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Three-dimensional geometry and growth of salt-detached strike-slip faults, Outer Kwanza Basin, offshore Angola

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Strike slip faults are a prominent tectonic feature in Earth to accommodate horizontal and/or oblique slip that trend parallel to fault strike. These faults are commonly formed on plate boundaries setting, where they are basement-involved and driven by elastic crustal loading at seismogenic depths. Still, we also observe the strike slip faults on salt-bearing slopes, where the faults are typically thin-skinned and accommodate spatial variability in the rate of seaward flow of salt and its overburden. In both cases, relatively little is still known of their three-dimensional geometry and growth in comparison to both normal and reverse fault, that have been extensively studied.

We use a high-quality, depth-migrated 3D seismic dataset to investigate salt-detached strike-slip faults in the mid-slope translational domain of the Outer Kwanza Basin, offshore Angola. We show that NE-SW-striking faults are presently located above elongate, margin-parallel, NE-trending ramps, more amorphous, dome-like structural highs, and areas of relatively subdued relief. The faults are broadly planar, display normal and/or reverse offsets, and may locally bound negative flower structures. These faults offset a range of salt and overburden structures, including salt walls and anticlines, and salt -detached thrusts and normal faults, defining six major structural compartments. Our displacement-distance (Tx) analysis of several faults reveal they are characterized by complex throw distributions that define 3-to-10, now hard-linked segments. In vertical profiles, these segments are characterized by symmetric-to-asymmetric throw distributions (Tz) that record throw maxima at the top of the Albian, Eocene and/or Early Miocene. Expansion indices (EI) and isopach maps demonstrate the presence of fault-related growth strata, with complex thickness patterns also reflecting the combined effect of vertical (i.e. diapirism) and horizontal (i.e. translation) salt tectonics. Taken together, our observations suggest the salt detached strike-slip faults evolved during three key phases: (i) Albian – nucleation and local linkage of individual segments; (ii) Eocene-to-Oligocene – reactivation, propagation, and death of many now-linked segments; and (iii) Miocene – local fault reactivation due to salt diapirism.

We show that salt detached strike-slip faults in the translational domain of the Outer Kwanza Basin grew above either rugose or relatively flat base-salt surface. More specifically, salt detached strike-slip faults, like normal and reverse faults documented elsewhere, grew in response to the

propagation and eventual linkage of initially isolated segments. We also highlight that the coeval growth of salt walls can play a role in controlling the three-dimensional geometry and kinematics of salt detached strike-slip faults.