BAHAMIAN OÖLITIC SAND[1]

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ABSTRACT

Deposits of oölitic aragonite sand are being formed in a discontinuous belt in very shallow waters along the margins of the Great Bahama Bank. In a studied area south of Bimini, there is strong negative correlation between water depth and oölitic structure of the grains suggesting that waters less than six feet deep are optimal for oölite formation. The largest percentage of oölitically coated grains, and the grains with the greatest number of lamellae are concentrated in, and just below, the intertidal zone, where they are in contact with sea water judged to be supersaturated (metastable) with respect to aragonite. The metastable condition is believed to result from the fact that tidal flow over the barrier rim of the shelf lagoon brings relatively cool, CO_2-rich water into a shallow, heated, turbulent zone so rapidly that organic extraction of calcium carbonate does not keep pace with the increase in carbonate saturation due to CO_2 loss.

Each oöid consists of a *nucleus*, usually an abraded shell fragment or a recrystallized fecal pellet, surrounded by a concentrically laminated *envelope*, which may range in size from a thin, superficial coating to a layer comprising seven-eighths of the volume of the grain. Grains with a thick, laminated envelope tend to be subspherical or ellipsoidal. Grains with few layers may be any shape, depending on the form of the nucleus. The distinctive and environmentally significant feature of these grains is judged to be the laminated layer. Consequently, the term "oöid" is here used for grains displaying this structure, regardless of the shape. "Oölite" refers to aggregates of oöids.

The concentric lamination of the envelope is due to the presence of distinct, relatively unpigmented, lamellae which are regular in thickness (about one to three μ) and composed of submicroscopic crystals of aragonite with *c*-axes oriented tangential to the lamination. In addition to these *oriented aragonite lamellae* the envelope contains *unoriented cryptocrystalline aragonite*, generally more heavily pigmented and occurring both as discontinuous layers and lenses intercalated between oriented aragonite lamellae and as irregular blebs transecting the concentric structure. A fabric seemingly identical to that of the unoriented cryptocrystalline aragonite of the envelope occurs also in pellet nuclei and in recrystallized skeletal grains. Thus the unoriented fabric is at least in part demonstrably a product of recrystallization, but it may in part result from interstitial precipitation.

The grains contain much organic matter, which occurs both as perforating filamentous algae and as a gelatinous substance resembling organic detritus and tending to concentrate in the unoriented aragonite.

It is concluded that the oriented lamellae represent grain growth by the addition of aragonite at the grain surface as a physicochemical precipitate. The unoriented aragonite is believed to result from interstitial recrystallization (and possibly precipitation) associated with organic matter incorporated in the grain (1) as the organic fraction of a fecal pellet, (2) as an adherent film of organic detritus, and (3) as remains of boring algae.