

are deposits of great extent in our country, apparently more or less connected with the beaches, which are referable to this class of accumulations. This will not confuse the practical geologist, for he reflects that as the country gradually arose from the ocean, the original sea bottoms would be brought to the surface, and have beaches deposited upon them manufactured from their own ruins. They occupy much more of the surface than all the other forms of modified drift combined. Many of the deposits called *Pleistocene* by geologists are ancient sea bottoms or beaches.

Under this head we embrace all those deposits which contain remains of pelagic animals; as, for example, the lower parts of the Champlain clays in Canada and Vermont. The same kind of deposits at higher elevations may not contain fossils. On the shore of Lake Erie, by rising about 240 feet, the well-marked terraces disappear; and from that level to 650 feet the surface of northern Ohio presents the characters of these ancient sea bottoms. A rise of water 250 feet above Erie, or 850 feet above the ocean, would submerge northern Indiana, Illinois, Michigan, much of New York and Canada West, with much of Wisconsin and Iowa, all which exhibit more or less of these sea bottoms. The same is true of the country near the coast in New England, especially in Rhode Island and Massachusetts. The Pampas of South America and the Steppes of Siberia are also of this class.

The superficial character of sea bottoms is a broad expanse of level or undulating surface, composed entirely of water-worn materials. Many of the Western prairies, especially those confined between ranges of mountains, may be taken for the type. Fine clay and sand, or loam, may compose most of the materials; but bowlders and coarse gravel may have been dropped by melting icebergs, and thus be intermingled with the finer materials.

We introduce here the description of a series of deposits combining both the sea beaches and sea bottoms.

*Champlain Clays.*—From the mouth of the River St. Lawrence to Lake Ontario, and in the Champlain valley from Montreal to Whitehall, N. Y., and thence to New York City, there are numerous deposits of clay, silt, sand and fine gravel, more or less abounding in marine fossils—molluscs and mammalia. Along the sea-coast from Maine to the Gulf of Mexico, similar deposits occur. These are called *Champlain clays* or *Lawrentian deposits*, from the localities where they are best developed. They extend as high as 540 feet above the ocean, at Montreal, and to 400 feet in the valley of Lake Champlain. The lowest member is a tough, blue clay, containing fossil shells, which must have inhabited very deep water. Those inhabiting the deepest waters were *Foraminifera*; such remains as have been brought up by sounding from the bottom of the Atlantic ocean. These are in the very lowest strata, immediately overlying the bowlder clay. Some of the species of shells observed are extinct; as the *Nucula Portlandica* and *N. Jacksoni*, etc. Thus the character of this lower member is clearly an ancient sea bottom.

Overlying the clay is a mixture of clays, sand, silt and gravel, containing numerous species of littoral shells, such as are now found upon the sea-shore. The most common are *Sanguinolaria fusca*, and *Mya arenaria*, the long clam. Remains of cetacea have been found in Vermont, and of other mammalia in the Southern States. Most clearly, then, all the banks containing these fossils are ancient sea beaches, and the ocean level during this period has been sinking, and the land rising.