

girdle. The body-scales have likewise been found associated with the bones.

We have also good reason to conclude that the genus *Archichthys* occurs not only in other coal-fields, but likewise considerably lower in the Carboniferous series.

#### EXPLANATION OF PLATE VI.

View of the inner surface of a portion of a mandibular ramus of *Anthracosaurus Russellii*, a little reduced in size : *a*, alveolar border ; *b*, inferior margin ; *c*, inner or splenial plate ; *d*, outer plate or dentary bone ; *e*, depression in alveolar border ; *f*, elevated straight portion of ditto ; *g*, impression of first tooth of the series ; *h*, remains of the last ditto.

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#### X.—*On Foraminifera from the Gulf and River St. Lawrence.* By G. M. DAWSON\*.

SEVERAL of the species of Foraminifera found in the Gulf of St. Lawrence have been noticed by Principal Dawson in vol. v. of the 'Canadian Naturalist,' p. 188 *et seq.* The following Table (pp. 88, 89), however, is the only approach to a complete view of the species and their distribution hitherto attempted.

Many of the deeper samples were small quantities of mud brought up in sounding, by Capt. Orlebar, R.N., of the Coast Survey, and by him kindly presented to Dr. Dawson.

The specimens from Labrador were obtained from material dredged by the officers of the Geological Survey ; those from Prince-Edward Island were from a sample secured by C. Robb, Esq. ; and those from the bank of Newfoundland were obtained from the late Sheriff Dickson, of Kingston.

The somewhat extensive series from Gaspé Bay was obtained during a dredging-expedition in the summer of 1869. The mud was sampled when brought up by the dredge, and reserved for examination, the depth being ascertained as carefully as possible. Several very rich and interesting samples are also from the dredgings of Mr. J. F. Whiteaves, F.G.S., in Gaspé and its vicinity.

The means were, unfortunately, not at hand for ascertaining the temperature of the bottom. But though there is reason to believe that the water at Gaspé Bay is somewhat warmer than the Gulf of St. Lawrence in general, the mud as it came over the boat's side felt icy cold to the hand, showing even here what a great effect the iceberg-laden arctic current has on the bottom temperature. The number of species tabulated must not in every instance be taken as a criterion of the rela-

\* From the 'Canadian Naturalist,' June 1870 ; communicated by the Author.



tive richness of the localities, as much often depends on the amount of material at disposal. This is especially the case when comparing dredgings with soundings.

The general aspect of the Gulf-of-St.-Lawrence Foraminifera is northern, and in many places closely resembles the fauna of the Greenland coast and the Hunde Islands, as given in Parker and Jones's memoir (Phil. Trans. 1865). The gulf, at least so far as its Foraminifera are concerned, evidently belongs to the Arctic province, the limits of which skirt the Banks of Newfoundland, and pass thence southward to Cape Breton.

The refrigeration of its waters depends on the arctic current, which, entering the Straits of Belle Isle, floods the whole bottom of the gulf with water almost at the temperature of the Arctic seas. To these conditions the series of collections from Gaspé offers somewhat an exception, and is of a slightly more southern character, both as regards the species represented and the development which they attain. This difference depends on purely local causes, which, while slightly changing the character, give opportunities for a very abundant development of Foraminifera, more especially of the arenaceous forms. Gaspé Bay in no part exceeds 50 fathoms in depth, is about twenty miles in extreme length, well land-locked, and disturbed by no other current than that caused by the ebb and flow of the tide. The depth is not so great as to allow of the incursion of the cold and deep layer to any great extent; and the proximity of land and the shelter thus afforded tend still further to modify its temperature.

The bottom, in most of the deeper parts, is composed of fine sand and mud; and this it is which favours the very large development of arenaceous forms.

Past the mouth of Gaspé Bay sweeps the very strong tidal current of the St. Lawrence; and immediately we pass the shelter of Ship Head and come within its influence, the changes in the Foraminifera become strikingly apparent. The bottom consisting for the most part of clean gravel or coarse sand, most of the arenaceous forms disappear at once, and, instead of the abundance of *Nonioninas* and *Miliolas* previously found, a very large proportion consists of *Planorbulina lobatula*, which can hold its own, attached to seaweeds and polyzoans. *Polystomella arctica* also becomes somewhat prominent, while the *Lagenidæ* and *Entosolenidæ* appear in abundance.

What few sandy forms do occur are depauperated and composed of very coarse particles. The Foraminifera as a whole, however, are very abundant, and in some samples dredged by Mr. Whiteaves almost equal in quantity those in the deeper Atlantic soundings.



In the estuary of the St. Lawrence itself, *Bulimina pyrula* becomes a somewhat common form. Among forms which in the Gulf of St. Lawrence may be mentioned as specially characteristic of deep water are *Nodosaria* (*Glandulina*) *lævigata*, *Globigerina bulloides* (very small), *Bulimina*, principally *B. squamosa* (also small), *Uvigerina pygmæa*, *Cassidulina*.

From depths greater than 100 fathoms all the Foraminifera are very small and delicate; and Lagenidæ, Buliminidæ, *Globigerina bulloides*, together with a few depauperated *Nonionina*, constitute the greater part of the fauna. From these depths also come many Diatoms, mostly *Coscinodiscus*, and sponge-spicules. *Polystomella striatopunctata* is almost everywhere prevalent, though it nowhere attains to any very great size, and below about 30 fathoms becomes small and generally rare, and continues increasing in rarity till it almost disappears at 300 fathoms. In some localities, at about 30 fathoms, *P. arctica* is abundant, and greatly surpasses in size the ordinary *Polystomellæ* occurring along with it. The remaining *P. striatopunctatæ* also at this depth often show a remarkable proneness to run into modifications resembling one or other of the numerous species and varieties into which the genus is subdivided; but as the transition series are complete, it is very difficult to place the bulk of the specimens satisfactorily under them. It has been thought better, in the Table, to include as many as are easily seen to be modified *striatopunctatæ* under that name. *Nonionina labradorica*, though not so universally distributed as the above, is a very characteristic species in the gulf. It seems to be best developed and in largest numbers at about 30 fathoms. It thins off both in numbers and size as we go into shallower water, and decreases much in size, though not so perceptibly in numbers, as the water deepens to 100 fathoms and below. There is a remarkable absence of Miliolas in the estuarine parts of the gulf, which strongly contrasts with their abundance in Gaspé Bay and also on the Atlantic coast of Nova Scotia, and south.

One specimen of a curious sandy form of *Cornuspira foliacea* was obtained at a depth of 18 fathoms at Gaspé.

*Biloculina ringens* scarcely occurs above 30 fathoms.

At Murray Bay, which is only about sixty miles below the point where at least the surface of the St. Lawrence becomes permanently fresh, the Foraminifera become very scarce and poor. *Polystomella striatopunctata* is the most common, but it has become very small. *Nonionina labradorica*, *Lituola canariensis*, and *Trochammina inflata* also occur, but all much reduced in size, and, relatively to the amount of material examined, scarce. On passing from the gulf to the east of



Newfoundland, or to the south of Cape Breton, a change from the gulf fauna is immediately detected. *Polystomella striatopunctata*, there so common, becomes rare. *Nonionina labradorica* to a great extent ceases to appear, and *Uvigerina pygmaea* and *Cassidulinidae* become more frequent.

The arenaceous *Lituola findens*, D. & P. (1)\*, *Hippocrepina indivisa*, D. & P. (2), *Lituola cassis*, D. & P. (3), are most plentiful at depths less than 20 fathoms. *Lituola scorpiuris* (4) goes down to the greatest depths in Gaspé Bay, and is yet abundant at 10 fathoms, while the immense *Rhabdopleura*? (7) only appears at about 20 fathoms, and continues from that point increasing in numbers and size to the depth of 50 fathoms, which is the greatest depth in Gaspé Bay, where alone it has been found.

The distribution of these Foraminifera would tend, with other facts, to show that these organisms, together with most other marine animals of low organization, do not depend to any great extent on the depth or intensity of daylight, but almost entirely on the *temperature* of the water, as Dr. Carpenter maintains in his account of his recent deep-sea dredging; so that they would not give very satisfactory evidence of the conditions of deposit of Postpliocene or other beds, unless other facts were at disposal to show the depth, when the Foraminifera would give valuable assistance with regard to the climatic conditions at that depth. The quality of the bottom, however, has much to do with the general *facies* of the Foraminifera, as with other animals; for, as shown above, calm water, with a bottom composed of fine sand and sediment, is particularly favourable to the arenaceous forms, though, even under these conditions, they do not thrive in the very cold, deep water (such as that below 100 fathoms) in the open gulf. A strong current at once causes all sandy forms to disappear, mostly, no doubt, from the want of the fine materials necessary for their shells, and brings in a large preponderance of *Planorbinae*, *Lagenidae*, &c.

The arenaceous forms, with the exception of those which are tubular, constitute a series parallel to the calcareous forms, and the members of which graduate into one another. It seems not improbable that the individuals of the same species may assume either appearance. It does not appear, however, that the same individual can present both forms at successive periods. On the other hand, the sandy forms may really constitute a distinct group parallel to the others. Sketches of some interesting new forms are given. Dr. Parker has kindly assisted in naming some of the arenaceous forms. There are

\* The figures refer to the numbers of the woodcuts.



also in the Gaspé collections some irregular arenaceous forms adherent to stones, along with *Truncatulina*; these have not been figured.

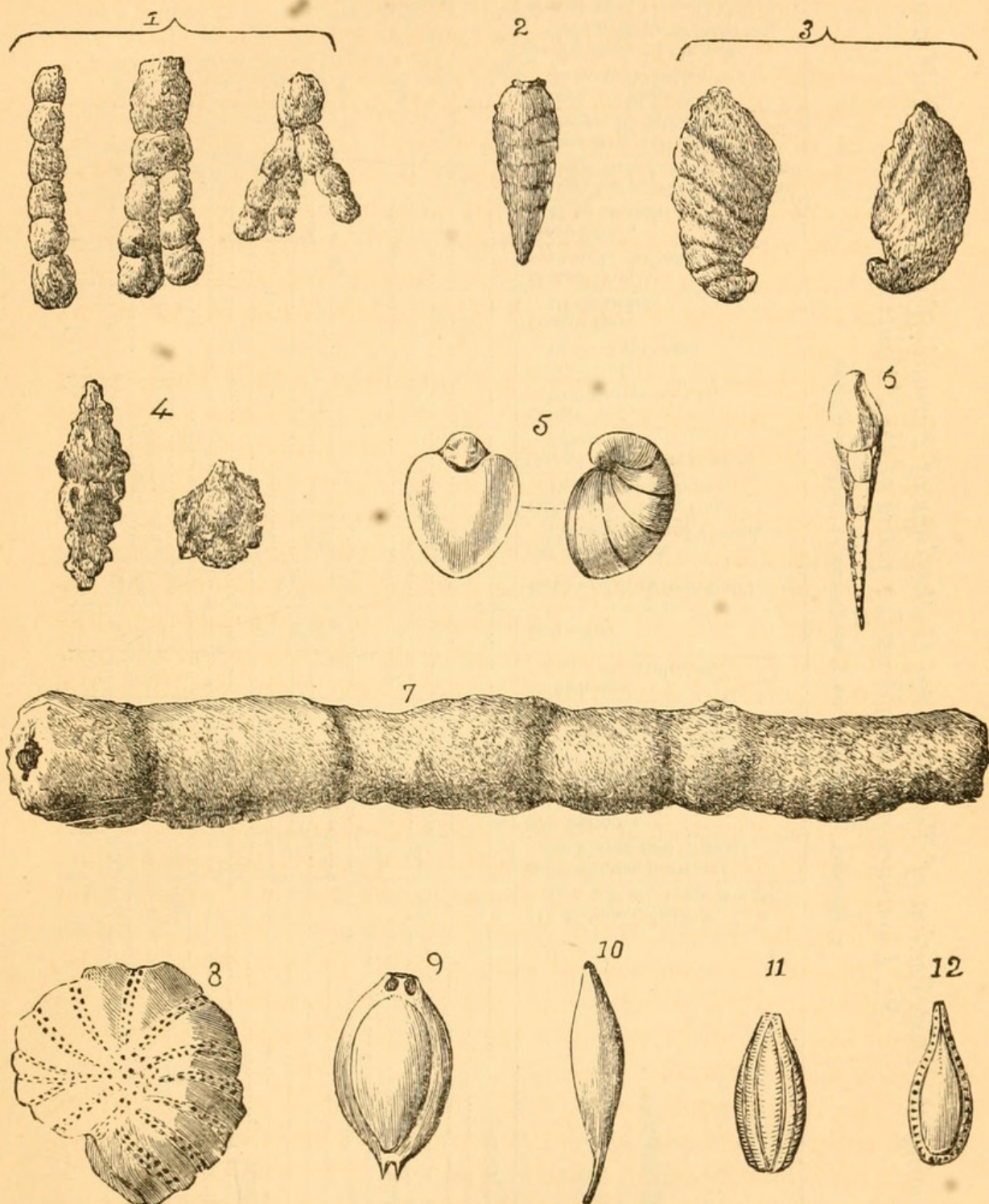


Fig. 1. *Lituola findens*, D. & P.

Fig. 2. *Hippocrepina indivisa*, D. & P.

Fig. 3. *Lituola cassis*, D. & P.

Fig. 4. *Lituola scorpiuris*, var.

Fig. 5. *Nonionina scapha*, var. *labradorica* (313 fms.).

Fig. 6. *Bulimina Presli*, var. *squamosa* (313 fms.).

Fig. 7. *Rhabdopleura*?

Fig. 8. *Polystomella arctica*.

Fig. 9. *Biloculina ringens*.

Fig. 10. *Lagena sulcata*, var.

Fig. 11. *Entosolenia striatopunctata*.

Fig. 12. *Entosolenia marginata*.

Figs. 1, 2, 3, 4, & 7 are drawn to a scale half that of the other figures.











TABLE II.—*Supplementary List of peculiar Arenaceous Forms.*

See figs. 1–4 and 7.

FORAMINIFERA.	Labrador.	Gaspé Bay, 10 fathoms (sand).	Gaspé Bay, 10 to 15 fathoms.	Gaspé Bay, 16 fathoms.	Gaspé Bay, 18 to 20 fathoms.	Gaspé Bay, 16 to 17 fathoms.	Gaspé Bay, off Grande Grève, 35 fathoms.	Gaspé Bay, off Grande Grève, 40 to 50 fathoms.	Gaspé Bay, St. George's Cove.	River St. Lawrence, off Cape Rosier (Whiteaves).
<i>Lituola flndens</i> , D. & P. (fig. 1).				* C L	*	*			* R	
<i>Hippocrepina indivisa</i> , D. & P. (fig. 2).				* C L	* C					
<i>Lituola cassis</i> , D. & P. (fig. 3)		*	* C	* C L						
— <i>scorpiuris</i> (fig. 4).	*		* C	* C L	*	* C	* C L	* C	* C	* C L
— —, var. (fig. 4).				* C L			* C L			
<i>Rhabdopleura</i> ? (fig. 7)						*	* C L	*	* C L	* C L

# XI.—*Outline of some Observations on the Organization of Oligochaetous Annelids.* By E. RAY LANKESTER, B.A. Oxon.

FOR some time past I have, as opportunity offered, examined the structure of the freshwater and terricolous Annelids. I have already published an account of the larval form of *Chaetogaster* (Trans. Linn. Soc. 1868), and of its sexual form (Quart. Journ. Microscopical Science, 1869), to which I have now something to add; I have also briefly described the remarkable genital setæ which characterize *Nais* equally with *Chaetogaster* (Ann. and Mag. Nat. Hist. 1869), and have shown that the Naididæ as a group present in their development two very distinct forms—the one larval, reproducing by fission, the other sexual, of a limited number of segments, provided with additional segments interposed between segments present in the larva, arising by new growth, bearing peculiar setæ and the generative organs—the setæ of the whole worm differing also to some extent in the adult and larval forms.

The mud-banks of the Thames about and below London swarm with countless masses of red worms belonging to the Sænuridæ; and these, besides others from ponds at Hampstead, have furnished me with abundant material. I propose to give a short statement of some new facts, which I hope to illustrate with detailed drawings hereafter. The immense profusion of the worms in the Thames mud, of which they are the almost solitary occupants of high organization, is surprising. They appear to exist under the most favourable conditions as re-





Dawson, George Mercer. 1871. "X.—On Foraminifera from the Gulf and River St. Lawrence." *The Annals and magazine of natural history; zoology, botany, and geology* 7, 83–90. <https://doi.org/10.1080/00222937108696324>.

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