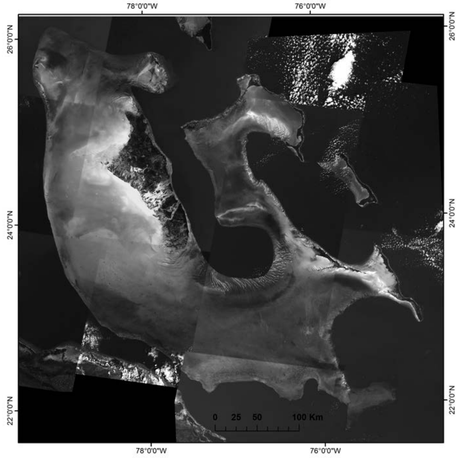
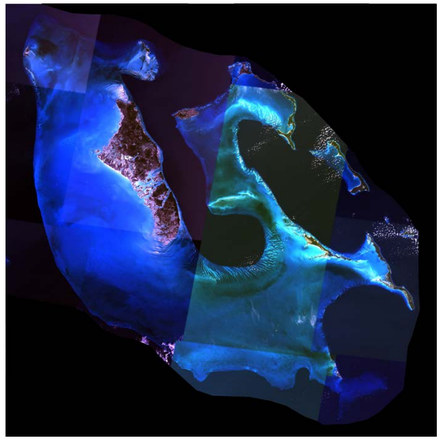
Creating the Bathymetric Map

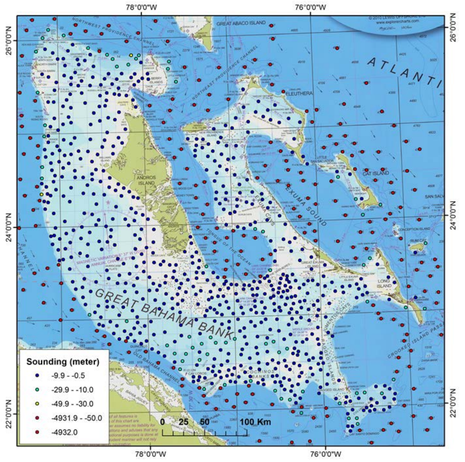
We have used Landsat ETM+ imagery and an extensive set of water depth measurements to critically evaluate the magnitude and patterns of bathymetry across GBB.



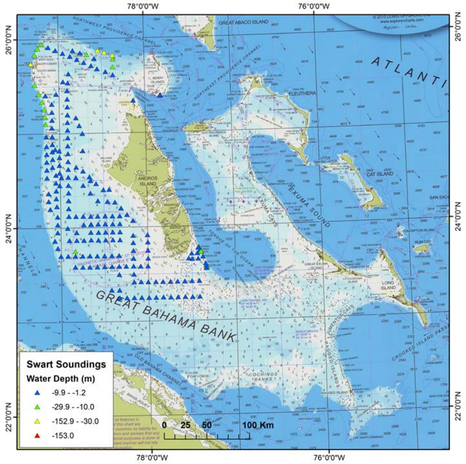
100 m Landsat TM Mosaic of 13 full scenes Band 1 (reflected blue light revealing maximum water depth)



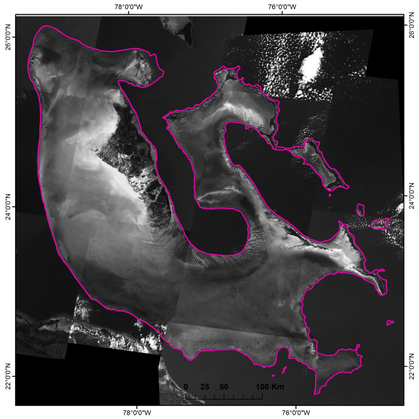
Color mosaic of 13 Landsat TM full scenes; mosaic has 5244 rows x 5208 columns or ~27,310,000 pixels



5,513 digitized soundings (932 shown here) from Explorer Charts "The Bahama Islands" ©2010 Lewis Offshore Ltd.

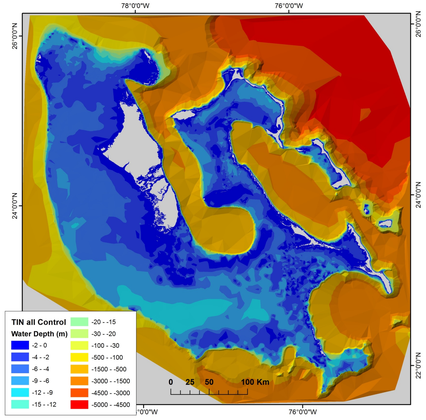


210 depth measurements from Reijmer et al (2009)

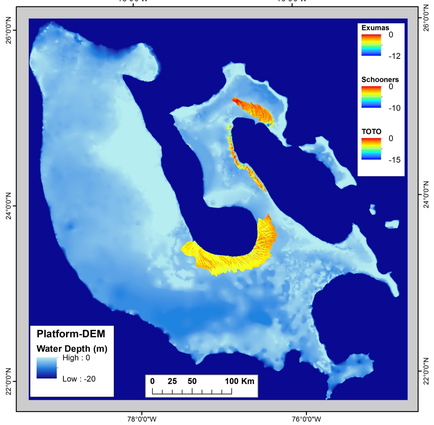


The edge of the platform was visually interpreted and digitized (with reference to soundings) as a 30 m contour from the blue light Landsat TM band 1.

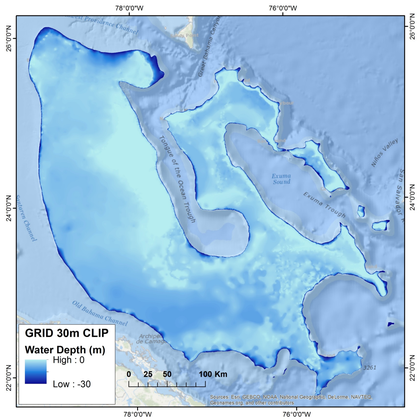
Shorelines of islands were derived from the shortwave-infrared Landsat band 5, as water is black and land is shades of gray.



The bathymetry depth model used the triangular irregular network (TIN) interpolation method to integrate the 5723 soundings, edge of platform contour, interpreted intermediate contours, and island shorelines.



The TIN model was converted to a regular 150 m grid using the Interpolated Distance Weighting (IDW) method to facilitate visualization.



Higher resolution (30 m) bathymetric DEMs of Exumas, Schooners, and TOTO resampled to 150 m grid for integration with platform DEM.

Great Bahama Bank – Part I:
Evaluating Water-Depth Variation on a “Flat-Topped” Isolated Carbonate Platform

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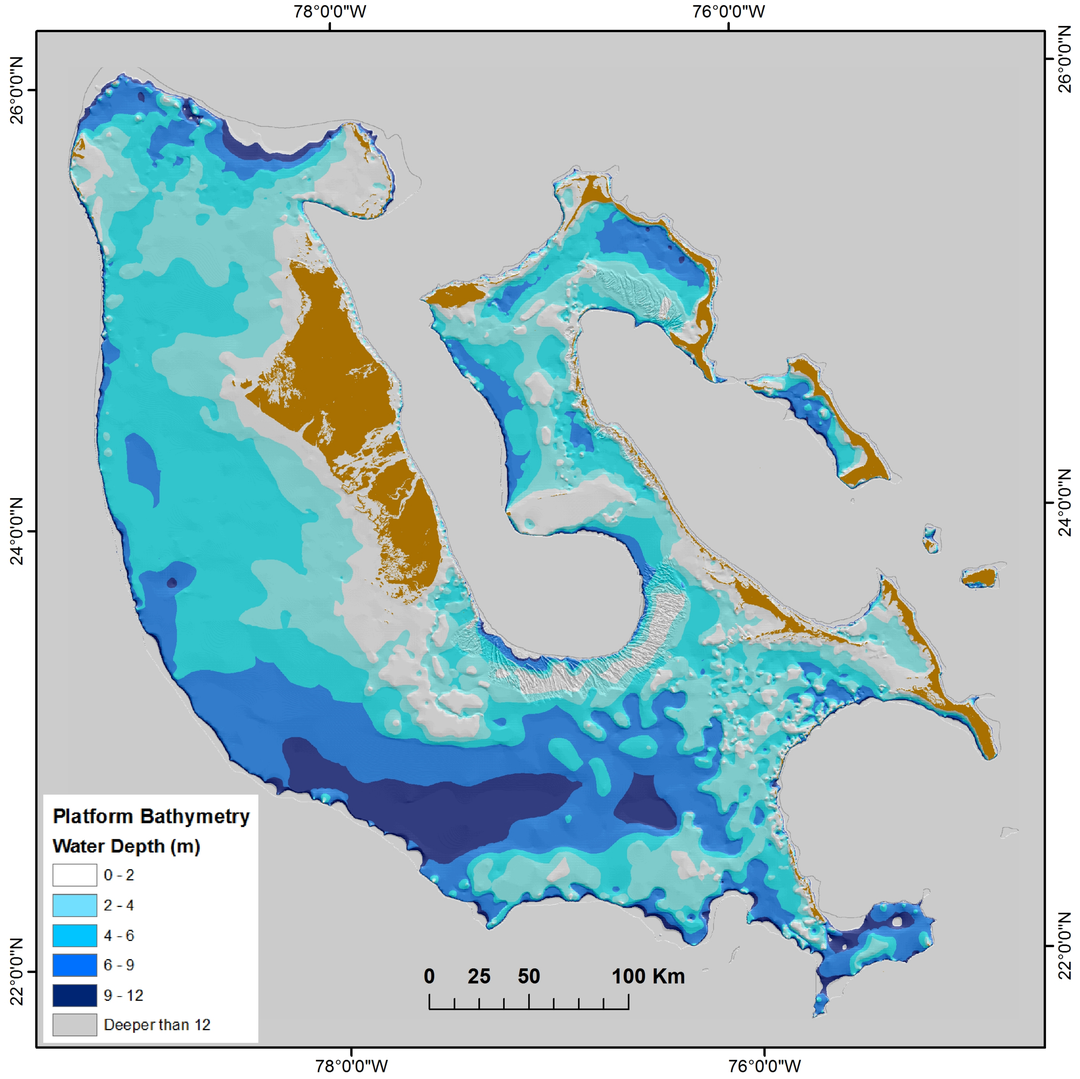
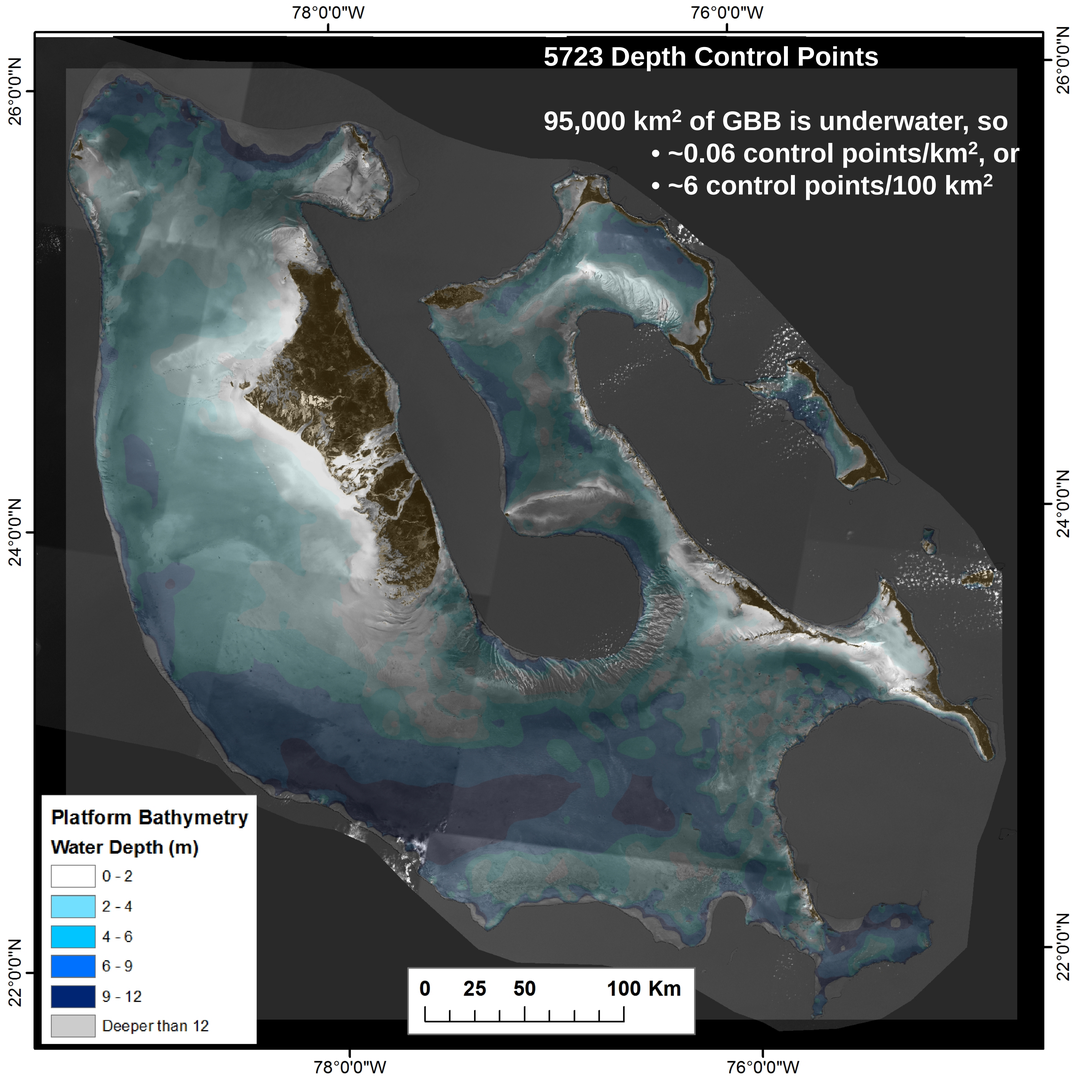
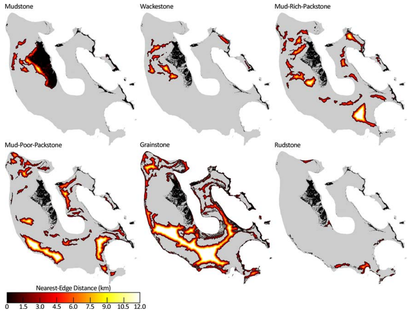




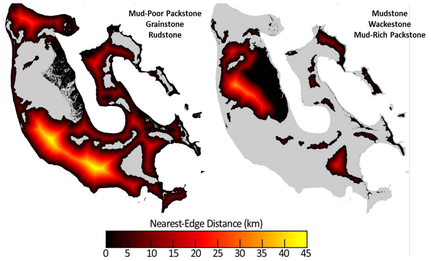
Interrogating the Facies Map



The influence of Andros Island over mud accumulation is evident in the maps to the left.

There is a clear trend that the **widest portion of the platform**, which lies to the south of the TOTO and lacks islands, **hosts the most continuous expanses of grainstone**.

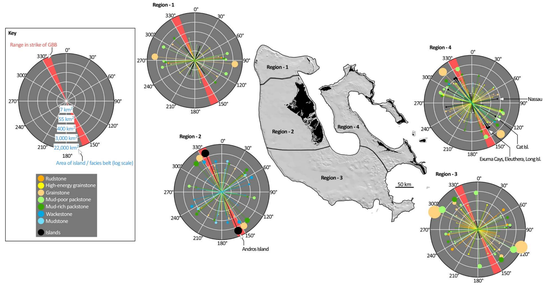
The prevalence of **rudstone increases from north to south** in step with an increase in water depth.



The breadth of the grainy fairways on the platform top is double that of the mud-rich.

Grainy lithologies are more laterally expansive on the southern platform (in deeper water).

Grainy sedimentary bodies are highly interconnected, mud-rich bodies are more isolated.



For regions **1** and **3** with few and small islands only, the orientation of facies belts is unrelated to the orientation of islands.

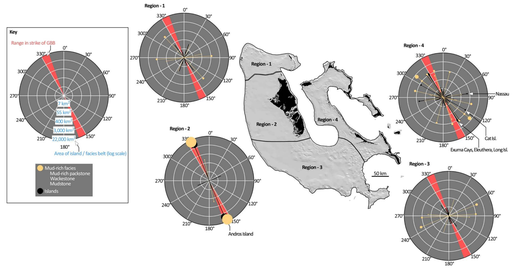
For regions **2** and **4** with numerous islands, there is consistency in orientation between islands with areas exceeding 3,000 km^2 and the largest facies belts.

Alignment of facies belts in regions **1** and **3** is E-W suggesting windward-leeward influence, whereas alignment of belts in **2** and **4** is controlled by islands which, in turn, because they are preferentially situated on the platform-margin, align with the strike of the platform (NW-SE).

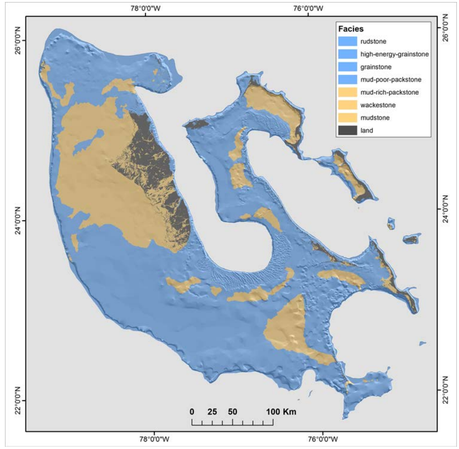
Plotting the mud-rich facies as a single category shows the influence of islands vs. wind on the accumulation of fine sediments, e.g.,

Orientation of the muddy facies belts is predominantly E-W in regions **1** and **3**, whereas the sediment bodies are island aligned regions **2** and **4** .

While mud-rich sediments might be precipitated (whitings), islands evidently modulate the deposition of the muddy facies belts.



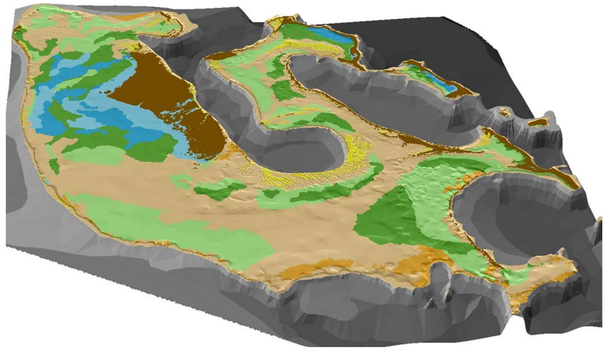
Of particular importance is the detailed and generalized distributions of muddier and grainier lithologies shown by our mapping relative to that of previous maps.



GBB is essentially a **very grainy platform** with muddier accumulations only in the lee of substantial island barriers. **Andros Island, which is the largest island on GBB, exerts a direct control over the muddiest portion of GBB**.

Mudstones, wackestones, and mud-rich packstones cover 8%, 5%, and 14%, respectively, of the GBB platform top. **Mud-poor packstones, grainstones, and rudstones account for 20%, 45%, and 3%,** respectively.

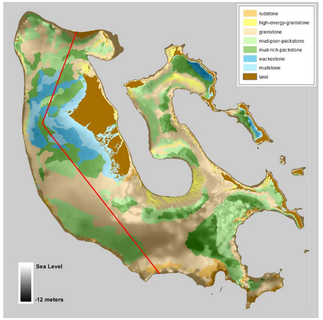
Of the 45% of the platform-top classified as grainstone, only 3% is composed of "high-energy" deposits characterized by the development of sandbar complexes.

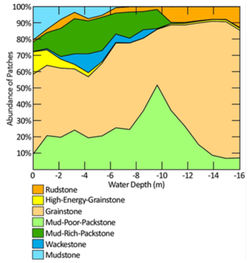


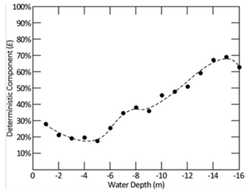
The diversity and size of facies bodies are broadly the same on the eastern and western limb of GBB, though the narrower eastern limb, the **New Providence Platform, hosts a higher prevalence of grainstones**.

The **most abrupt lateral facies changes are observed leeward of islands**, areas which also hold the highest diversity in facies type.

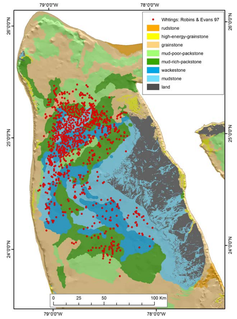
The **northern half of the platform hosts a more heterogeneous facies mosaic than the south half**, a difference likely related to the greater prevalence of islands.







Grainier sediment types are abundant across the full range of water depths found across the platform top of GBB. Muddier sediment types occur across a wide range as well, but do not extend as deep as the grainer counterparts.



Relationship between whitings (mud production) and the distribution of muddy facies can be investigated in more detail –

Robbins et al (1997) concluded that even their lowest estimate of whitings mud production produces a larger volume of lime mud than is currently observed on the platform top and could conceivably have sourced all or part of the off-platform mud wedge.