Evidence of active fluid migration and gas expulsion on the Amazon deep-sea fan: the "Capivara" seep site

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Résumé

The Amazon River extends from the Andes to the Atlantic continental margin and has the world's highest flux of suspended sediment and terrestrial organic carbon to the ocean, leading to the formation of one of the world's largest deep-sea turbiditic fans, 10 km thick, down to water depths of 4500 m. The fan is undergoing gravitational collapse, resulting in paired extensional and compressional belts across the shelf and upper slope above water depths of 2500 m. In addition, rapid burial since late Miocene of both coarse sand and fine-grained clays, which possibly play the role of reservoir and impermeable seals respectively, is highly favourable to the generation, migration and expulsion of fluids at the seafloor.
During the recent AMAGAS campaign in May-June 2023, numerous active gas seeps were identified in the compressional domain along the axis of anticlines. They are located above regional BSR (Bottom Simulating Reflector) patches previously identified from 2D and 3D seismic data, marking the presence of an active upward flux of gas-rich fluids (Praeg et al., 2022). In particular, one site called "Capivara" seep site, was investigated in details using long Calypso cores, multibeam data, high-resolution Chirp profiles, reinterpreted 3D seismic data and heat flow measurements.
Initial results show that the BSR rises towards seafloor beneath two pipes associated with water column gas flares, indicating an active fluid flux through the gas hydrate stability zone. This is confirmed by an increased heat flow compared to the regional background. A core has recovered massive hydrates from 6 to 12 m within clay-rich intervals. Several weakly to indurated micritic sediments and centimetre carbonate concretions were collected, indicating an intense anaerobic oxidation of methane process related to the active fluid migration. In order to better understand the biogeochemical processes triggering these authigenic precipitations with emphasis on the implication of microorganisms, petrographic observations

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and mineralogical analyses will be coupled with the measurement of the carbon and oxygen isotopic composition of bulk carbonates. Future results should help quantifying integrated fluid flow rate and defining the nature of such active fluid seep site: mud/sand volcano or pockmark ?

Mots-Clés: fluid seeps, fluid pipes, pockmarks, gas hydrates, authigenic carbonates, gas flares, heat flow