
A source-to-sink approach for marine carbonate systems applied to the Bahamas carbonate platform during the Neogene and Quaternary: quantification and variation of the carbonate production.

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Résumé

Marine carbonate production is a critical parameter of the Earth system at different spatial and temporal scales, from global carbon-climate cycles to local carbonate sedimentary systems, yet difficult to quantify in deep time for the following reasons: incompleteness of the geological record in time and space (dissolution, erosion, export), uncertainties in age dating and stratigraphic interval duration, absence of direct geochemical proxy and complexity of controlling factors (biological and physico-chemical).

A source-to-sink approach is applied to a portion of the Bahamas carbonate platform, next to the Exuma Sound, during the Neogene and Quaternary. A full carbonate sedimentary system is considered during a well-constrained stratigraphic interval, from the platform (carbonate production zone) to the adjacent slope and basin where sediments are exported and

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redeposited. Volumetrics are estimated thanks to marine sedimentological-geophysical surveys, anchored by seismic and well data. The exported sediment "catching area" on the platform is well delineated.

We develop a twofold approach: **(1)** mass balance calculations of the preserved sediments on the platform, the slope and the basin for discrete stratigraphic units. Carbonate production rates on the platform ($\text{kg}\cdot\text{m}^{-2}\cdot\text{kyr}^{-1}$) are estimated by integrating all the preserved volumes per time units. The volumes of exported sediments are rated over different scenarios of sediment production areas on the platform. **(2)** 3D stratigraphic forward modelling of the studied interval from the platform to the adjacent slope and basin. Carbonate production rates are tested given that the geometry of the system and accommodation parameters (topography, subsidence, sea level) are well constrained. Calculated (method 1) and modelled (method 2) carbonate production rates are compared and plotted over time. Carbonate export rates are also compared over time to the carbonate production rates.

This study allows the identification of several peaks of high carbonate production and export during the last 12 million years, most likely related to high sea levels. Preserved carbonate production rates on the platform is generally higher than the exported carbonate rates, explaining the general aggrading-prograding architecture of the platform margin. Estimated carbonate production rates are one to two orders of magnitude less than instantaneous production rates measured from modern carbonate biota.

Mots-Clés: carbonates, source, to, sink, carbonate production, platform