The Demerara Marginal Plateau: a Case Study of a Distal Marginal Plateau Dominated by Contouritic Processes and Gravity Instability

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ABSTRACT

Mercier de Lépinay et al. published in 2016 an updated inventory of transform passive margins in the world. This inventory shows that those margins represent 30% of continental passive margins and a cumulative length of 16% of non-convergent margins. It also highlights the fact that many submarine plateaus prolong transform continental margins, systematically at the junction of oceanic domains of different ages. In the world, we identified twenty of those continental submarine plateaus (Falklands, Voring, Demerara, Tasman, etc). The understanding of the sedimentary evolution of those marginal plateaus has many scientific and economic issues.

The Demerara marginal plateau located off French Guiana and Surinam belongs to this category of submarine provinces. It is potentially fed by sediments from the Amazon, Orinoco, Maroni and Oyapock rivers. The GUYAPLAC (2003), IGUANES (2013), MARGATS (2016) and DRADEM (2016) cruises allowed mapping the distal Demerara plateau with multibeam bathymetric data and acquiring high and very high resolution seismic data including chirp data. 20 piston cores were also collected during the IGUANES cruise that allowed to ground-truth and characterize deep sediments.

This dataset has been analyzed at different scales. The seismic analysis of the dataset shows that the distal plateau evolves through three evolutionary stages: (1) a “pre-contourite phase” from late Albian to Early Miocene with depocenters highly influenced by the structure of the Northern transform-derived border of the plateau. Major unconformities record the Cretaceous/Tertiary re-suspension event, and the Paleocene/Eocene Thermal Maximum (PETM). (2) a transition period from middle Miocene to early Pliocene during which a major unconformity possibly records major changes in oceanic circulation and during which major gravitational events affected sediments down to Paleocene strata, (3), a “contourite phase” during which strong bottom-currents shape the distal Demerara plateau. In particular, the NADW (North Atlantic Deep Water) follows an older slope failure headscarp that is regularly and locally eroded during the Plio-Pleistocene. A contourite Depositional System made of a longitudinal moat and a drift has been mapped. Some pockmarks develop within this drift that is expressed at the scale of recent sedimentation on Chirp data The analysis of current meter data recorded in the study area in a 8 month time period shows that the NADW is flowing parallel to the bathymetric contours at speeds reaching 32 cm/s. Core data allowed confirming the importance of contourite and mass-wasting processes in the recent (last 120-250 kyr) sedimentary evolution of this domain. Sedimentary sequences are clearly impacted by the variations of the NADW intensity and associated winnowing effect during glacial/interglacial cycles. In addition, in this area, periods of intense winnowing are marked by glauconitic neoformation. We suggest that the presence and degree of maturity of glaucony might be used as an effective proxy to study current variations depending on climatic oscillation. The next step of our program will be to better assess the sediment source – probably exclusively transported from the North by the NADW as illustrated by preliminary results.