

Into the deep: A coarse-grained carbonate turbidite thalweg generated by gigantic submarine chutes

Thierry Mulder (1), Hervé Gillet (1), John Reijmer (2), André Droxler (3), Thibault cavailhes (1), Vincent Hanquiez (1), Kelly Fauquembergue (1), Stéphane Bujan (1), David Blanck (3), Sara bashah (4), Léa Guiastrennec (1), Natacha Fabregas (5), Audrey Recouvreur (6), and Chloé Seibert (7)

(1) Bordeaux University, UMR 5805 EPOC, France, (2) College of Petroleum Engineering and Geosciences, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi-Arabia, (3) Rice University, Houston, Texas, USA, (4) Division of Marine Geology and Geophysics, University of Miami, Florida, USA, (5) ENSEgid, Pessac, France, (6) Aix-Marseille University, CEREGE, France, (7) IPGP, Paris, France

New high-resolution multibeam mapping, in the Southeastern Bahamas, images in exquisite details the southern part of Exuma Sound, and its uncharted transition area to the deep abyssal plain of the Western North Atlantic bounded by the Bahama Escarpment (BE) between San Salvador Island and Samana Cay, referred here to the San Salvador abyssal plain. The transition area is locally referred to as Crooked Island Passage, loosely delineated by Crooked, Long, and Conception Islands, Rum and Samana Cays. Surprisingly in such a pure carbonate landscape, the newly established map reveals the detailed and complex morphology of a giant valley formed by numerous gravity flows originated in Exuma Sound itself, in addition to many secondary slope gullies and smaller tributaries draining the surrounding upper slopes. The valley referred here as the Exuma canyon system starts with a perched valley with low sinuosity, characterized by several flow restrictions and knickpoints initiated by the presence of drowned isolated platforms and merging tributaries. The valley abruptly transforms itself into a deep incised canyon, rivaling the depth of the Colorado Grand Canyon, through two major knickpoints with outsized chutes exceeding several hundred of meters in height, a total of 1600-1800 m. The sudden transformation of the wide valley into a deep narrow canyon, occurring when the flows incised deep into an underlying lower Cretaceous drowned carbonate platform, generates a huge hydraulic jump and creates an enormous plunge pool and related deposits with mechanisms comparable to the ones operating along giant subaerial waterfalls. The high kinetic flow energy, constrained by this narrow and deeply incised canyon, formed, when it is released at its mouth in the abyssal plain, a wide deep-sea channel with well-developed levees and fan, made of coarse-grained carbonate defined layers separated by fine carbonate sediments mixed with fine siliciclastics transported along the BE by the energetic Western Boundary Undercurrent.