the calices and the spiniform surface projections thence proceeding. The walls of the calices (Fig. 7, b) are thin, and are themselves destitute of spines or tubercles, the spines exclusively proceeding from the points where the angles of contiguous calices come together. *Stenopora spinigera* of Lonsdale carries spines, as its name implies, but these are borne by the walls of the calices all round, and the other characters of the fossil are different. *Stenopora exilis*, Dawson, from the Carboniferous rocks of Nova Scotia, also possesses spines; but these likewise spring from the margins of the calices, are much more numerous than in the present species, and are different in form and arrangement, whilst the calices are oval instead of being polygonal, and the entire coral is of a more slender and branching habit. In addition to its peculiar spines, *Chaetetes moniliformis* is further characterized by the comparatively large size of the calices, their thin walls, their polygonal form, and (with the exception of those occupying the "mamelons") their nearly equal dimensions.

Locality and Formation.—Rare in the Hamilton Shales of Widder, Township of Bosanquet.

CHAETETES BARRANDI, Nicholson. Pl. IV. Fig. 7, c.

Spec. char.—Corallum ramose or forming small lobate masses, with a diameter of from two to five lines. Corallites polygonal, thin-walled, nearly equal, though with some smaller ones irregularly intercalated amongst the larger ones. The surface does not exhibit distinct eminences, but here and there are groups of corallites slightly larger than the ordinary ones, and separated by intervals of about a line and a half. From four to five calices in the space of one line.

This species (Fig. 7, c) is closely allied to *C. Goldfussi*, Edw. and H., but is distinguished by the fact that the calices are markedly polygonal, instead of being circular or oval, and that they are sub-equal, with a very few smaller ones intercalated amongst them,

whereas in the latter species there are interspersed numerous exceedingly minute calices amongst those of ordinary size. From the well-known *Chaetetes tumidus*, of the Carboniferous rocks again, the present species is distinguished by the polygonal shape of the calices, their thin walls, and their much larger size; the corallites of the former being thick-walled and nearly circular, and there being about eight of them in the space of one line.

Locality and Formation.—Not rare in the Hamilton Group at Widder, Township of Bosanquet.

CHAETETES QUADRANGULARIS, Nicholson. Pl. IV. Fig. 8.

Spec. char.—Corallum forming exceedingly thin crusts of from one-tenth to one-sixth of a line in thickness. Corallites sub-equal, with very thin walls, about eight in the space of one line, for the most part polygonal, but often quadrangular in shape. The surface is smooth, and destitute of eminences, nor are there groups of larger corallites regularly interspersed amongst the smaller ones.

Chaetetes quadrangularis is found commonly encrusting *Heliophyllum Halli* and *Cystiphyllum vesiculosum*, and often forming expansions of considerable extent. The crusts, however, are of excessive thinness, and are apparently never composed of more than a single layer of corallites. It is distinguished from *C. tuberculatus*, Edw. and H., to which it is most nearly allied, by the tenuity of the crusts, the smaller size of the corallites, the absence of distinct eminences or gibbositities of the surface ("mamelons"), and the very commonly quadrangular form of the calices.

Locality and Formation.—Not uncommon in the Hamilton shales of Bartlett's Mills, near Arkona, township of Bosanquet.

Genus HELIOPHYLLUM, Hall.

The genus *Heliophyllum* is particularly well represented in the Devonian rocks of Canada, no less than nine species having come under my notice as occurring in rocks of this age. Of these, six species, viz. *H. Halli*, *H. Canadense*, *H. Eriense*, *H. Hayugaense*, *H. exiguum*, and *H. colligatum*, have been recorded and described by Mr. Billings (Canadian Journal, new series, vols. iv. and v.), and one species, viz. *H. Colbornense*, has been described by myself. All these species occur in the Corniferous Limestone, *H. Halli* alone, so far as at present known, passing on into the Hamilton group. I have now, however, to record from this last-mentioned formation one apparently new species of this genus, together with another from the Corniferous Limestone.

HELIOPHYLLUM SUB-CÆSPITOSUM, Nicholson. Pl. IV. Fig. 9.

Spec. char.—Corallum small, simple or compound, cylindrical, or slightly expanding towards the calice. Arched striæ upon the flat sides of the septa, and spines upon their free edges, placed at distances of from a third to a quarter of a line apart. Calice oval or circular, shallow. Septa apparently sixty in number, at a diameter of eight lines. Epitheca with numerous annulations and constrictions of growth. Occasional individuals, with the other characters of the species, appear to be simple; but the majority of examples increase by the production of lateral buds. The new corallites thus pro-

duced by parietal gemmation are few in number (generally one or two, rarely three), and are directed upwards, nearly in the direction of the parent corallite. In some cases calicular gemmation appears also to occur.

H. sub-cæspitosum has a general resemblance to *Cyathophyllum cæspitosum*, Goldf.; but the presence of well-marked septal striæ and septal spines, proves it to be a true *Heliophyllum*. The latter species, also, is "fasciculated or astreiform," and increases principally by calicular gemmation, whereas *H. sub-cæspitosum* never produces sufficient buds to form aggregations of any size, and the increase is principally or entirely by parietal gemmation. It is, further, distinguished from the other forms of *Heliophyllum* by its comparatively small size, its cylindrical form, and its mode of growth, standing in this last-mentioned respect almost alone among the species of the genus. *H. proliferum*, Nich., increases in the same way, but is a much larger species, and is distinguished by other characters as well.

Young individuals of *H. sub-cæspitosum* are usually strongly nodulated with irregular growth-swells, and have a length of from half an inch to an inch, with a diameter at the cup of from two to three lines. Large individuals have a length of from two to three inches, with a diameter at the calice of from eight to ten lines.

Locality and Formation.—Common in the Hamilton Shales of Bartlett's Mills, near Arkona Township of Bosanquet.

HELIOPHYLLUM PROLIFERUM, Nicholson.

Spec. char.—Corallum large, simple or compound; growing socially in particular localities, where numerous individuals occur together, nearly in contact, though not organically connected. Form cylindrical, with numerous irregular growth-swells in the majority of examples. Calice moderately deep, with about sixty septa at a diameter of fourteen lines. The septa are unequally developed, and extend to the centre of the calice, where they are usually more or less twisted, and are sometimes elevated in the form of a central boss. Arched septal striæ and spines from a third of a line to half a line apart. Some individuals appear to be simple; but most increase by the production of lateral buds, which spring from the parent corallite in an obliquely ascending manner. The epitheca exhibits numerous encircling striæ and annulations of growth. Large individuals have a length of seven or eight inches or more, with a calicine diameter of an inch and a half, and a similar diameter throughout.

H. proliferum is readily distinguished from the other species of the genus by its elongated cylindrical form, its increase by lateral gemmation, and its social habit. Not only is the species composite, in the sense that most examples produce one or more lateral buds, but, so far as I have observed, it is strictly social, vast numbers of individuals occurring together, growing vertically, side by side, but separate. I have not seen more than one or two buds borne by a parent corallite, and calicular gemmation appears to be unknown. The only other species of *Heliophyllum* known to increase by lateral

gemmation is *H. sub-cæspitosum*; but this is a very much smaller form, and is solitary in its habits. Detached individuals of *H. proliferum*, in which budding appears not to have taken place, may usually be recognized by their great length and almost cylindrical form, there being little or no increase of diameter as the calice is approached. There are also usually regularly developed constrictions and swellings of growth.

Locality and Formation.—Extraordinarily abundant in one bed of the Corniferous Limestone at Ridgeway.

EXPLANATION OF PLATE IV.

- FIG. 5.—*a.* Fragment of *Alveolites cryptodens*, Billings. *b.* *Alveolites lobiosa*, Billings. *c.* Portion of the stem of *Alveolites conferta*, Nicholson. All of the natural size. From the Corniferous Limestone.
- FIG. 6.—*a.* Fragment of *Alveolites ramulosa*, Nich., natural size. *b.* Portion of the same magnified. *c.* Fragment of *Alveolites Billingsi*, Nich., natural size. From the Corniferous Limestone.
- FIG. 7.—*a.* Fragment of *Chaetetes moniliformis*, Nich., enlarged. *b.* A portion of the surface of the same still further enlarged. *c.* A portion of the surface of *Chaetetes Barrandi*, Nich., greatly enlarged. From the Hamilton Group.
- FIG. 8.—*a.* Portion of the crust of *Chaetetes quadrangularis*, Nich., encrusting *Heliophyllum Halli*, slightly enlarged. *b.* A few of the calices of the same greatly enlarged. From the Hamilton Group.
- FIG. 9.—*Heliophyllum sub-cæspitosum*, Nich., of the natural size. From the Hamilton Group.

(To be continued.)

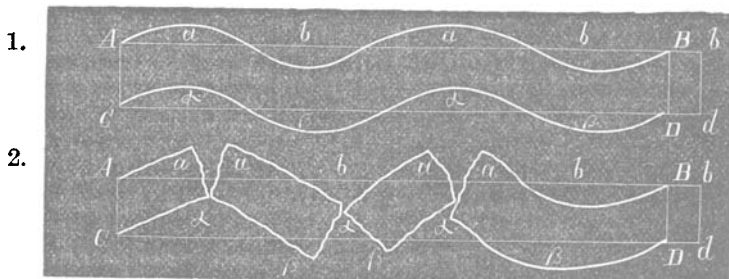
IV.—ON THE FORMATION OF MOUNTAINS VIEWED IN CONNEXION WITH THE SECULAR COOLING OF THE EARTH.

By the Rev. O. FISHER, M.A., F.G.S.

Being the substance of a paper read at Cambridge, December 1, 1873.

AS a further contribution to the subject of mountain elevation, of which the Editor of the MAGAZINE has given an interesting and lucid *résumé* in his late Presidential Address to the Geologists' Association,¹ I send an outline of a paper which was read by me in December before the Cambridge Philosophical Society.

The subject required to be treated in too technical a manner to appear in full in the MAGAZINE, or I should have chosen that as the vehicle for its publication; for it was in truth a continuation of a paper which has already appeared in these pages.²



Referring to that paper for the explanation of the meaning of the

¹ See GEOL. MAG. 1873, Vol. X. p. 530.

² Vol. X. p. 248.