Salt restoration challenges: a simplified approach

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Résumé

Many extensive margins worldwide involve thick salt with specific deformation described as salt tectonic or gravity deformation. Hydrocarbon exploration of such margins has pushed the scientific community for decades to retrace kinematics of salt associated deformations with aim at constraining geometrical evolution through time in conjunction with hydrocarbon migration and trapping histories. Very abundant literature and numerous examples highlight the complexity of salt deformation, the different styles, the different mechanisms, the associated geometries and the imaging issues. Lots of efforts have been made to reproduce analogically and numerically this deformation style and retrace kinematics of deformation with relatively good confidence.
A large, good quality 3D seismic coverage in the northern part of the Lower Congo Basin allows to observe spatial deformation changes that bring important constraints to understand gravitational deformations linked to thick Aptian salt in three dimensions. The seismic image from onshore undeformed salt series to offshore tilted blocks, translated rafts and deep-offshore spectacular compressive duplexes is observed in continuity and shows an unexpected S-shape of the onset of the compressive limit.

To perform structural deformation restoration along a series of 2D lines thanks to 3D Move software, a few hypotheses have been set acknowledging simplifications with their geometrical consequences. A set of key structural horizons have been mapped and support the restoration. It is assumed length and surface conservation through time considering at margin scale there is no easy method to quantify elongation or shortening other than faults and the impact on overall deformation is negligeable. Due to the presence of salt diapirs the restoration is performed by patches with independent horizontal movements and some horizontal compressive movements are compensated for within salt. In the absence of obvious no lateral movement the 2D lines are drawn perpendicular to apparent deformation directions and only out of plane salt movement is considered. Salt volume is constant, neglecting possible dissolution and no decompaction is added.
Despite these simplification hypotheses, this restoration of the salt gravity deformation in the Lower Congo Basin brings constraints on kinematics with potential high impact on hydrocarbon exploration of the margin.

Mots-Clés: Salt Tectonics, Rift, Passive margins, South Atlantic, Structural geology

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