

south of the Strait of Belle Isle.¹ *Portlandia artica* "now lives in sea water at a temperature below 0 degrees Cent and thrives in the muddy waters discharged at the mouth of glacier streams."² The silty lower clays holding *Portlandia* and other fossil shells of arctic species occur in the vicinity of Ottawa at altitudes from 130 feet in the lowest portion of the Ottawa valley up to at least 510 feet above sea-level, the highest locality, so far as known, being at the above-mentioned locality near Kingsmere. *Portlandia artica* also occurs in the sand beds in the upper portion of the lower clay, as well as many other species; but the forms are generally small as compared with those of the lower portion, apparently showing an amelioration of temperature conditions. The fauna occurs in the lower clays most abundantly at altitudes from 175 feet up to 275 feet above sea-level.

The upper clays are generally nearly barren of fossil shells. This is especially the case in their upper portion. In the sand layers interbedded with clay layers near the base of the upper clays, *Macoma Balthica* Lin. sometimes occurs in considerable numbers. *Saxicava rugosa* also occurs and, rarely, small forms of *Portlandia*. In general, though, the abundant and characteristic fauna of Arctic species found in the lower clays is absent from the upper clays.

As the typical and common species of the lower clays have been found to live abundantly in high arctic seas only at depths of from about 10 to 30 metres,³ and as these clays in the vicinity of Ottawa occur at altitudes of from 130 feet up to at least 510 feet above the sea, and occur abundantly at altitudes from 175 feet up to 275 feet above the sea, hence it is evident that the sea must have stood at a considerably lower level with respect to the land when the lower clays holding shells of arctic species were deposited in the lower part of the Ottawa valley than when those at high altitudes were deposited. The clays at low altitudes could not have been deposited during the time of emergence of the land for they are

¹ Whiteaves, J. F., "Catalogue of the marine invertebrata of eastern Canada," Geol. Surv. Can., 1901, p. 127.

² Wright, W. B., "The Quaternary Ice Age," p. 327.

³ Brögger, W. C., *Ibid.*, p. 681.