The Symphony of the Spheres: Oolitic Sand bodies, Bahamas*

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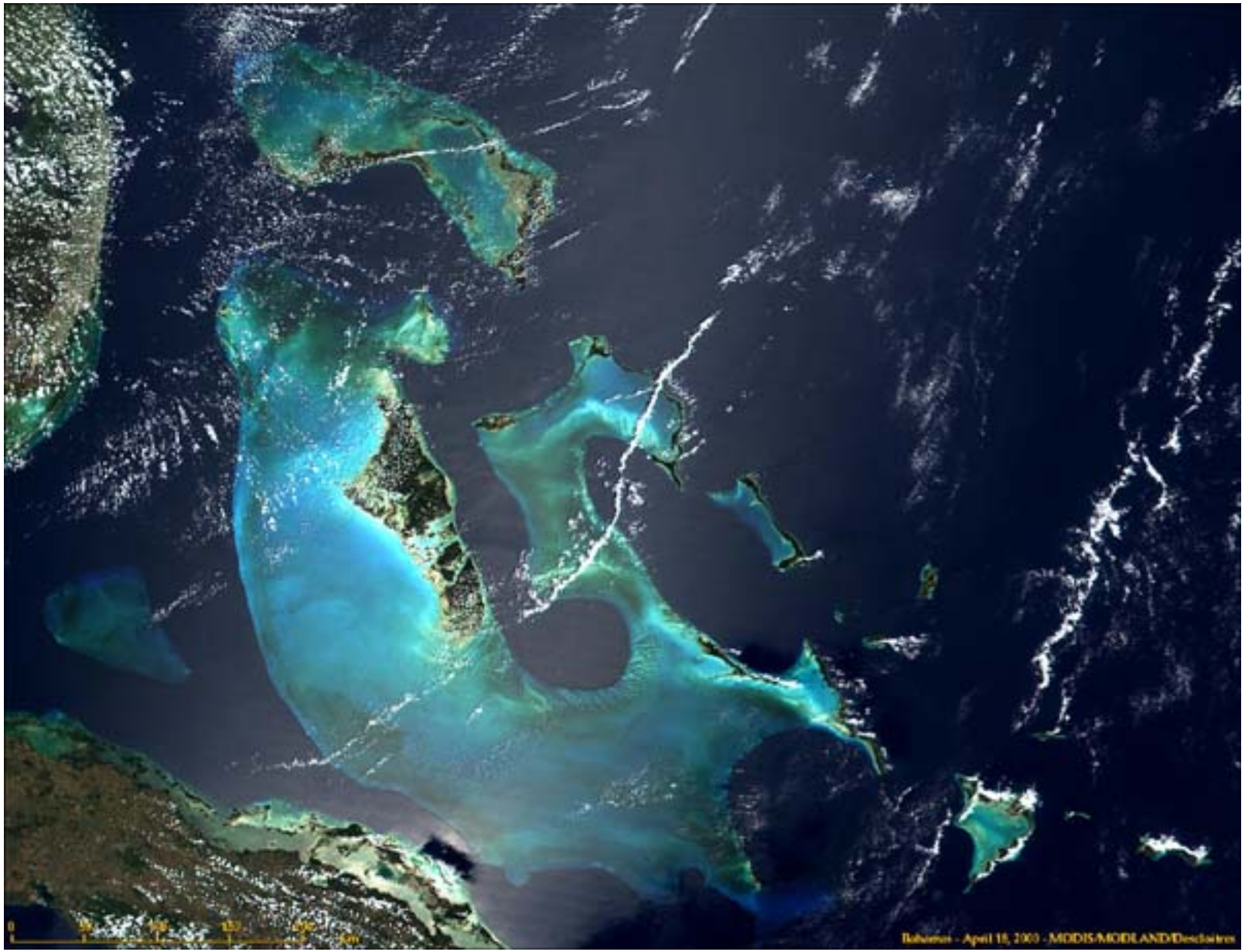
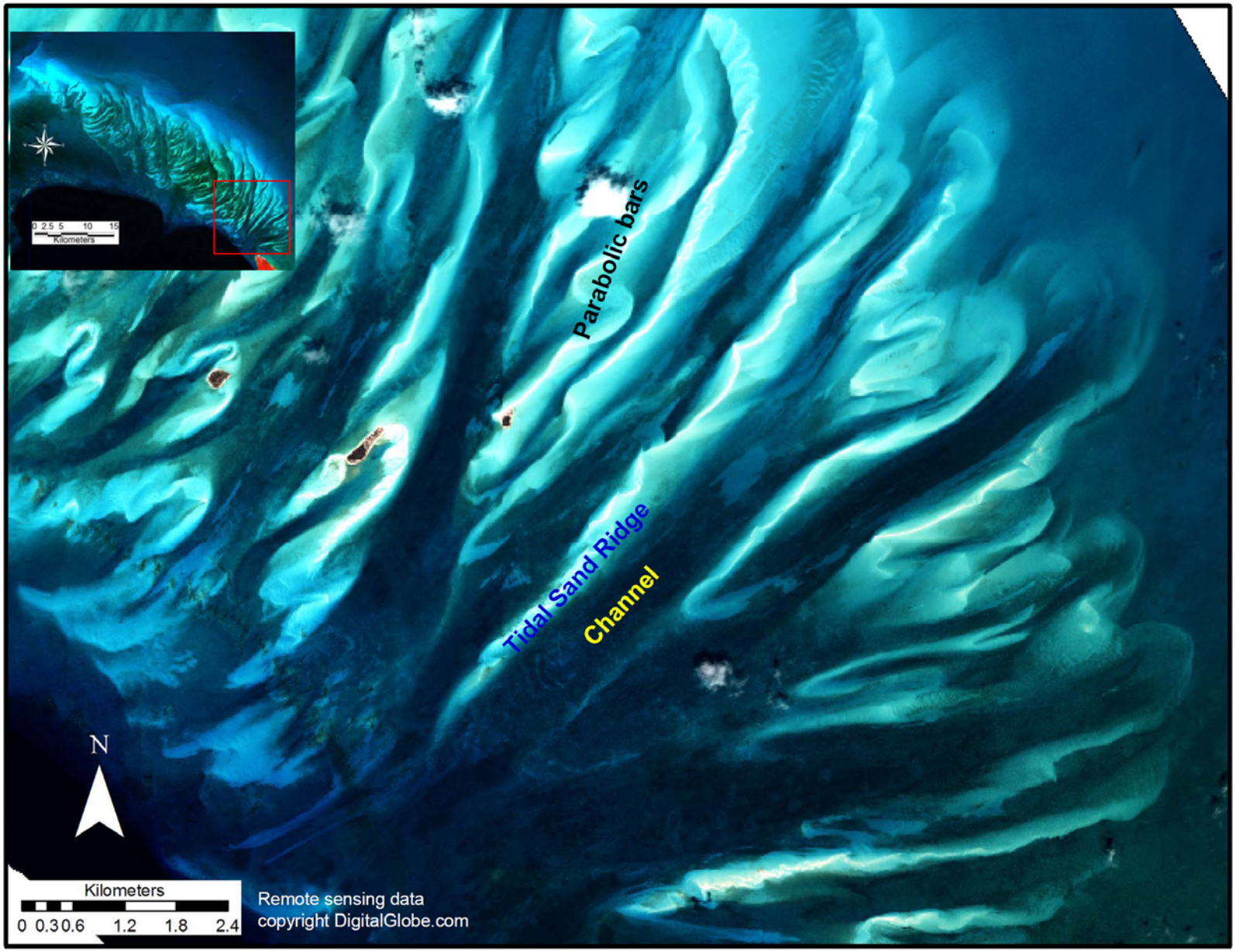
Abstract

Oolitic strata are ubiquitous in the stratigraphic record. Although the sedimentologic criteria indicative of shoals, their subfacies, and the general factors that control the distribution of shoals on platforms have been well documented, details of the spatial geomorphic and sedimentologic patterns within individual shoals, the processes active within these shoals, and feedbacks are less systematically explored. To start to fill this gap, the goal here is to summarize persistent themes in landscape-scale patterns and depositional processes from Holocene tidally dominated ooid shoals of the Bahamas. The insights provide information on the origins of possible shapes of oolitic geobodies and trends in depositional porosity and permeability that could be present within the bodies, information useful for building more robust reservoir models.

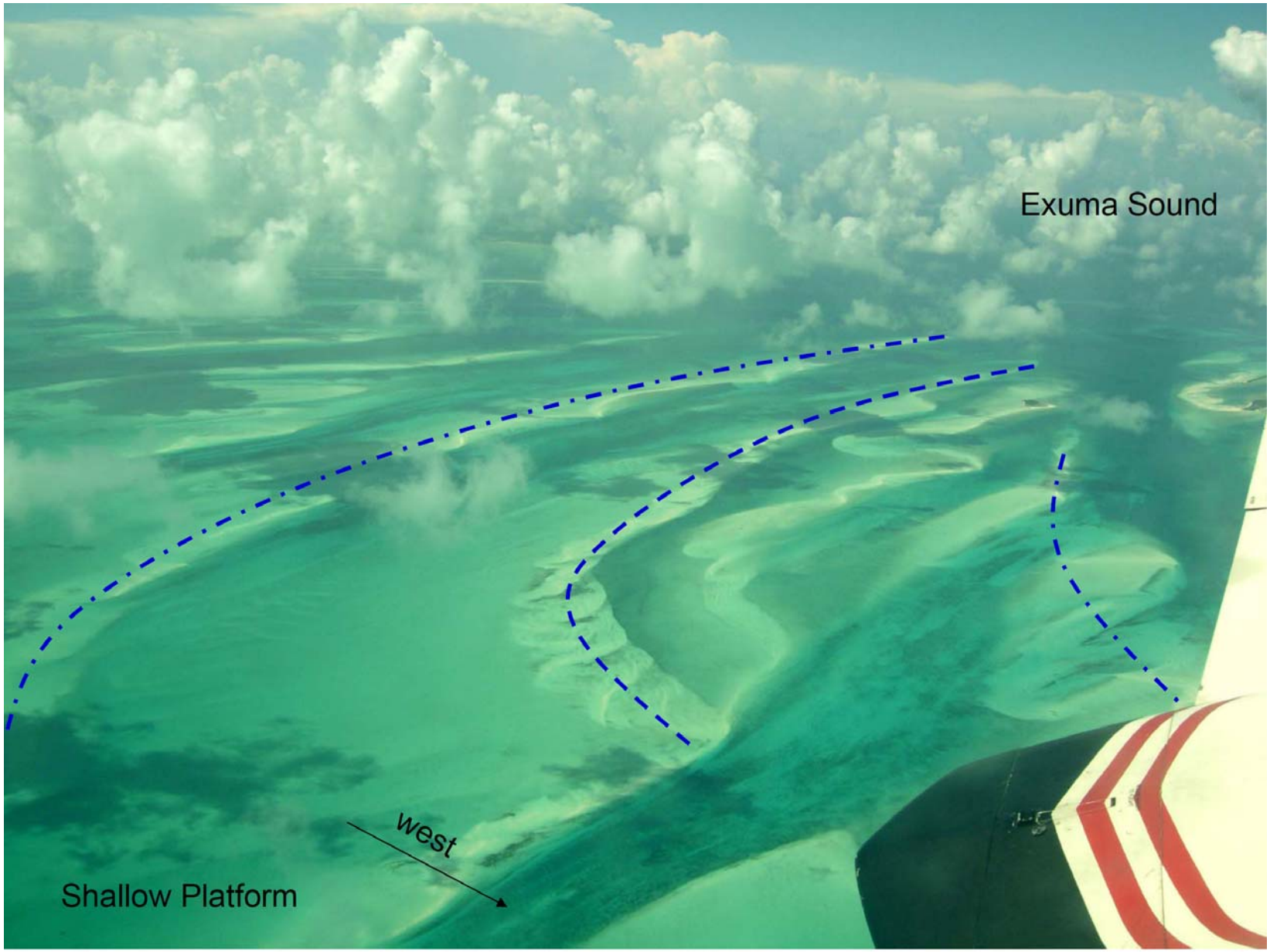
Geomorphic, sedimentologic, and hydrodynamic observations from oolitic systems in the Bahamas illustrate that: 1) Shoals are characterized by systematic trends in grain type, size, and sorting. At the largest scale, many oolitic facies belts include a platformward-fining trend related to wave and tidal energy dissipation. Similarly, sedimentology across individual bars varies. Commonly, where bounded by fixed (e.g., rocky) margins, channel sediments are coarser than bar crests; if mobile sandy bars flank channels, bar crests include coarser sediments. 2) Sedimentologic trends are shaped by close linkages and feedbacks among hydrodynamics, morphology, and sedimentology. In many systems, mutually evasive tidal flows establish a net circular flow pattern around oolitic bars, facilitating transport of ooids as they encircle bars, but their remaining in the shoal system facilitate growth of ooids. 3) Bar morphology is closely related to flow velocity, and feedbacks can result in the emergence of a series of bars with similar geomorphic shapes, as oolitic bars concomitantly are formed by, and direct, tidal flows. 4) Although many shoals are influenced by lateral restriction from bedrock highs, shoals do not require underlying highs on which to nucleate. 5) Shoals are not markedly impacted by tropical storms. Instead, day-to-day processes appear more significant in shaping their morphology. 6) Shoals are morphodynamically akin in numerous ways to siliciclastic systems, even though their carbonate sediment can be produced and cemented in place.



Bahamian oolitic sand shoals.



Facies belt-wide patterns.



Arrangement of oolitic shoals, Exuma Sound.

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