CRUISE REPORT; C-2311

BAHAMA CARBONATE BANKS: STRUCTURE AND TECTONICS

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Shallow-water carbonate platforms were widespread around the margins of the young North Atlantic Ocean during the Jurassic and Early Cretaceous. Growth of these platforms persisted until various times in the Cretaceous when drowning or classic influx or other environmental changes caused their termination. The last survivor of this peri-Atlantic bank trend is the Bahamas where a continuous record of carbonate margin deposition exists at least since mid-Jurassic. Deposition on the Bahama Banks has been affected by regional subsidence, local tectonics, and eustatic sea-level changes.

Many questions about the local geology of the Bahamas that remain unanswered are very critical to our understanding of the evolution of the North American margin. What is the nature of the basement under the Bahamas? If continental, how does this contradict pre-drift reconstructions which have overlap with Africa? If oceanic, how did shallow-water facies such as reefal carbonates begin to deposit on a basement which normally is deep? If there are salt diapirs in Exuma Sound, how was the salt deposited on oceanic crust? Did the early Atlantic dry up to allow shallow facies to deposit on oceanic basement? Why is the Bahama Platform not welded into a single mega-bank like Yucatan, or the west Florida shelf? Why are there the complex banks and intersecting channels?

Possibly the Bahama Platform originated on oceanic crust formed during oceanic rifting. A broad mega-bank of carbonates persisted until the Cretaceous when the bank was dissected by channels which evolved only during the

Tertiary (figure 1). Cretaceous faulting may have produced minor relief which seeded the bank outlines and the banks grew throughout the Tertiary while intervening channels were eroded by turbidity currents.

CONRAD Leg 23-11 was a multichannel seismic reflection survey of the Bahama Platform and the neighboring North Atlantic designed to investigate in more detail the development of the Carbonate banks. The track chart shown in figure 2 shows the multichannel track in Exuma Sound and Tongue of the Ocean as well as existing wells, drill holes, and dredges, that will permit dating of the stratigraphy mapped by the seismic survey.

In Exuma Sound the deep stratigraphy which passes beneath the Cat Island block to be exposed on the Bahama Escarpment and which continues seaward to the DSDP holes can be seen on the CONRAD data. Preliminary results are exciting. The Upper Cretaceous and Tertiary seismic stratigraphy proved quite mappable and many distinguishable geologic phenomena such as bank margin retreats and submarine erosion are well documented. Moreover, the single-channel data indicate that good reflectivity exists and that continuous seismic reflectors can be traced over hundreds of km. Also, the crossing from the basin interior in the sound to the Bahama Escarpment shows little small-scale roughness in the topography that might cause diffractive scattering. Very likely deeper reflectors can be traced through to the outcrops once multichannel processing is completed. Also, the monitor records show that the North Atlantic Jurassic reflectors C and O can be traced into the Bahamas from the adjacent abyssal plain farther than heretofore possible (figure 3).

The dredges on the escarpment collected abundant freshly broken rocks of Early Cretaceous age. Rudists and grainstone facies indicate that a shallow-water carbonate bank margin is exposed along the escarpment. Projection of this shallow-water sequence to shallow-water seismic units at the same elevation under the sound gives a correlation of the multichannel data. The good quality seismic reflection profiles of R/V CONRAD give the correlation from the interior of Exuma Sound to the escarpment outcrops.

The R/V CONRAD single-channel monitor data in the Tongue of the Ocean indicate excellent signal-to-noise ratio and penetration. Processing of these data should reveal the deeper stratigraphy and basement structure. It is already apparent from the fine-scale stratigraphy that numerous unconformities exist in the Upper Cretaceous and Tertiary part of the section. These erosional and non-depositional events record the processes that recur in the Tongue to strip it clean of sediments. Correlation of these seismic sequence boundaries by seismic ties to DSDP 98 and the Andros Island well will be done after processing.

Some structures that appear to be lithoherms now buried below the shallow sediments are seen on the data. On some profiles possible post-Cretaceous faults are seen. The faults seem to associate with the flanks of a positive magnetic anomaly in the southern part of the Tongue. Apparently magnetic basement structures control the faulting.

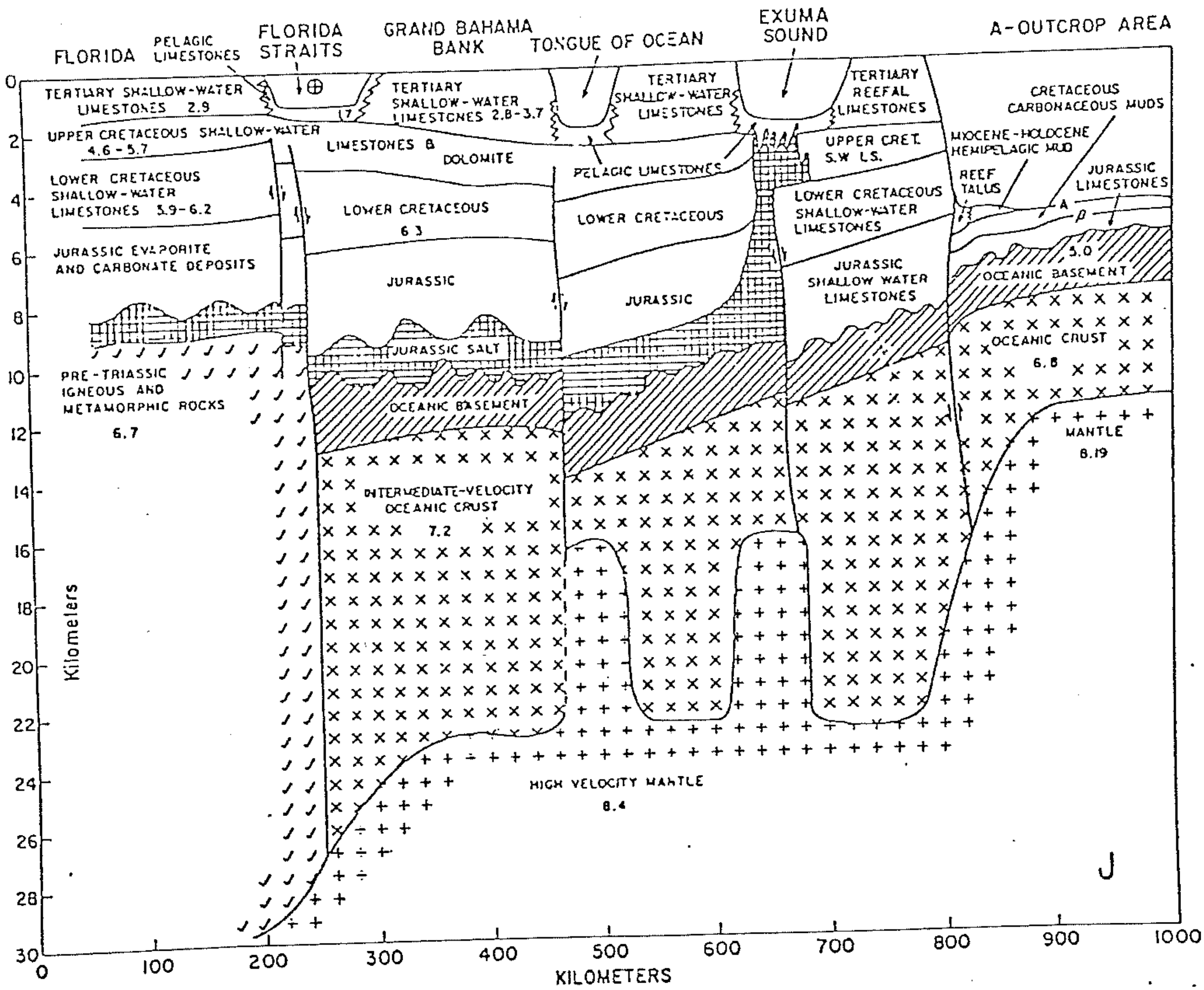
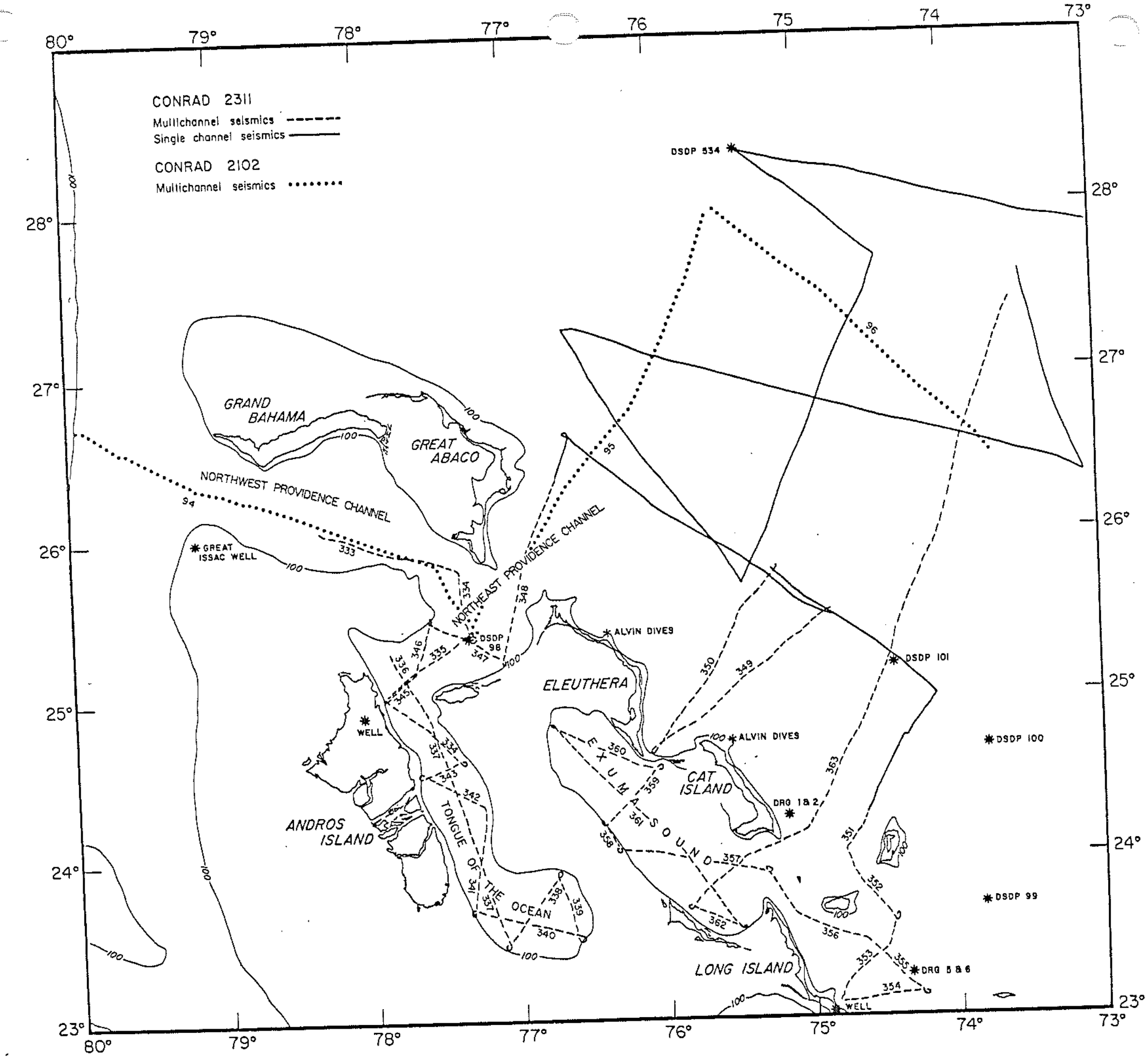


Figure 1. Sheridan's (1974) interpretive cross-section of the Bahamas. Channels are Late Cretaceous and Tertiary features overlying continuous older platforms. Channels are located along faults but relief of the sea floor is non-tectonic, caused largely by upbuilding of the banks. Basement is intermediate oceanic crust formed during rifting.



CONRAD 2311
Multichannel seismics
Single channel seismics
CONRAD 2102
Multichannel seismics
GRAND BAHAMA
GREAT ABACO
NORTHWEST PROVIDENCE CHANNEL
NORTHEAST PROVIDENCE CHANNEL
GREAT ISSAC WELL
DSDP 534
DSDP 98
DSDP 101
DSDP 100
DSDP 99
ALVIN DIVES
ELEUTHERA
CAT ISLAND
EXUMA SOUND
DRG 1 & 2
DRG 5 & 6
ANDROS ISLAND
WELL
TONGUE OF THE OCEAN
LONG ISLAND

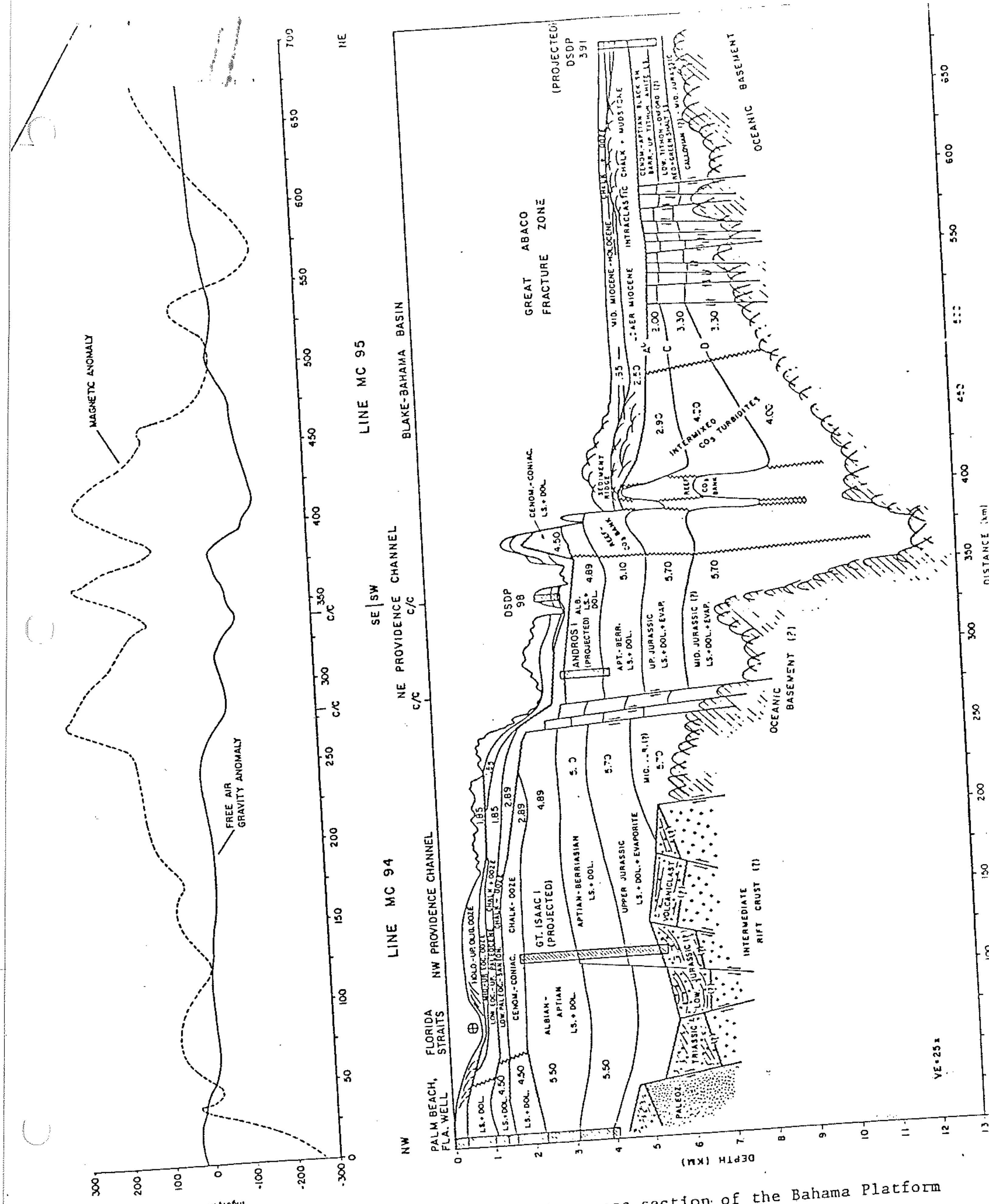


Figure 3. Sheridan et al.'s (1981) interpretive cross section of the Bahama Platform based on multichannel seismic data, magnetics and gravity.