



## **Paleoenvironmental control on carbonate platform clinoforms (Neogene, Maldives)**

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The Maldives archipelago contains a carbonate edifice that bears a unique and mostly unread Indian Ocean archive for understanding how both sea level and current patterns shape carbonate platforms. During the Lower and Middle Miocene there was a carbonate platform system that had different clinoforms with distinctive internal structure and external geometry as imaged by the seismic profiles. There are three types of clinoforms based on their geometries: 1) ramp-like to slope-like clinoforms with low-angle planar slopes; 2) clinoforms defined by exponential steep slopes with well-developed platform edges and terminating into subhorizontal topsets; and 3) exponential to sigmoidal clinoforms where the platform edges are replaced by gently inclined hanging shoulders. Such clinoform geometries have been observed in other carbonate systems elsewhere, but those of the Maldives have a quality and situation that made them ideal for understanding the processes shaping the clinoforms and linking them to the global events occurring during the Miocene. The sediments forming the proximal and distal slope of these clinoforms were retrieved during IODP Expedition 359 and were the subject of facies, microfacies, and ichnofabrics analyses. The objective of such analyses was to characterize the paleoenvironmental conditions along the clinoforms, as well as subtle changes of the depositional regime controlled by variations in the frequency and intensity of the platform shedding and the current regime. There are major turnovers marked by surfaces with abrupt changes in the fossil assemblage, the ichnofabrics, and the natural gamma ray values that bound the intervals with different clinoform geometries. The interval of ramp-like clinoforms is at the base of the succession and is characterized by carbonate production in the ramp with abundant shallow-water bioclasts and weak bioturbation. The interval with exponential clinoforms directly overlies the ramps and is dominated by hemipelagic components with eventual sediment export from the platform occurring as debris flows, sediment flows, and slumping. The main phase of development of the exponential clinoforms occurred between 17 and 15 Ma, coincident with the global Middle Miocene Climate Optimum. The overlying interval of sigmoidal clinoforms with hanging shoulder is characterized by the strongly reworked material and the good oxygenation of the slope sea-floor inferred from the ichnofabrics. Such features are interpreted as increased significance of currents flowing into the Inner Sea of the Maldives as a result of the Middle Miocene Climate Transition and the concomitant expansion of the East Antarctic Ice Sheet. The enhanced current had a double effect on the clinoforms with erosion at the proximal part, hanging shoulder, and input of oxygenated waters at the distal slopes. This current system may be anticipatory of the onset of the South Asian Monsoon that terminated with the platform development and initialized the drift deposition in the Maldives during the Middle Miocene. Therefore this system provides a very good example to show how clinoform geometries are related to internal factors as the carbonate production and external factors as the global circulation pattern.