

is mainly sustained by the dew, which may be seen at sunrise dropping off the leaves. The porosity of the coral rocks retains like a half dry sponge moisture enough for growth. There is everywhere here a remarkable plant known as the Life plant (*Bryophyllum calycinum*), a leaf of which pinned up against a wall throws out rootlets and young plants from each indentation of the margin, these are nourished apparently by the air alone, for which reason the plant is sometimes called the Air Plant.

I have compiled a work entitled "In the Bermudas" dealing with all the fauna and flora of the islands, and containing a large amount of interesting history which will give details of use to naturalists. I only wish the O. F. N. C. could get an outing here, but I fear many of them after a day among the flowers here would feel loath to return to a northern clime.

H. B. SMALL.

Hamilton, Bermuda, }
April 12th, 1898. }

THE CRETACEOUS OF ATHABASCA RIVER.

By J. B. TYRRELL, M.A., B.Sc., F.G.S., F.G.S.A.

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In the spring of 1893 the writer descended the Athabasca river from Athabasca Landing to Athabasca Lake, on his way to unknown portions of the Barren Lands west of Hudson Bay. The descent of this river was only a preliminary part of the work of the season, to be accomplished with as little delay as possible, so that no stoppages were made except such as were necessary for preparing the meals, pitching camp, examining rapids or making portages.

Besides, Mr. McConnell, of the Geological Survey, had carefully examined the river a few years before, and had given an excellent account of the character and thickness of the rocks which compose its banks.

The rocks first met with below Athabasca Landing are all

of Cretaceous age, and in describing them Mr. McConnell gives a section as follows :

La-Biche Shales, upper.....	700	Montana.
La-Biche Shales, lower.....	225	Colorado.
Pelican Sandstone.....	40	
Pelican Shales.....	90	
Grand Rapids Sandstone....	300	
Clearwater Shales.....	275	Dakota.
"Tar Sands".....	220	

The upper parts of the La Biche shales are thus correlated with the Montana terrane, which corresponds to what is usually known as the Fox Hills and Pierre formations in most of the reports of the Geological Survey of Canada. The lower portion of the La Biche shales, the Pelican sandstone and shales, the Grand Rapids sandstone and the Clearwater shales, were correlated with the Colorado (Niobrara and Benton) terranes, while the "Tar Sands," in which no fossils were found, were provisionally classed with the Dakota.

The observations which it was possible for the writer to make were chiefly confined to the examination of a few horizons in this section and to the collection of fossils at occasional localities, and while they do not add anything to the accuracy of the section in itself, they may add something to our knowledge of the correlation of the beds with those along the Manitoba escarpment in western Manitoba, and they besides indicate the existence in this rather remote northern region of a Dakota fauna of distinctly marine type.

For the provisional generic or specific determination of the fossils, thanks are due to Mr. J. F. Whiteaves, Palæontologist to the Geological Survey, but since many of the species, though determinable, are as yet undescribed, letters of the alphabet have been added to them to designate them more exactly, where it is necessary to speak of their range through different beds.

Sixteen miles below the mouth of La Biche river the Cretaceous shales contain, along with crystals of selenite, many rounded calcareous grains, apparently foraminifera, associated with *Ostræa congesta*, *Baculites ovatus* and fragments of a small gasteropod and of a large aviculoid. They also contain bands of nodules of limestone, many of which are mottled like the

calcareous bands in the Niobrara shale of Manitoba, and contain foraminifera, oysters, gasteropods, &c.

A few miles lower down the stream another outcrop of hard gray mottled shale was observed. It contained, besides the little calcareous dots representing foraminifera, fragments of fish bones, and a few specimens of *Ostræa congesta*, and was thus precisely similar in general appearance to the Niobrara shale of North-Western Manitoba.

The presence of this foraminiferous horizon, with its association of other fossils, would go to confirm Mr. McConnell's conclusions that these lower beds of the La Biche shales are of Niobrara age.

The Pelican sandstones and shales were not closely examined, but as they are evidently poor in fossils, Mr. McConnell having found none in them, they would in that respect, as well as in position, correspond closely with the Benton shales of Manitoba, in which fossils are very rare.

In the Grand Rapids sandstones, at Grand Rapids, a large ammonite was seen, which seemed to be clearly *Hoplites McConnelli*, but it was found impossible to get it out.

An Burnt Rapids the interesting glauconitic band described by Mr. McConnell as occurring in the Clearwater shales (which are everywhere very arenaceous) was carefully examined, and found to be very similar to some rather persistent green bands in the upper portion of the Dakota sandstone along the banks of Red Deer river, and in exposures in the adjoining area of North-Western Manitoba, and the whole bank had very much the general appearance and character of many of the Dakota beds.

At the foot of the bank the following fossils were collected, some of which had already been collected by Mr. McConnell from the same vicinity : *Ostræa congesta*, *Camptonectes* sp. *a*, *Modiola* sp. *a*, *Nucula* like *N. Coloradoensis*, Stanton, *Yoldia* sps. *a* and *b*, *Callista tenuis* ?, *Protocardia boreale* ?, *Panopæa* sp. *a*, *Chemnitzia* like *C. Coalvillensis* Meek, *Actæon* sp. *a*, a gasteropod of uncertain affinities and a conical tooth like that of *Teleosaurus*.

Eleven miles lower down the stream the Clearwater shales were again searched for fossils and the following were found :

Camptonectes sp. a, *Yoldia* sp. a, *Callista tenuis*?, *Panopæa* sp. a, *Dentalium* sp. a, *Lunatia* sp. , *Hoplites* like *H. McConnelli*, but with much stronger ribs.

At Boiler Rapids, where the "Tar Sands" first crop out from beneath the Clearwater shales, many masses of rotten ferruginous limestone were lying on the beach, apparently derived from the top of the "Tar Sands." From these were collected *Pecten* sp. a, "large, four inches high, and higher than broad, nearly smooth, one valve convex, the other flat" (Whiteaves). A small gasteropod, and a small ammonite, perhaps a form of *Hoplites McConnelli*.

At middle rapid a large number of fragments of ferruginous limestone were lying on the beach, derived from bands in the "Tar Sands." From these were collected specimens of fossil wood. *Pecten* sp. a, *Camptonectes* sp. a, *Inoceramus* sp., *Modiola* sp. a, *Cytherea* or *Cyprina* sp., *Panopæa* sp. a, *Dentalium* sp., *Hoplites McConnelli*, and fragments of large dinosaurian bones.

At the head of the bend above Crooked Rapids, a thin band of ferruginous limestone outcrops at the very base of the Tar Sands and from it were obtained a number of specimens of *Pecten* sp. a, and fragments of a minute gasteropod.

From the list of fossils above enumerated it will be seen that the fauna of the arenaceous Clearwater shales continues downwards into the conformably underlying "Tar Sands," and as far as could be determined from the few traces of fossils seen in the Grand Rapids Sandstone, it also contains essentially the same fauna.

It is to be noted, that the fauna is marine, and not fresh water, as in the original Dakota of the States to the south.

In lithological character, also, as well as in stratigraphical position, all these beds are very similar to the Dakota Sandstones of Western Manitoba.

The palæontological evidence thus appears to show that it is necessary to modify Mr. McConnell's correlation of the Cretaceous of the Athabasca river to the extent of taking all the beds below the base of the Pelican Shales out of the Colorado Group, and of grouping together the Grand Rapid Sandstone, the Clear-

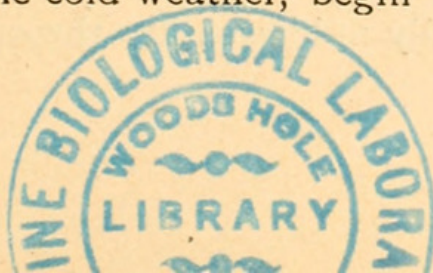
water Shales, and the "Tar Sands" as one formation. This is a marine formation, stratigraphically equivalent to the Dakota, the fossils of which are practically the same throughout, and although no corresponding marine fossils are known elsewhere in the west, it appears to represent the marine conditions of the Dakota Period.

BIRD MIGRATION 1898.

To the Editor of the Naturalist.

The bird migration of the present spring, so far as it has yet progressed, has developed some features which I think are worthy of note.

The usual course of the migratory movement of the earlier part of the season may be described somewhat as follows:—As soon as the March thaw has made sufficient progress to lay bare a good part of the surface of the ground—say one-third—the earliest of the true migrants begin to arrive. The song sparrow and the robin are generally first, but they are followed in three or four days, if not actually accompanied, by the bluebird and several species of grackle. These are all ground-feeders, at least at this time, for the winter visitants and the storms have stripped the trees and shrubs of the last remains of last season's fruits and seeds, so that the only food supply is that which has lain all winter under the snow. Should the warmth of the sun bring out a few winged insects in sheltered nooks, an odd phoebe will be found looking after them; but he may be considered a venturesome pioneer, while all the other flycatching birds still linger in their winter homes. Probably every individual of these first arrivals will have spent, at least the latter part of the winter in Southern New York or Pennsylvania, for the first two species regularly winter there while the others, though retiring somewhat further south at the commencement of the cold weather, begin to push northward early in February.





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