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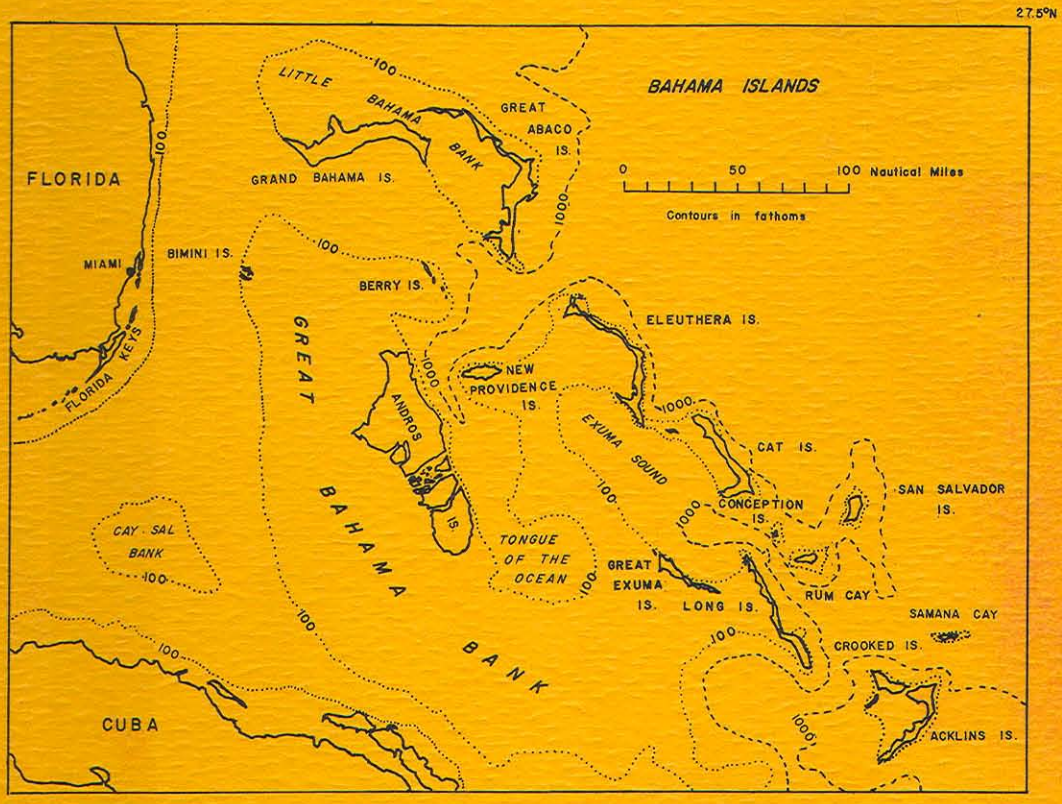

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THE USE OF AMINO ACID RACEMIZATION DATING FOR UNRAVELING THE CHRONOSTRATIGRAPHY OF SAN SALVADOR, BAHAMAS

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Various investigators have attempted to analyze the stratigraphy of San Salvador (i.e., Titus, 1980; Supko, 1977). Titus (1982) has proposed a three unit subdivision for the rocks that outcrop on San Salvador. Although that scheme is workable from a physical stratigraphy point of view, and indeed seems to match well with the rocks exposed on other Bahamian islands (Supko, 1970), it nonetheless, does not yield a viable chronostratigraphic understanding of San Salvador's Late Pleistocene geologic history.

In an attempt to refine our understanding of the chronostratigraphy of San Salvador, amino acid racemization analyses have been conducted on samples of Cerion sp., Chione cancellata, and Acropora cervicornis by my colleague Dr. John Wehmiller of the University of Delaware. Initial results from these analyses indicates that the rocks exposed on San Salvador range in age from modern beach rock to approximately 140,000 years before present (see Table 1).

Amino Acid Racemization Dating

This relatively new dating method has been largely pioneered by Wehmiller (1971; Wehmiller, et al. 1971, 1976, 1977, 1978, 1980, etc.) and Mitterer (1974, 1975, 1976; Mitterer, et al. 1967, etc.). This technique is based upon the knowledge that

the amino acids in a once living organism undergo a steady increase in the ratio of molecules that rotate plain polarized light to the right (dextro) to those that rotate it to the left (levo), after the organism's death. This phenomenon is termed racemization and consists of the conversion of L-configuration amino acids present in the living material into an equilibrium mixture of D- and L-amino acids. Racemization is time and temperature dependent (Wehmiller, et al., 1977).

Dating of San Salvador Samples

Samples of Ceron sp., Chione cancellata, and Acropora cervicornis were collected from numerous locaities on San Salvador, but only those for which analyses have been completed are discussed here (see index map for localities C-0 to C-7). The results provide a relative stratigraphic order for the localities, and these can be compared to the physical stratigraphy as proposed by Titus (1980, 1982) (see Table 1). Additionally, approximate absolute dates are also provided.

Titus' (1980, 1982) glacio-eustatic hypothesis for the origin of the stratigraphic sequences seen on San Salvador seems a reasonable one; however, the detailed chronology may prove to be somewhat more complex. As an example, samples from locality C-3 which is at an elevation of approximately 13 meters (40 feet) above sea level in the Sandy Point area and presumably in the Graham's Harbor Formation as mapped by Titus (1980) yield a date of approximately 20,000 year B.P. (before present), while samples from nearby locality C-5 at an elevation of approximately 16 meters (50 feet) and also presumed to be in the Graham's Harbor

TABLE 1

Amino acid racemization dated localities and samples in stratigraphic order, and enantiometric D/L amino acid ratios.

LOCALITY*	TAXON	ROCK UNIT**	FACIES	LEU***	GLU	VAL	ALA	PRO	PHE	ASP	ESTIMATED AGE, YRS. BP (x 10^3)
C-0	*Cerion* sp.	NA	Modern shell	0.02	0.02	0.00	0.01	ND†	0.03	0.09	0
C-1	*Cerion* sp.	Graham's Harbor	eolianite	0.30	0.25	0.23	0.60	0.45	0.21	ND	10 ± 3
C-2	*Cerion* sp.	Graham's Harbor	breccia	0.16	0.17	0.09	0.15	0.29	0.09	ND	?
C-3	*Cerion* sp.	Graham's Harbor	eolianite	0.27	0.32	0.22	0.38	0.49	0.23	ND	20
C-4	*Cerion* sp.	Graham's Harbor	eolianite	0.47	0.48	0.35	0.65	0.72	0.46	0.48	50 ± 20
C-5	*Cerion* sp.	Grotto Beach	eolianite	0.63	0.60	0.53	0.82	ND	0.64	0.57	100 ± 25
C-6	*Acropora cervicornis*	Grotto Beach	reef	0.53	0.49	0.49	0.90	ND	0.47	0.63	75-130
C-7	*Chione cancellata*	Grotto Beach	reef fill	0.64	0.46	0.55	0.97	ND	ND	0.64	120-140

*See map.
**As per Titus, 1980.
***LEU=Leucine, GLU=Glutamic acid, VAL=Valine, ALA=Alanine, PRO=Proline, PHE=Phenylalanine, ASP=Aspartic acid.
†Not determined.

yield an age of approximately 100,000 years, plus or minus 25,000. This suggests that either the date at locality C-3 (which is more suspect than C-5) is incorrect or the two localities are not from the same rock unit. Furthermore, the date of 100,000 plus or minus 25,000 years for C-5 suggests that it correctly belongs in the Grotto Beach Limestone of Titus (1980) rather than the Graham's Harbor. Hopefully, this particular problem will soon be cleared up, as samples collected in March 1982 with Titus' stratigraphy specifically in mind are currently being analyzed.

Analyses of Chione and Acropora from the Cockburn Town reef (localities C-6 and C-7), which is mapped as Grotto Beach Limestone by Titus (1980), yield ages of 120,000-140,000 years and 75,000-130,000 years respectively. The coincidence of these dates enhances the reliability of that age, and also further suggests that the rocks at locality C-5 correctly belong in the Grotto Beach Formation and were being deposited coevally with the Cockburn Town reef.

It seems at this time that a generalized three-fold stratigraphic subdivison of rocks exposed on San Salvador (as per Titus 1980, 1982) is both workable and reasonable, but the concept of an island-wide unconformity to neatly divide the units is somewhat more suspect. It appears that the detailed chronology may yield a picture consistent with the 3-fold scenario, but considerably more complex in its temporal development.

Continuing analyses will hopefully more thoroughly

elucidate the chronology of the complex series of lithofacies developed and exposed on San Salvador, particularly because several samples were collected from localities that were deemed critical by Titus and others during the geology field conference held on San Salvador in March 1982.

Localities and Samples

Locality C-0: Modern shells of Cerion sp. from Rocky Point.

Locality C-1: Fossil Cerion sp. from rhizocretion eolianite along the cliffs of French Bay, approx. 3 meters above sea level. Collected from the layer just above the lowest paleosol.

Locality C-2: Fossil Cerion sp. from a breccia horizon approximately 15 meters east of Locality C-1.

Locality C-3: Fossil Cerion sp. from an eolianite, road cut, approximately 13m (40 feet) above sea level in the Sandy Point area.

Locality C-4: Fossil Cerion sp. from the rhizocretion eolianite exposed along the shore at Rocky Point.

Locality C-5: Fossil Cerion sp. from eolianite, road cut, approximately 16m (50 feet) above sea level in the Sandy Point area.

Locality C-6: Fossil Acropora cervicornis, Cockburn Town Reef.

Locality C-7: Fossil Chione cancellata, in reef-fill debris, Cockburn Town Reef.

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