

physical character of the upper clay shows that it was largely derived from the erosion of land surfaces by stream and wave action. It must have been deposited in a considerable depth of water because of its fineness and the even, undisturbed character of its bedding.

The physical character of the Champlain clays in the Ottawa district shows that different climatic and physical conditions existed during the times of deposition of the lower and upper clay. Up to the time of maximum submergence of the land the ice-sheet was probably not far distant, but during the greater part of the time when emergence of the land was taking place the ice had retreated far to the north. The physical character of the marine deposits also suggests that the sea rose on the land as the ice-sheets retreated.

The Significance of the Molluscan Fauna of the Champlain Clay.

Fossil marine shells of species of mollusca occur abundantly in the Champlain clays of the Ottawa district, but they are confined almost exclusively to the lower clays. The commonest and most characteristic fossil shell found in the lower clay is *Portlandia* (*Yoldia*) *artica* Gray (= *Leda glacialis*), from the abundant occurrence of which in the clay the name "Leda clay" was given by J. W. Dawson. The molluscan fauna of the lower clays in the Ottawa district also includes *Nucula tenuis* Mont., *Macoma calcarea* Chemn., *Saxicava rugosa* Lin., *Natica affinis* Gmel., *Neptunea despecta* Lin., *Cylichna alba* Brown, and *Astarte compressa* Mont. (?). Fossil shells of these species have all been found by the writer to occur in the lower clays at various localities in the vicinity of Ottawa. They have with one or two exceptions been previously reported to occur in the clays of the Ottawa district.¹ These species of mollusca are all, in European waters, high arctic.² They are nearly all, however, known to be living in the colder parts of the Gulf of St. Lawrence. A notable exception is *Portlandia artica* Gray, which is not known to occur

¹ Ami, H. M., Geol. Surv., Can., Ann. Rept., vol. X11, 1899, pt. C, Appendix.

² Brögger, W. C., "Om de Senglaciale og Post-glaciale Niraforondringer i Kristiani-feltet"; Norges Geologiska Undersøgelse No. 31, 1901, p. 681.