e.g., at the 4,420-foot, 4,480-foot, 4,620-foot, 4,830-foot, and 6,560-foot levels (Goodell, 1969, p. 534-535). Oöids are sand-sized grains which have one or more coats of microscopic-size, needle-like crystals of calcium carbonate around them. Sometimes the "nucleus" (original part which received the coatings) is a very small fragment of a marine shell, but it can be practically any small sand particle. When an oöid which has several coats of crystals is cut in two, the coats show as concentric rings. The crystals of these layers are arranged in very orderly patterns, and when viewed under high magnification, are often found to have a radial arrangement with the "needles" pointing outward from the center. These needle-like crystals are composed of one of the pure forms of calcium carbonate which is called aragonite.

The fact that these oöids appear in abundance at various levels, such as those listed above, shows that at various times in the past there were periods of many years when the environment of the bank was of a type especially suitable for their formation. Oöids can form only in very special environments. There must be (a) warm, very shallow water, (b) a moderate amount of turbulence, such as is produced by a strong ocean current coming up over the western edges on to the Bahama Banks, (c) the proper amount of calcium carbonate and carbon dioxide, and (d) probably one or more kinds of organic action by algae or bacteria. When these conditions are present the crystalline coatings are gradually precipitated on to the grains as the ocean currents cause them to roll back and forth on the bottom.

All studies of this Bank point to the inescapable conclusion that it was formed <u>in situ</u>. (If it had somehow been heaped up by a catastrophic process bringing huge quantities of carbonate sediments from the sea floor, it would contain high proportions of fine-grain deep-sea ooze, terrigenous silt and clay from the nearby continent, and terrigenous materials from the nearby Cuban land mass. We must therefore allow time enough for the growth and production of the shallow-water, carbonate sediments of which it is almost entirely composed, and also time for the cementation processes involved in forming the limestone and dolostone layers. Since the sides of the Bank have such a steep slope, it is absolutely necessary that we recognize that effective cementation of the lower strata occurred before the layers above were added. Otherwise, the perimeter would have been unstable and the sediments lost from the lower layers when the weight above was added. See Friedman (1975, p. 379-384) for a brief description of this type of cementation, and the almost universal presence of it in limestone deposits.

With regard to the length of time required for lithification, we should also remember that the cementation of marine sediments is a slow process. Furthermore, for the dolostone, this had to also include time for the bringing of the magnesium ions into the sediment mass by percolating water. We must not forget that the total amount of cementing mineral which must be carried into the pores of the sediment mass, in order to transform it into dense limestone or dolostone, is truly enormous. (Frequently 50% of the substance of such limestone and dolostone is made up of cement crystals.) (Friedman, 1975, p. 380-381; Bathurst, 1975, p. 439-442)

A further time requirement found in the strata of the Great Bahama Bank is that some of the deep layers are of types of limestone which are formed only when the surface on which the sediment lies is exposed to weathering processes at least periodically. This made possible the freshwater cementation which is evident from the types of cement crystals