PETROGRAPHY AND PALEOENVIRONMENTS OF MARINE LIMESTONES NORTHERN INTERIOR, SAN SALVADOR ISLAND, BAHAMAS

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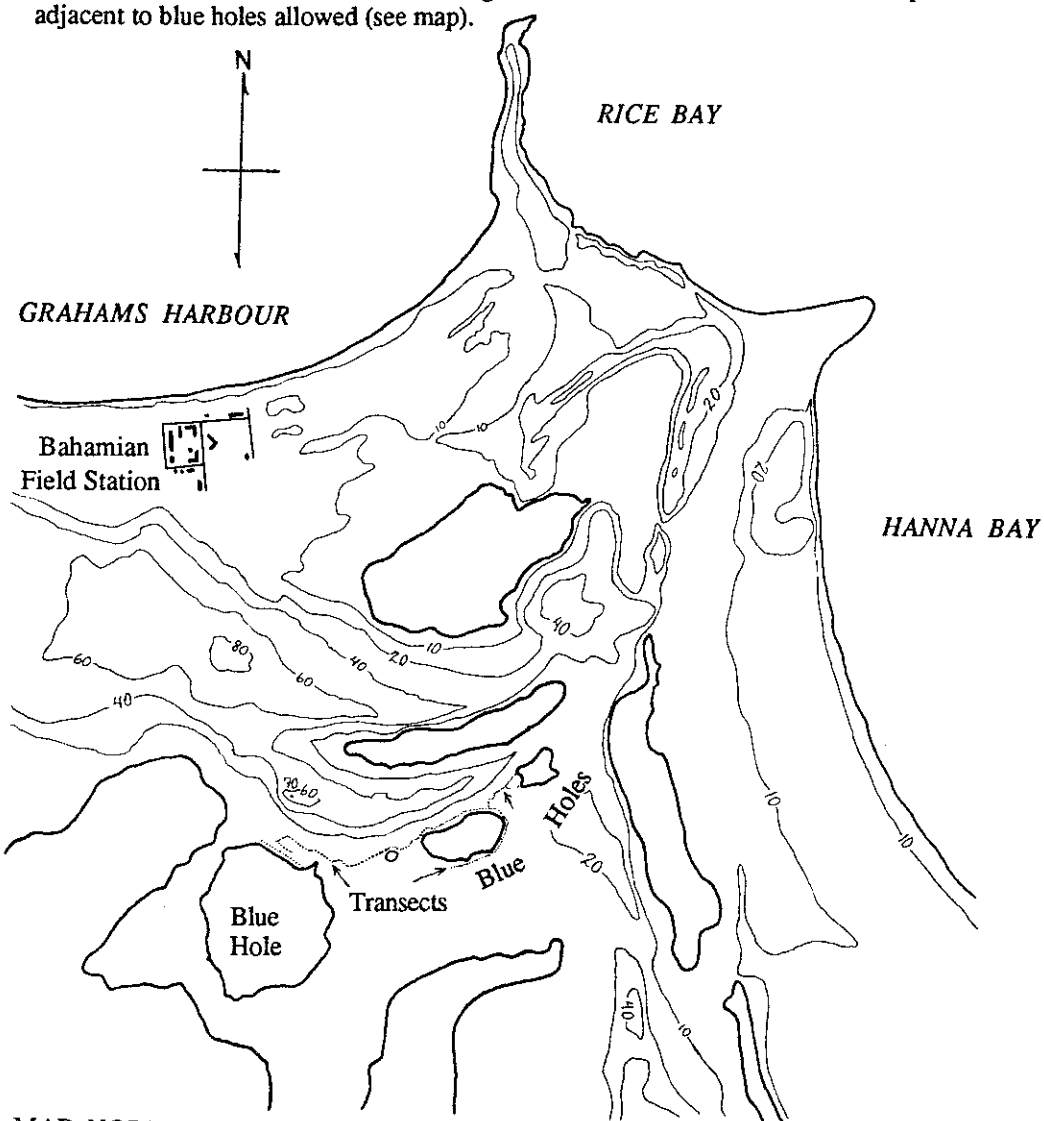
INTRODUCTION

Though the coastal areas of San Salvador Island have been much studied by geologists, the interior has received less attention. While cutting a path to study the ecology of several blue holes in the interior, southeast of the Bahamian Field Station, researchers discovered several fossil-bearing outcrops. Fossils initially noticed included large bivalve and Strombus shells. The present study was designed to investigate these rocks and to determine their petrography and paleoenvironment. Because of the constraints of dense vegetation, the study transects generally dog-leg along the path, passing four blue holes in a roughly linear stretch. Other transects were studied along offshoots from the main trail as minor paths and clear areas adjacent to blue holes allowed (see map).



MAP: NORTHERN INTERIOR, SAN SALVADOR ISLAND

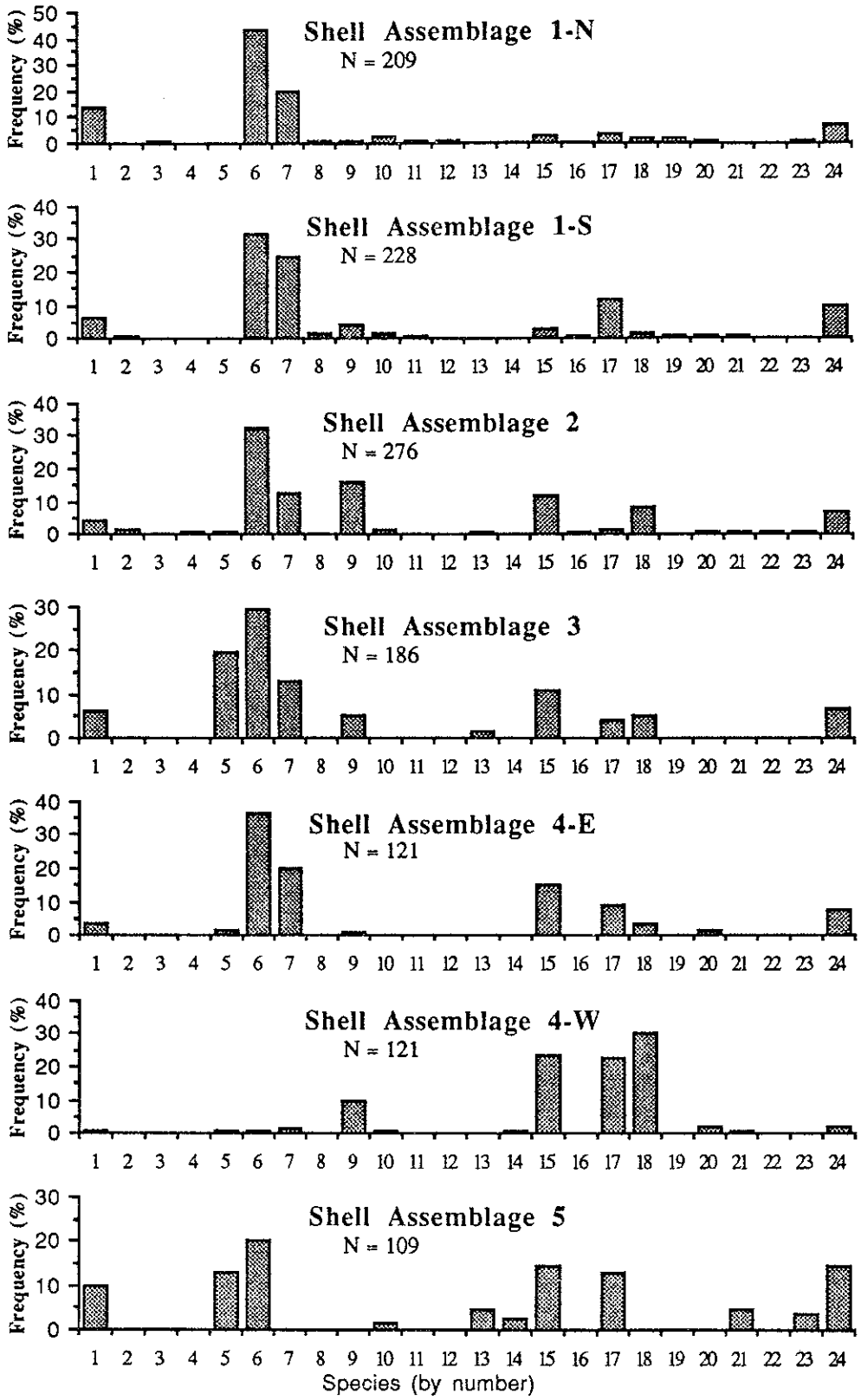


Figure 2. Histograms illustrating frequency of each species in each fossil assemblage. Species are listed by the numbers assigned in Table 1.

The relative proximity of all outcrops to blue holes was helpful in determining the elevation of outcrops. Since blue holes are an accepted measure of sea level, with a slight tidal lag, all outcrops studied are within one or two meters of sea level. This fact enables correlation with coastal marine outcrops that have radiometric age dates of 132,000 to 120,000 years before present (Chen et al., 1991). Thus it may be concluded that study outcrops date from the Sangamon Interglacial Period.

FIELD METHODS

Transect lengths and bearings were taken with a tape measure and compass. Using straight sections of maximum length (before the next sharp bend in the path), each starting point was marked and numbered, giving several sections of different bearing to each transect. These were plotted later to make a base map of the area.

General topography and trends of rock notable in hand sample were recorded as transects were made. Approximately 150 hand samples were collected and sample locations recorded. The samples were brought back to the Bahamian Field Station for further study, labeling, and comparison with previously collected samples.

After all transect work had been completed, sites for drill cores were selected. Using a two-foot drill bit, cores were taken from twenty-two locations chosen to give the most geologic variety while providing a well-distributed sampling. Core samples were marked for orientation and numbered sequentially as they came out of the drill core.

LABORATORY METHODS

Initial cores for thin section making were chosen on the basis of their quality of lithification and petrographic interest as evaluated under a hand lens. Later thin sections were made from samples chosen to represent facies changes within a core or transect areas that had not yet been covered.

Cores were cut longitudinally to reveal a vertical section that would display any geopetal fabric or a facies change if present. All thin sections were made on a Logitech lapping and polishing machine or hand polished. Some degree of impregnation of poorly lithified rocks was achieved by inundating with epoxy. Thin sections were examined with a petrographic microscope to determine grain types, specific flora and fauna represented by skeletal fragments, amount of pore space, degree of calichification, and any cements present. Point counts were performed on those thin sections from rock not completely masked by calichification to aid in facies definition.

OBSERVATIONS

In many areas rocks had undergone extensive calichification and paleosol formation that often obscured the original grains. Signatures of calichification, including but not limited to glabules, caliche stringers, alveolar texture and black clasts, were present in varying amounts. Intense micritization had occurred in numerous cases. Rhizomorphs were often associated with calichification, but in a few instances occurred in apparent isolation in relatively unmodified rock. Whisker calcite usually occurred in the pore space of rocks containing rhizomorphs.

Large trends in the rock were visible from a general survey of the area. Patches stained dark tan to bright red and varying in width from a meter to tens of meters deviated from the usual cream-colored rock. Hard, dark caliche caps were also visible on the surface. As discovered by the initial path-cutters, several deposits of large (>10cm length) bivalves and conch were found, and core samples revealed these rocks to be rich in a variety of sizes and types of molluscs.

Petrographic study revealed marine flora and fauna. Interestingly, the flora was found to be dominated by red coralline algae with calcareous green algae as only a minor element, if at all present. Some cores revealed a layered pattern of coarse red coralline algae fragments alternating with layers where these were absent, each layer about 1-3cm in thickness. Ooids were a minor presence where they occurred, while some samples were rich in peloids. The dominant skeletal elements were mollusc, red coralline algae, and foraminifera fragments.

DISCUSSION

The presence of large molluscs makes a marine paleoenvironment a doubtless conclusion. Other marine flora and fauna substantiate this deduction. The lack of ooids in almost all samples (see Figure 1) suggests the lack of an ooid-forming environment, that is a relatively hard substrate with a slow rate of sedimentation. The general abundance of red coralline algae, especially relative to the absence or only minor presence of calcareous green algae (see Figure 2), contrasts sharply with previous findings on San Salvador (Kurkjy, 1984).

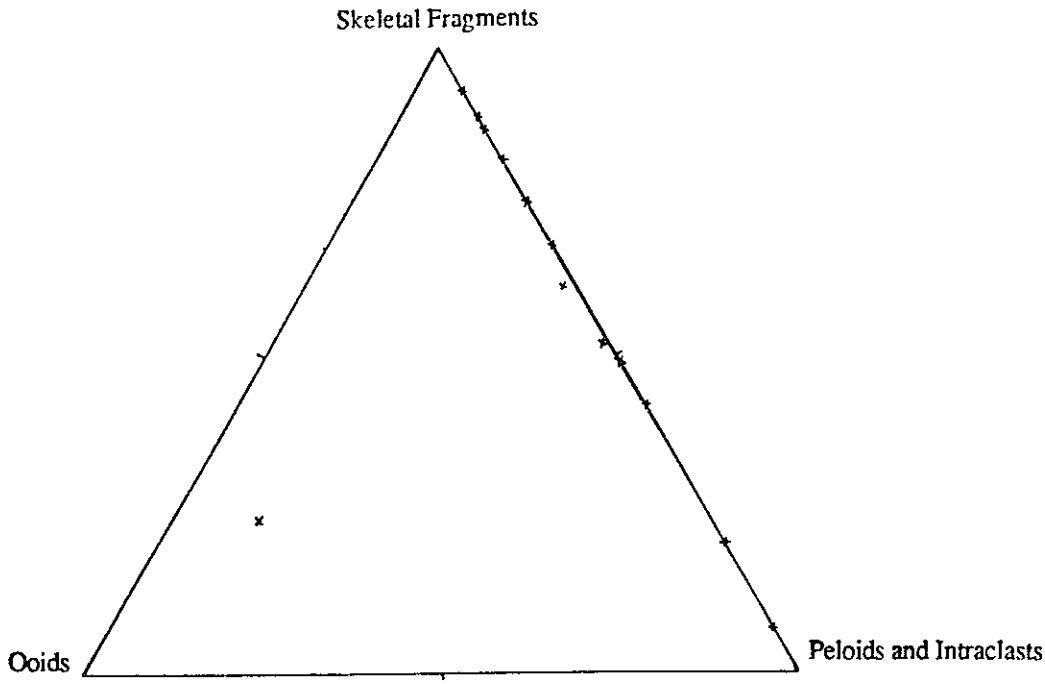


Figure 1: Grain Composition (n=13)

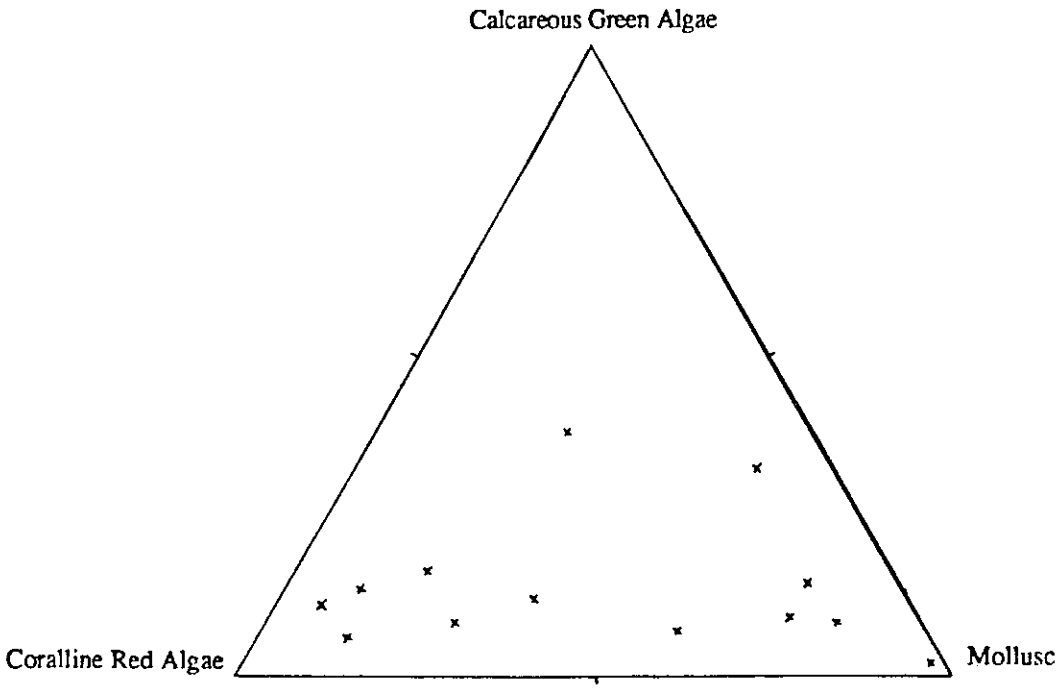


Figure 2: Principle Bioclasts (n=13)

The core displaying alternating layers rich and poor in red coralline algae suggests a pulsating deposit from anther source that periodically interrupted background deposition of sediment, or perhaps deposition from two alternating sources as might occur in a tidal channel. The basic dichotomy across all cores of coarse skeletal fragments and sediment in some areas and contrasting fine fragments and sediment in other areas or a combination of these appearing in distinct horizons within a single core suggests the presence of at least two paleoenvironments in this area. Large molluscs and other evidence point to the circulation of a large volume of sea water, such as in a tidal channel. Contrasting facies containing much finer fragments and foraminifera suggest a more protected, lagoonal or tidal flat environment.

Widespread paleosol formation and calichification in these rocks indicates a fall in sea level following the deposition of the marine facies. Rocks thought to correlate stratagraphically to the study area, such as those in coastal areas that date from the Sangamon, have undergone similar calichification thought to have resulted from subaerial exposure during marine regression at the beginning of the Wisconsinan Glacial Period (Stark, 1988).

Because of the extensive nature of calichification in many samples, some types of skeletal fragments may be preferentially masked by micritization. If only intensely calichified samples existed for a given facies, the apparent representative floral and faunal grain counts may be skewed from the original. However, in samples thus far investigated there seem to be at least several less altered samples for each facies that could be used as a reference for comparison. These samples generally come from the deeper section of a core.

REFERENCES CITED

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