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Typology of seafloor fluid seeps in the Lower Congo Basin

A. Gay (1), M. Lopez (2), C. Berndt (1) and M. Séranne (2)

(1) Geology and Geophysics Research Group, National Oceanography Centre, Southampton, UK, (2) Laboratoire Dynamique de la Lithosphère, Université Montpellier 2, Montpellier, France

A synthesis of high-resolution backscatter imagery coupled with a large 3D seismic dataset in the Lower Congo Basin (LCB) reveals patchy distribution of fluid seeps (pockmarks) from 400 m to 3000 m water depth. They concentrate in fields extending over several square kilometers where a regional polygonal fault system favors the fluids to migrate upwards. The extensive 3D seismic dataset in the LCB offers a unique opportunity to study the plumbing system that is feeding surface cold seep systems, and in general, to reconstruct the relationship between tectonics and fluid flow in passive margins. The fluid seeps in the LCB are associated with morphologically, stratigraphically or tectonically controlled fluid flow. The integration of the geophysical datasets, backscatter imagery coupled to 3D seismic, clearly indicates that fluid seeps are not randomly distributed, but their seabed organization reflects 1) the underlying structure location (reservoir or trap) where the fluids are coming from, 2) the geometry and morphology of the reservoir/trap, and 3) the discontinuities in the sedimentary column along which fluids have migrated. In the LCB seafloor pockmarks are always associated with underlying tectonic structures (fault zones, salt diapirs) or buried sedimentary bodies (turbiditic channels, erosional surfaces), while they never occur above sub-horizontal parallel-stratified fine-grained sediments. Even if triggering processes can not be clearly defined here, we propose a model of seafloor fluid seep organization, which represents a new tool for identifying the geometry of flow pathways and the underlying buried bodies where the fluids are originating from. This qualitative 3D model provides insight into the geohydrologic processes of continental margins.