

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

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Please refer to companion article, entitled “[Great Bahama Bank – Part II: Mapping Depositional Facies on a ‘Flat-Topped’ Isolated Carbonate Platform,](#)” Search and Discovery Article #50961 (2014).

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Abstract

Great Bahama Bank (GBB) has long served as a frequently visited and well-studied example of a flat-topped, isolated carbonate platform. As defined by a 30-m water-depth contour, GBB extends over 103,000 km². The maximum variation in depth-elevation over this vast platform extends from the 30 m contour to the highest Pleistocene eolianite ridge of 63 m on Cat Island, but as islands occupy only 8%, or 8000 km², of GBB, we focus here on the bathymetric variation. Our map of water depth variation across GBB ([Figure 1](#)) supports 1:1,000,000-scale geologic interpretations and bathymetric profiling.

We used Landsat ETM+ imagery (a mosaic of 13 images) and an extensive set of water-depth measurements (5700 digitized soundings) ([Figure 2](#)) to critically evaluate the magnitude and patterns of bathymetry across GBB and generate the depth map. The edge of the platform, highlighted by the purple line in [Figure 3](#), was visually interpreted and digitized (with reference to soundings) as a 30-m contour from the blue light band 1 of the Landsat TM mosaic. Shorelines of islands were derived from the shortwave-infrared band 5 of the Landsat mosaic, as water is black and land is shades of gray in [Figure 4](#).

The bathymetry depth model for GBB used the triangular irregular network (TIN) interpolation method to integrate the 5723 soundings, edge of platform contour, interpreted intermediate contours, and island shorelines (see [Figure 5](#)). The TIN model was

converted to a regular 150 m grid using the Interpolated Distance Weighting (IDW) method (see [Figure 6](#)) to facilitate visualization. Higher resolution (30 m) bathymetric DEMs of Exumas, Schooners, and TOTO from Harris et al (2011) were resampled to 150-m grid for integration with the platform DEM (see [Figure 7](#)).

A closer look at our bathymetry map for GBB ([Figure 8](#)) shows that 60%, or 61,400 km², of GBB lies in 5 m or less of water (tan on map below). This includes active carbonate sand accumulations, e.g., TOTO, Schooners, Exumas, Joulters, and Cat Cay sand complexes, and also vast portions of the northern portion of GBB surrounding Andros Island and the New Providence Platform to the west of the Exuma Islands. The 40% of GBB lying in greater than 5 m of water (blue on map below) occurs mainly in an east-west trending portion of the southern platform.

The bathymetric patterns across GBB, as illustrated in [Figure 9](#), are important as a potential primary control over flooding history, filling (accommodation) history, and the resultant depositional facies patterns. Bathymetric profiles like the one shown in [Figure 9](#)) highlight the irregular filling of accommodation space and graphically emphasize the challenges that occur in correlating depositional cycles of variable thickness across a platform.

References Cited

Harris, P.M., S.J. Purkis, and J. Ellis, 2011, Analyzing spatial patterns in modern carbonate sand bodies from Great Bahama Bank: *Journal of Sedimentary Research*, v. 81, p. 185-206.

Reijmer, J.J.G., P.K. Swart, T. Bauch, R. Otto, L. Reunig, S. Roth, and S. Zechel, 2009, A re-evaluation of facies on Great Bahama Bank. I: new facies maps of western Great Bahama Bank: *International Association of Sedimentologists, Special Publication*. 41, p. 29-46.

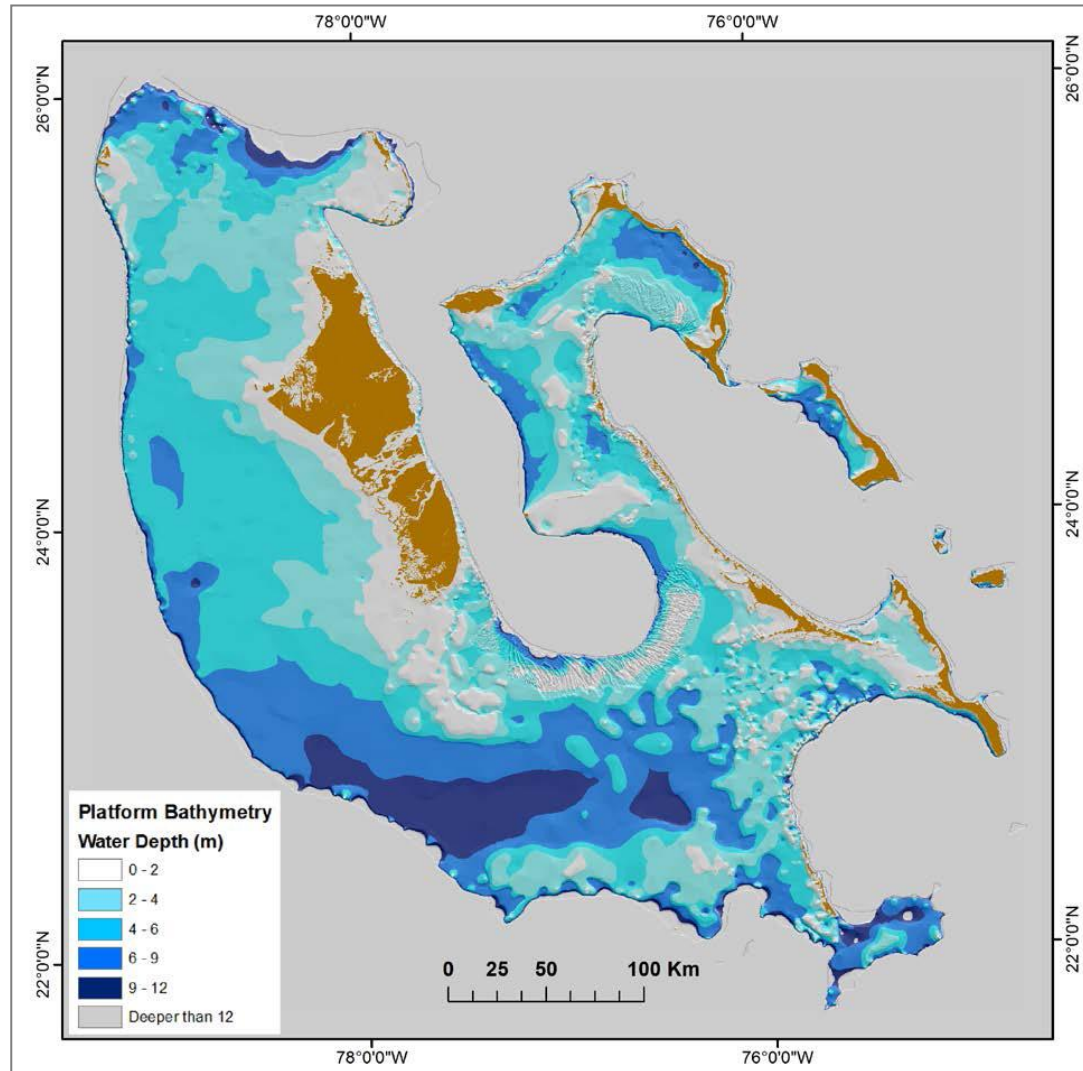


Figure 1. Platform bathymetry of Great Bahama Bank (GBB), showing water-depth variation across it.

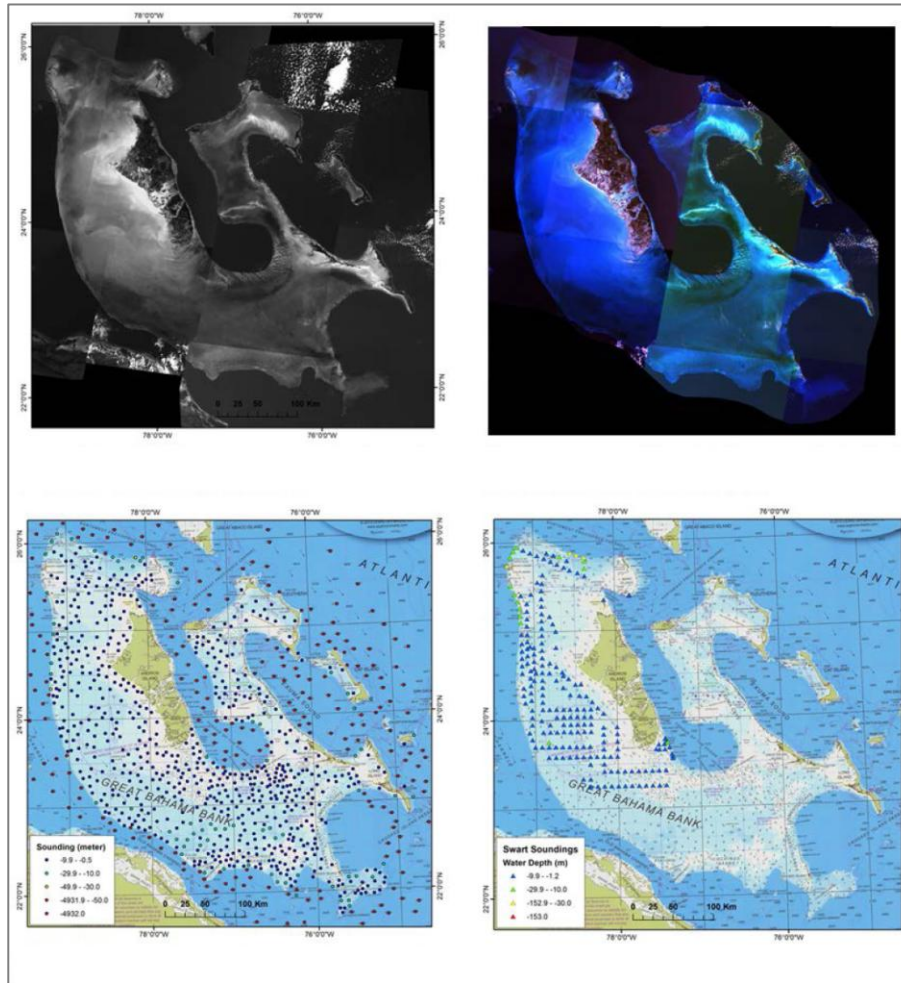


Figure 2. A. 100-m Landsat TM Mosaic of 13 full scenes Band 1 (reflected blue light revealing maximum water depth). B. Color mosaic of 13 Landsat TM full scenes; mosaic has 5244 rows x 5208 columns of ~27,310,000 pixels. C. 5513 digitized soundings (932 shown here) from Explorer Charts “The Bahama Islands” ©Lewis Offshore Ltd. D. 210 depth measurements from Reijmer et al. (2009).

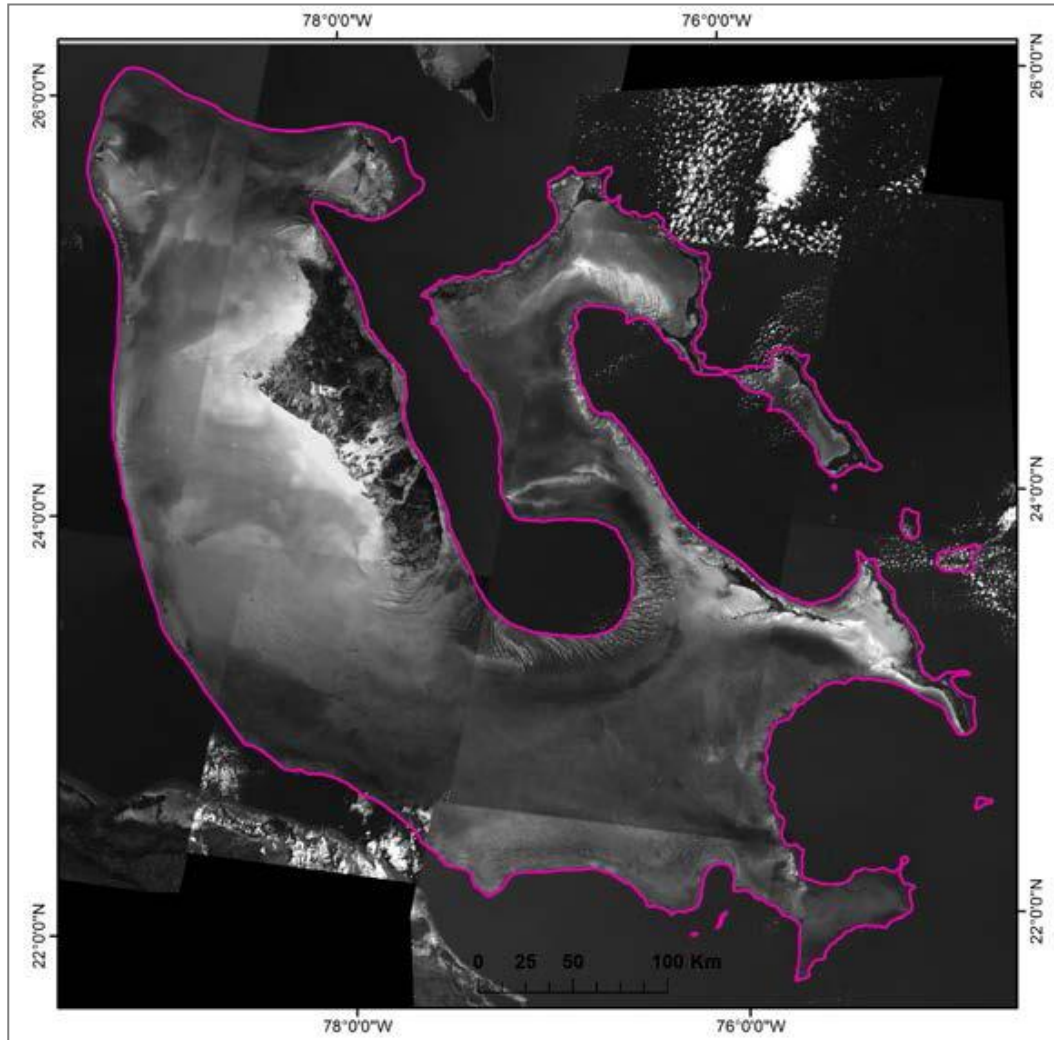


Figure 3. The edge of the platform, 30-m contour for the blue light band 1 of the Landsat TM mosaic, is shown by the purple line.

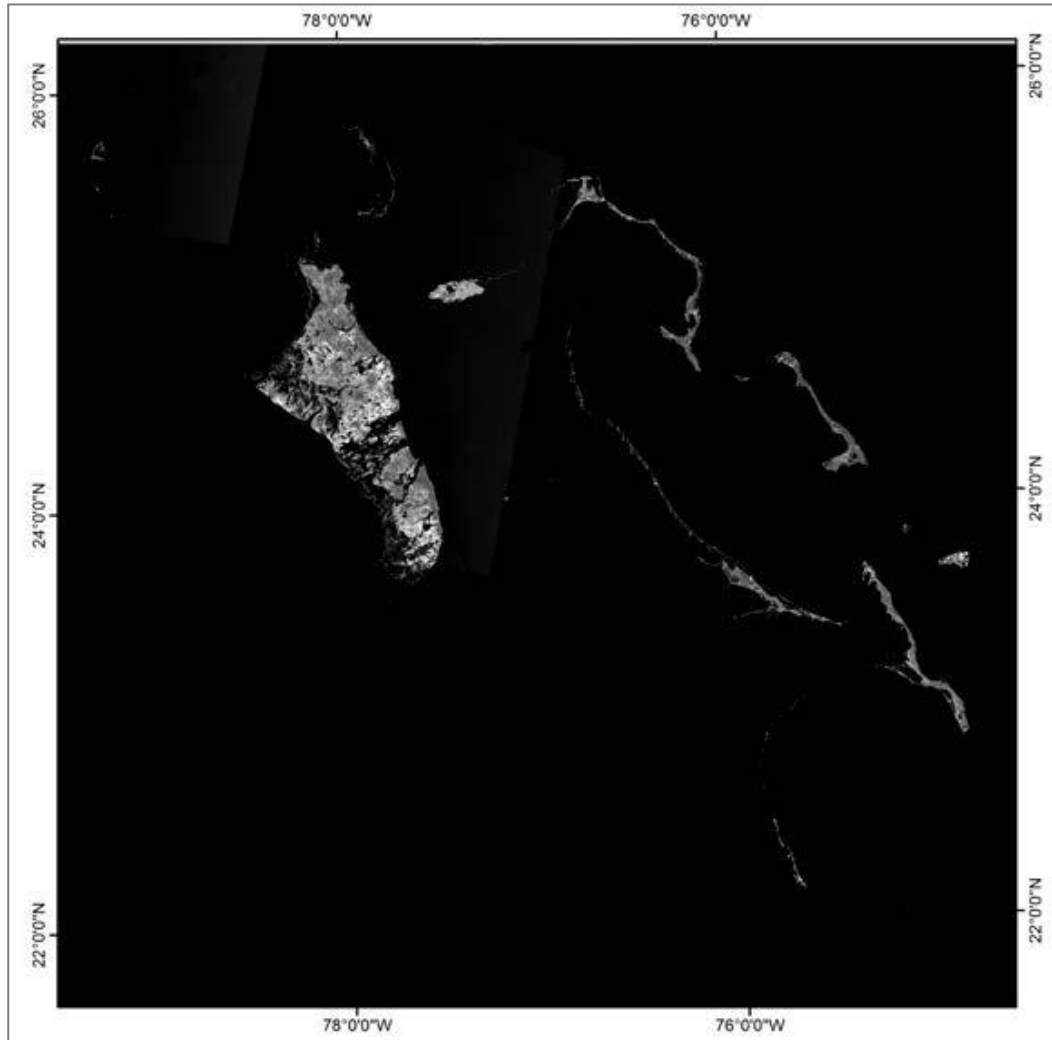


Figure 4. Shorelines of islands derived from the shortwave-infrared band 5 of the Landsat mosaic. Water is black; land is shades of gray.

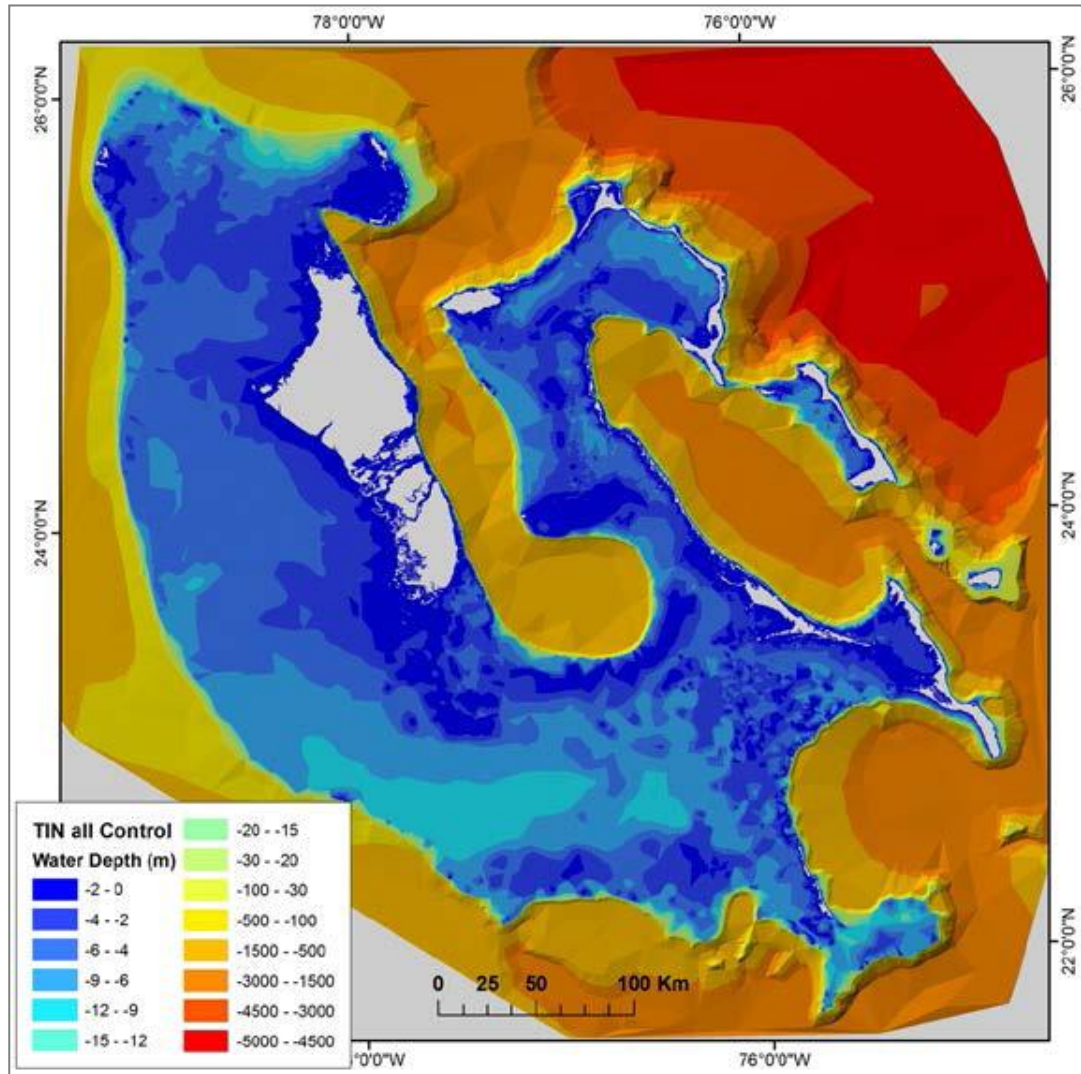


Figure 5. Water- depth map developed by use of the triangular irregular network (TIN) interpolation method.

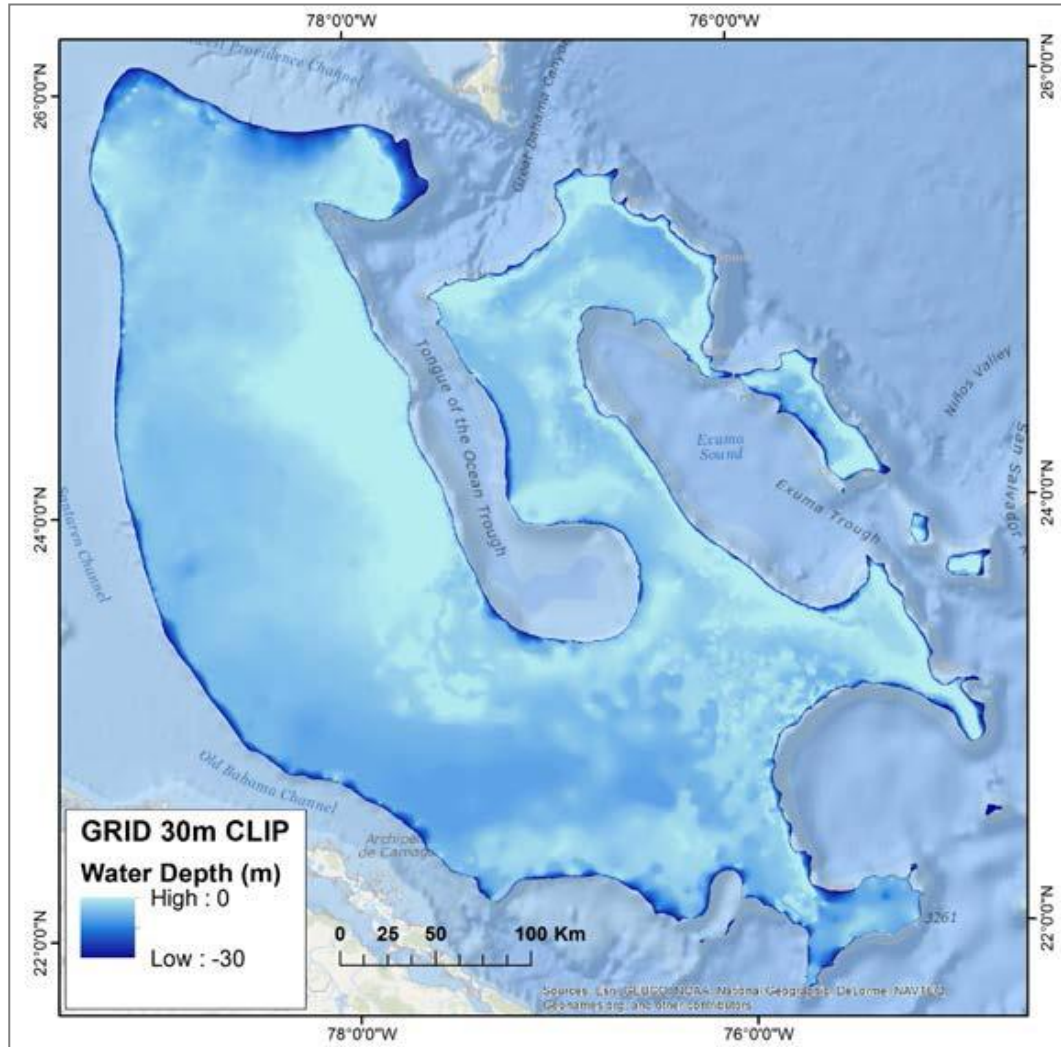


Figure 6. Water-depth map developed by conversion of TIN model to 150-m grid using Interpolated Distance Weighting (IDW) method.

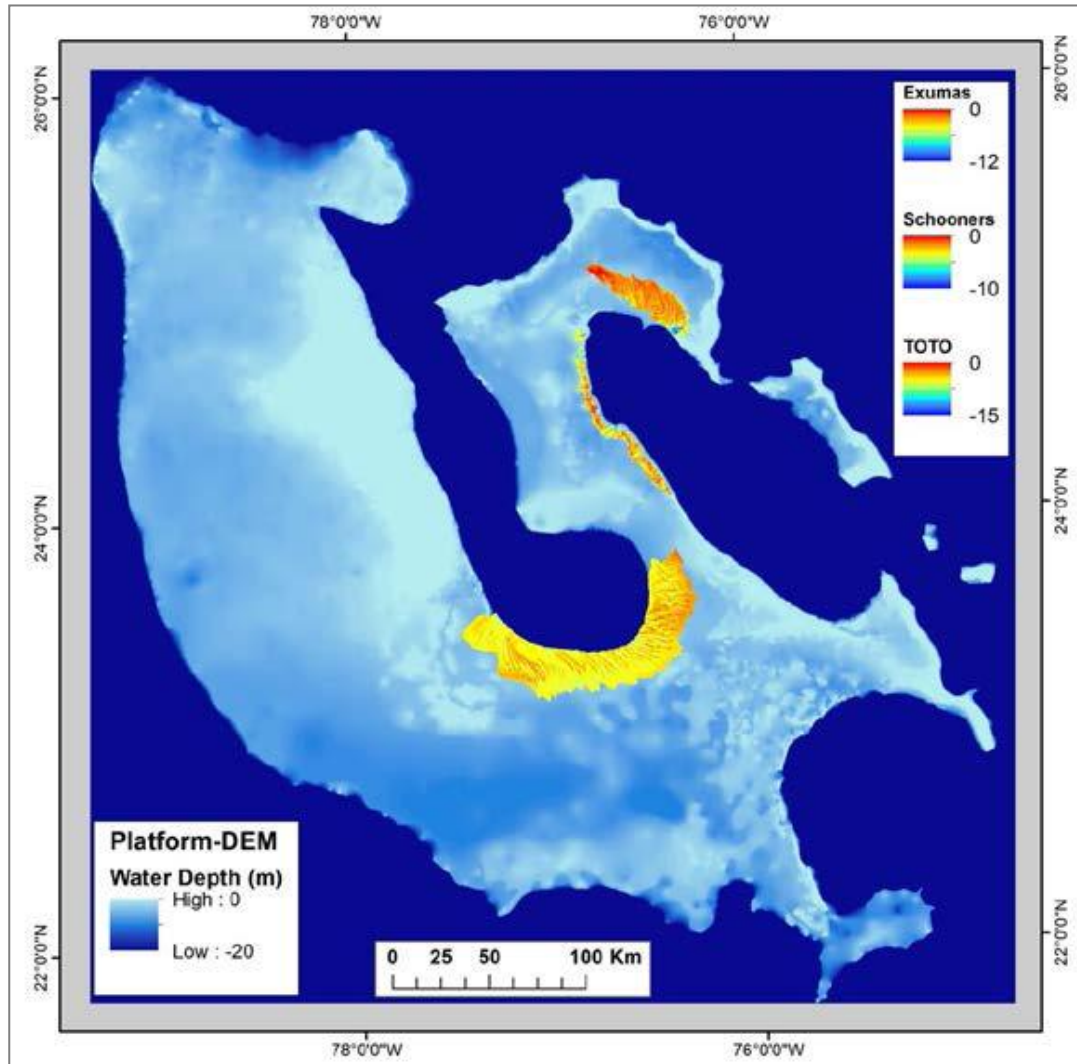


Figure 7. Platform map integrating resampled bathymetric DEMs from Harris et al. (2011) with the platform DEM.

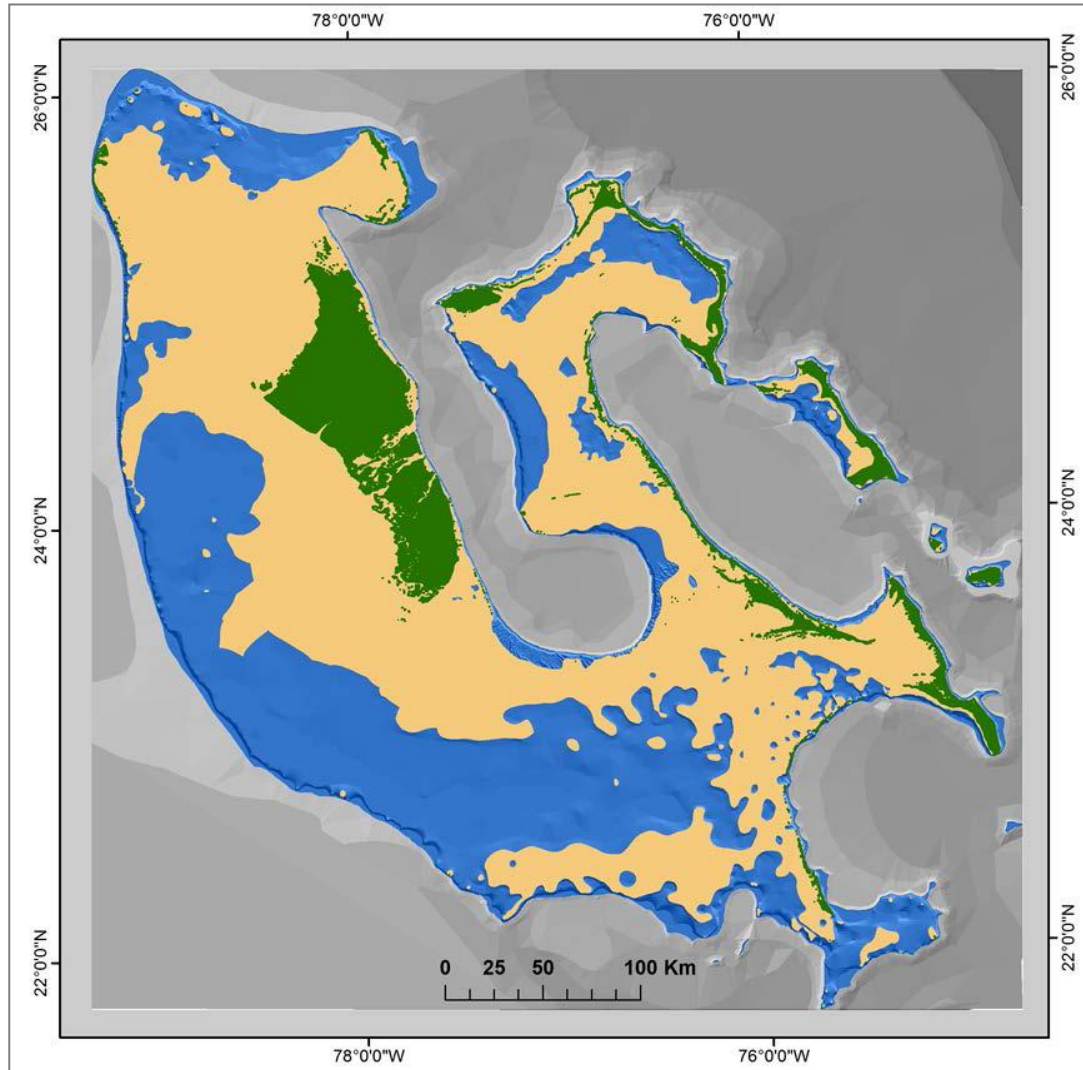


Figure 8. Bathymetric map of GBB, showing 60% of GBB lies in 5m or less of water.

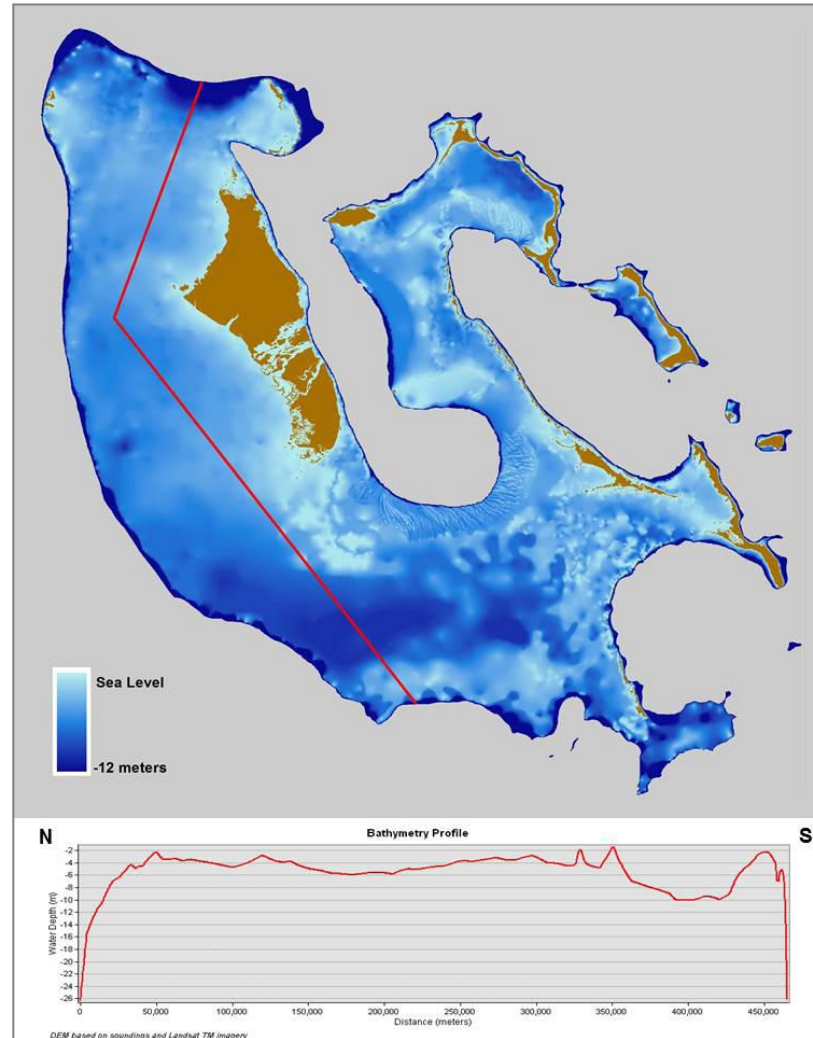


Figure 9. Map of GBB (upper), showing bathymetric patterns across GBB, which are a potential controlling factor of depositional facies patterns; bathymetry profile (lower) that illustrates the irregular filling of accommodation space.