PROCEEDINGS OF THE FIRST SYMPOSIUM ON THE GEOLOGY OF THE BAHAMAS

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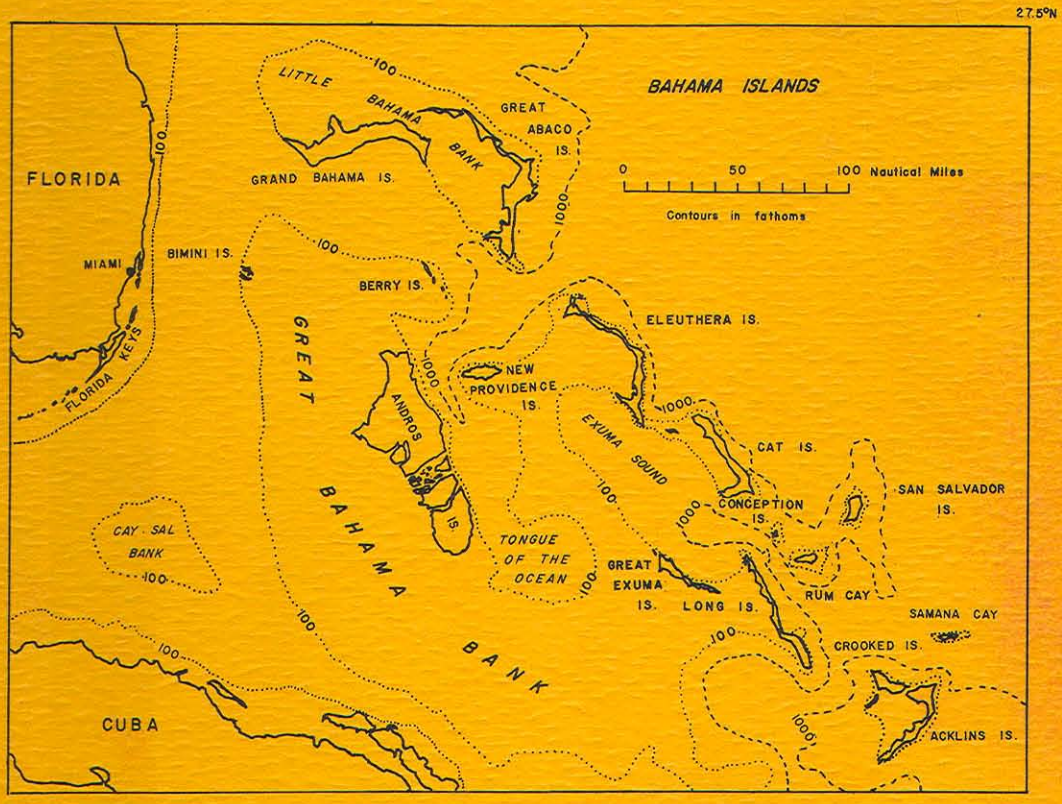

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QUATERNARY STRATIGRAPHY OF SAN SALVADOR, BAHAMAS

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Although much study has gone into the processes of sedimentation occuring on the Bahamas platform, surprisingly little work has been done on the near-surface stratigraphy of the region. A relatively simple, testable hypothesis relating glaciations, sea level fluctuations and facies patterns is presented herein. It describes the Quaternary stratigraphy of San Salvador Island, in particular, and perhaps the Bahamas in general.

A Glacio-eustatic Hypothesis

A series of Quaternary sedimentary cycles have been produced in the Bahamas as a response to glacial-related high and low stands of the sea level. During interglacial epochs the Bahamian platform was largely submerged. Carbonate sediment produced at such times consists largely of shell fragments in various stages of comminution, pellets and such chemical elements as ooids and grapestone grains. At the onset of glaciation sea levels drop and portions of the platform begin to emerge. Loose sediment is reworked into an emergent facies pattern. At any one location shallow subtidal deposits become overlain by beach and then dunal deposits.

Emergence is likely to be followed by relatively rapid cementation. Bahamian carbonates tend to be loosely lithified by

sparite rim cements. This hardens and protects the emergent facies patterns from later reworking.

Emergence is also followed, given time, by the development of a karst surface. The most notable features include the karst crusts, red soils and solution phenomena. The karst surface is of great stratigraphic value as it provides an obvious marker horizon which defines the top of the sedimentary cycle.

Eventually, with the end of the glacial epoch, sea levels once more rise and the exposed portions of the platform are submerged. Advancing seas erode coastal rocks and provide a large amount of small carbonate clasts for the next cycle of sedimentation. Nevertheless the previously formed emergent facies pattern is mostly unaffected by the return of the seas. These sediments have lithified and cannot be reworked.

With complete submergence the end of the cycle is reached. With resumed glaciation the next cycle will begin. In the meantime a carbonate-clast, rich veneer of sediment is produced. This will become the raw material for the next sedimentary cycle.

Thus cyclical sea level changes produce asymmetrical sedimentary cycles. Soft transgressive sequences become reworked and cemented into a permanent regressive facies pattern.

Quaternary Stratigraphy of the Bahamas

The literature of Bahamian geology reveals that several workers have looked at bedrock and have appreciated the significance of karst surfaces as stratigraphic markers. Despite

this, very little has been done to establish a formal Quaternary stratigraphy in the Bahamas.

Supko (1977) found, in his study of a 168m drill core from the island of San Salvador, at least five Pleistocene soil surfaces, all within 75m of the surface. The upper 7m of his core was described as carbonate sands, below this were micritic sands and below 37m he found mostly dolostones.

Other workers have not had the advantage of drill cores to examine. Lind (1969), in his study of Cat Island, recognized two unconformable Pleistocene units which he called the "old" and "young" eolianites. Supko (1970) noticed a similar two-fold stratigraphy in his study of Bimini. His first unit, the "old Bimini", was postulated to be late Pleistocene aged. It was described as in intraoosparite and largely dunal in origin. Overlying this, and separated from it by a karst surface, was the "New Bimini" unit, a Holocene aged beach deposit. Supko speculated that this unit was the product of storm activity.

Supko reported similar karst surfaces on Grand Bahama, New Providence, Andros and Mores islands and on Green Cay. He considered these surfaces to comprise an "important geologic feature" of the Bahamas.

Scant as it is, the literature suggests that Quaternary stratigraphy in the Bahamas consists of an unknown number of units bounded by Karst-crusted unconformities. The two most recent of these are commonly exposed. A key handicap in these studies is the complete lack of index fossils and a scarcity of reliable radiometric dates.

Surficial Stratigraphy of San Salvador Island

There appears to be a least one island-wide, karst-crusted unconformity on the island of San Salvador. It often appears as an obvious red karst crust with solution features; sometimes it is a subtle, uncrusted hiatus. The latter is most common close to the shoreline where karst features were less likely to have formed.

The unconformity can be seen in a number of shoreline exposures running the lengths of the western, southern and eastern shorelines of the island (stars on the index map). It can also be seen in the dolines and quarries of the Sandy Point vicinity and the dolines around Line Hole Settlement.

The units below and above this unconformity have been named the Grotto Beach and Grahams Harbor limestones, respectively (Titus, 1980). The facies patterns of the two units are remarkably similar and both record cycles of emergence. Both units begin with extensively cross-bedded and rippled, shallow subtidal facies. The Grotto Beach Limestone is more fossiliferous and contains coral reef deposits. Each unit grades upwards into a gently sloping, sheet-laminated beach facies. The Grahams Harbor Limestone contains beachrock boulder and large clasts of Grotto Beach Limestone within this facies. The upper portions of both units are composed of thick, extensively crossbedded eolianites. These dune deposits make up the higher elevations of the island.

A third and older unit may be represented by dunal deposits exposed in the deep dolines on Sandy Point and at the

Sandy Point Plantation quarry. Radiometric dates are needed to clearly establish that antiquity and validity of this unit.

Conclusions

At least two stratigraphically separable and quite mappable limestone formations can be recognized on San Salvador Island. The model presented herein relates glaciations and sea level changes in such a way as to account for the emergent facies patterns of these units. This model could easily be tested by extending its application to the other islands of the Bahamas. A formal Bahamian Quaternary stratigraphy appears to be a desirable and attainable goal.

References Cited

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