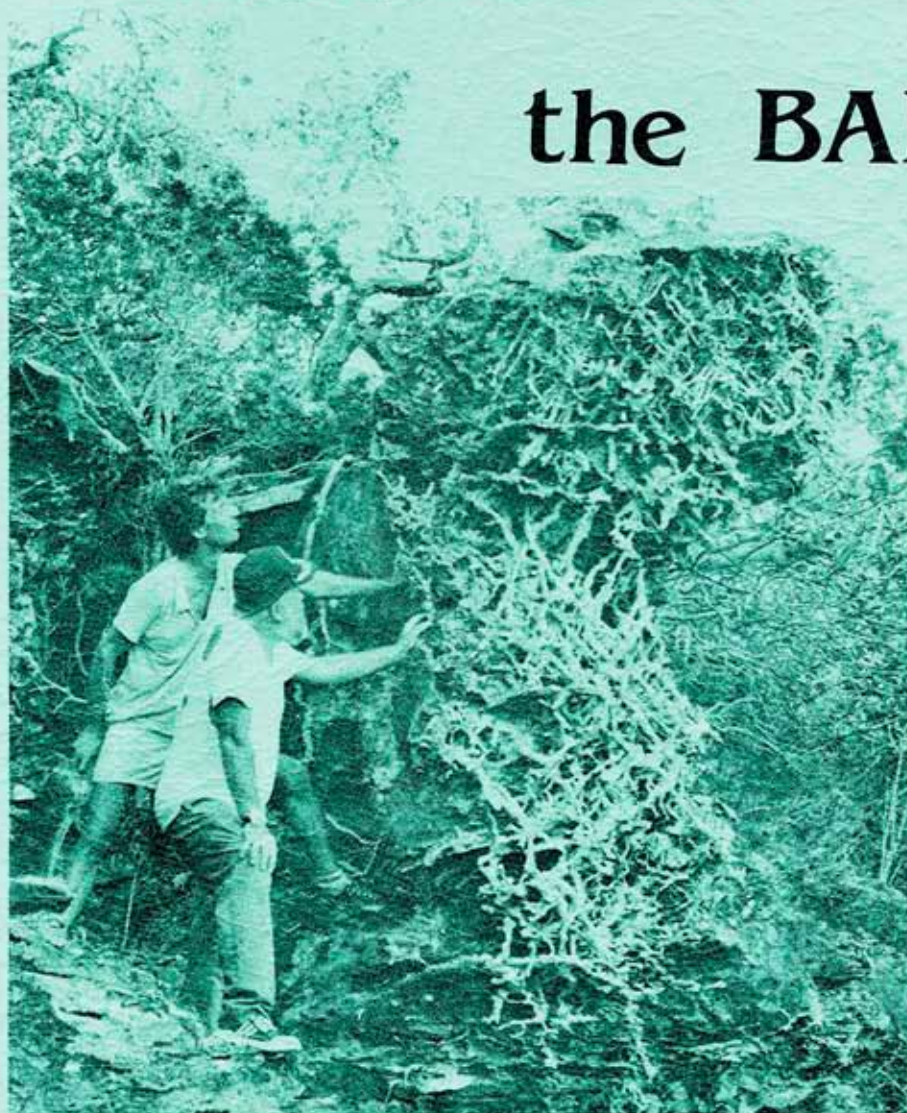


PROCEEDINGS
of the
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GEOLOGY of
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CCFL Bahamian Field Station

SECOND SYMPOSIUM ON THE GEOLOGY OF THE BAHAMAS
FIELD TRIP TO PIGEON CREEK

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Purpose

The purpose of this field trip is to examine and compare a modern tidal delta and adjacent environments and a Pleistocene analogue (Fig. 1).

Stop 1: Pigeon Creek Tidal Delta (Fig. 2)

We will enter the water at the dock just inside the mouth of Pigeon Creek, near Ocean House, and drift with the ebbing tide through the entrance to Pigeon Creek; and then swim southwest along the shore to our awaiting field vehicle. Along the way we will traverse the following environments (see Fig. 2).

1. Tidal channel and adjacent subtidal flats

Immediately downstream from the dock is a deep (3-4m), steep-sided tidal channel. A thin veneer of coarse molluscan shell hash floors the channel. Locally, in shallower parts of the channel, thick lenses of Halimeda (calcareous green alga) plates migrate with the tide.

A prominent branch of the tidal channel, extending

north from the entrance of Pigeon Creek, may be seen on Figure 1. This branch extends approximately 4.5 km and terminates in a large basin at the north end of Pigeon Creek.

Shallow, subtidal flats border the tidal channel. The subtidal flats support a lush growth of the marine grass Thalassia, between which grow the calcareous green algae Halimeda, Penicillus and Udotea. Locally, tidal flats are developed and support dense stands of red mangrove. Tidal and subtidal flat sediments are finer and more poorly sorted than those of the tidal channel.

2. Tidal delta

A prominent ebb tidal delta extends seaward from the entrance to Pigeon Creek. Water depth across the delta is approximately 1 to 2 m and maximum tidal fluctuation is approximately 1 m. The sediment of the tidal delta is a well winnowed carbonate sand, the surface of which is covered by current ripples which migrate and change direction with the ebb and flow of the tide.

The seaward edge of the delta is marked by a gentle descent to a Thalassia meadow over which the delta appears to have advanced. Locally, scouring has occurred along the delta margin, and elsewhere Thalassia is encroaching on the delta flanks. The



Figure 1: Granny Lake Estuary (Pleistocene) and Pigeon Creek Estuary (Holocene).

Thalassia meadow shelters a more diverse fauna and flora and its sediments are more poorly sorted than the tidal delta.

3. Rock-floored shallow subtidal and Thalassia meadow environments

The west shore of Pigeon Creek entrance and the adjacent shore of Snow Bay reveals a rocky shore environment which extends subtidally a few tens of meters seaward. The subtidal bedrock surface supports a variety of scleractinian corals, the most obvious of which is Diploria, thickets of the red calcareous algae Goniolithon, and sparse growths of calcareous green algae and Thalassia. Seaward, a dense stand of Thalassia grows in poorly sorted carbonate sediments.

The islands offshore, especially High Cay, represent bedrock erosional remnants of formerly more extensive aeolian ridges. The bedrock high to the west of Pigeon Creek entrance anchors a series of beach ridges lying to the south and west.

Stop 2: North Pigeon Creek Quarry Area (Fig. 1)

North Pigeon Creek quarry is located on a small hill (approximately 3-4 m elevation) on a short peninsula at the north end of Pigeon Creek. The shoreline here consists of a narrow bedrock platform. Present tidal fluctuation (15-20 cm) is much less than at the entrance to Pigeon Creek. Inland, to the east

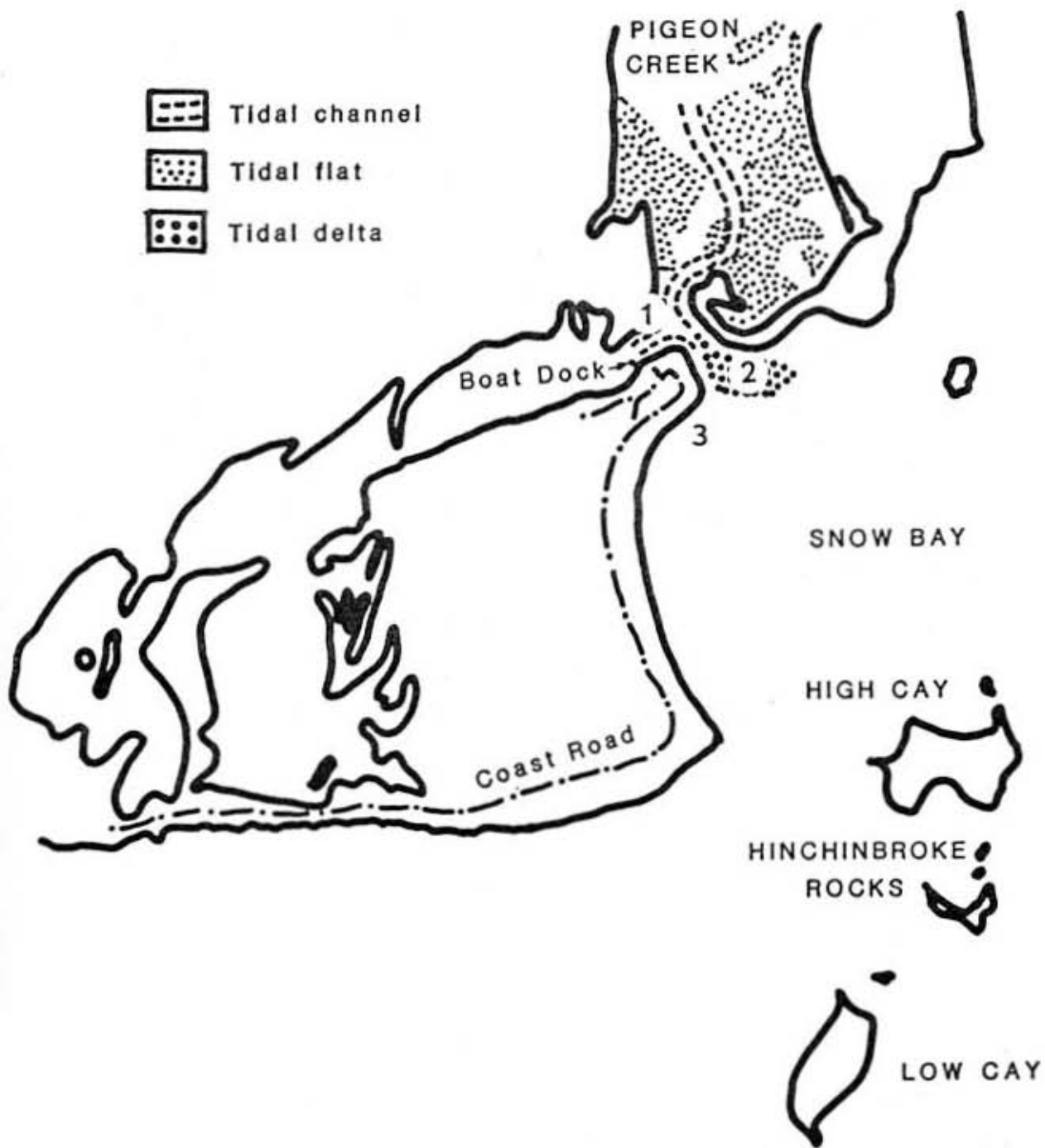


FIGURE 2: South Pigeon Creek area.

and west of the North Pigeon Creek quarry area, lie a series of old beach ridges (poorly visible on Fig. 1). The beach ridges consist of oosparite and biosparite. A sinuous channel (Granny Lake Channel) can be traced southward from Granny Lake almost to the North Pigeon Creek quarry area. A bedrock plain extends laterally 1 or more km from the channel to high bedrock hills. Based on limited sampling, the bedrock of the channel consists of oosparite and the plain consists of oomicrite, oobiomicrite and biopelmicrite.

We will make two stops in the North Pigeon Creek area as follows:

1. Shoreline bedrock platform

The bedrock here is a biopelmicrudite. Macrofossils include corals, especially Montastrea and Diploria, and gastropods. Thin sections reveal red algae among the bioclastic debris. These sediments rest unconformably on a subaerial crust and are correlated with the section exposed in the North Pigeon Creek quarry.

2. North Pigeon Creek quarry

The section exposed in the North Pigeon Creek quarry rests unconformably on a subaerial micritized crust and consists of 3 units, a lower massive biomicrudite overlain by a cross bedded oosparite and an upper massive oosparite.

Ostracodes (Thalman, 1983) reflect changing conditions within the section. The assemblage at the base of the lower massive unit reflects restricted conditions (brackish, or perhaps hypersaline) during initial flooding by rising sea level. Ostracodes in the rest of the lower massive unit suggest improved circulation and in the cross bedded unit and base of the upper massive unit they indicate normal marine conditions with possibly some hypersaline influence. Although diversity decreases in the remainder of the upper massive unit, the ostracode fauna indicates stable marine conditions.

Discussion

Hinman (1980) first suggested that the section exposed in the North Pigeon Creek quarry represents a nearly exact fossil analogue of the modern Pigeon Creek tidal delta. Thalman (1983) and Thalman and Teeter (1983 a, b) concur and provide additional evidence in support.

In the sections exposed at North Pigeon Creek quarry the lower massive unit represents a prodelta Thalassia meadow, the cross bedded unit represents a tidal delta prograding across this meadow and the upper massive unit represents the Thalassia subtidal flat as observed bordering the tidal channel inside the entrance to Pigeon Creek. The peninsula on which the quarry is located is remarkably similar in outline to the seaward edge of the modern tidal delta and the bedrock faunal assemblage flanking

the ancient delta is closely comparable to the modern subtidal bedrock community west of Pigeon Creek entrance. The beach ridges inland to the east and west of the quarry are similar in position to those flanking the present tidal delta. Granny Lake Channel, and the bedrock plain flanking it, is the ancient representative of the present Pigeon Creek Tidal Channel and the tidal to subtidal flats bounding it.

Thus, the Granny Lake basin, channel and North Pigeon Creek quarry area represents a Pleistocene lagoonal or estuarine system directly comparable to Pigeon Creek. Based on its elevation, the North Pigeon Creek tidal delta must have formed during higher sea level than present. We suspect that this may have formed during the higher sea levels (4 to 5 m?) of the Sangamon Interglacial, but it may have developed during more recent postulated higher levels (see Carew and Mylroie, this volume).

It is unlikely that such a tidal delta could have formed at the northern end of Pigeon Creek, more or less as it is today. The diminished tidal range at the north end would probably have provided insufficient currents to develop a tidal delta and Montastrea, Diploria and red calcareous algae do not live in the present restricted conditions of Pigeon Creek. Therefore, the Granny Lake Estuary must have emptied directly onto the open shelf just as Pigeon Creek does today. At that time, eroded aeolianite remnants, such as The Bluff and other rocky headlands, stood as islands offshore from the Granny Lake tidal delta. Enclosure of Pigeon Creek was accomplished after the development

of the Granny Lake system, possibly during the post Wisconsin rise in sea level, as dune-beach ridges linked together these former islands. If conditions remain static, it is quite possible that continued southward growth of the dune-beach ridge system will link the islands off the present tidal delta, thus extending Pigeon Creek and shifting the position of the modern tidal delta.

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