3D Seismic Geomorphology of a Sector of the Upper Amazon Submarine Fan– NW Foz do Amazonas Basin, Brazil

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Résumé

The Amazon submarine fan, on the equatorial margin of Brazil, is a dynamic geological setting in which slope depositional systems are strongly influenced by different forms of large-scale slope instabiliy: gravity-driven tectonism on shale detachments, which have resulted in seafloor extensional and compressional faults, and giant mass-transport deposits (MTDs) recording a history of slope failure. This study investigates the structures and morphologies of the Mid-Pleistocene to seafloor interval of part of the upper fan, based on industrial 3D seismic as well as CHIRP seismic profiles acquired during the AMARYLLIS-AMAGAS I campaign in 2023. Key stratigraphic horizons and features were mapped, including: the modern seafloor; an unconformity marking the base of an interval of widespread Mass-Transport Deposits (MTDs); and an erosional reflection correlative to a major change in relative sea-level signal (Mid-Pleistocene Transition, 0.75 Ma). Seismic attributes including RMS amplitude and DIP were also applied to characterize features such as gravity-driven slope failures, erosional channels, thrust-related folds, pockmarks, and mud volcanoes. Several 3D seismic geomorphological features were identified, including major MTD corridors, meandering and erosional channels, and other features and/or structures associated with deep-water gravity tectonics. The integration of 3D seismic data and CHIRP profiles enables a multiscale characterization of these features, highlighting the interplay between tectonic and sedimentary processes. Preliminary results reveal a clear evolutionary pattern of deep-water systems from the Mid-Pleistocene to Recent, marked by multiple sedimentation pulses linked to global base-level (eustatic) fluctuations and gravity tectonics. Erosional surfaces, sinuous channels, and MTD complexes progressively shaped the deep-sea geomorphology and the

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internal architecture of the fan. These features are consistent with previous studies that suggest increased sediment supply during this period. This study underscores the utility of integrating 3D seismic with higher resolution datasets to effectively characterize deep-water depositional systems, particularly in geologically complex environments such as the Amazon submarine fan, in order to understand the interaction and evolution over time of active sedimentation, slope failure, and shale-based gravity tectonics.

Mots-Clés: Shale detachments, Gravity tectonics, Mid, Pleistocene Transition, RMS Seismic attribute, DIP Seismic attribute, Chirp