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

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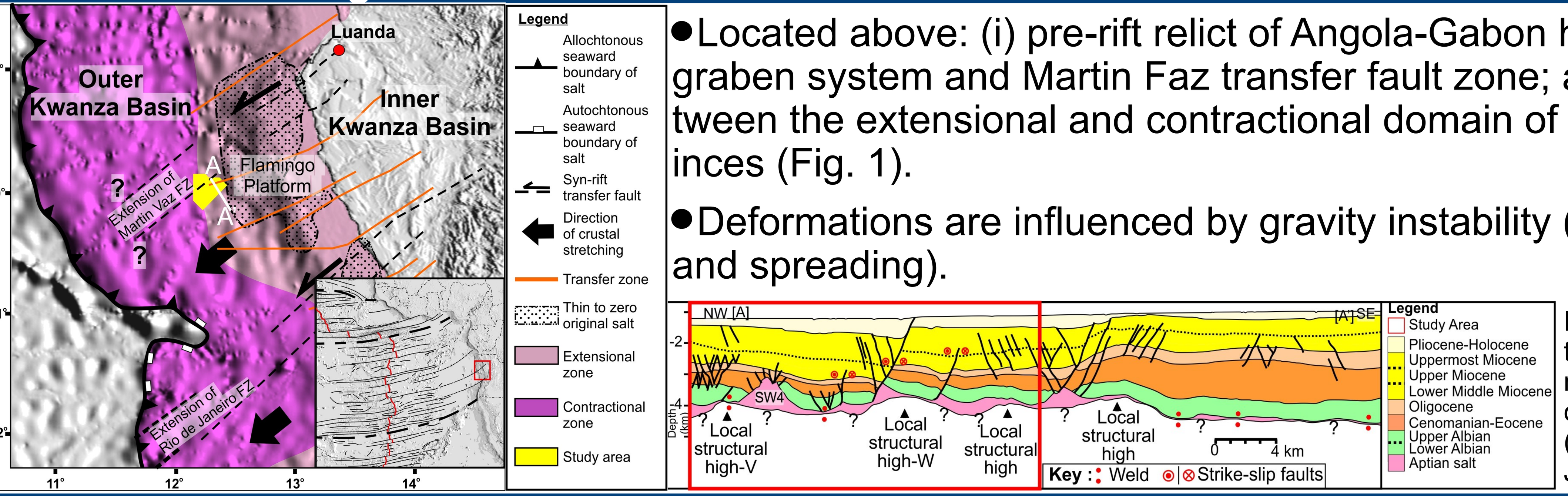
1. Introduction

- **Rationale**: Strike slip faults are a prominent tectonic feature in Earth to accommodate horizontal and/or oblique slip, commonly forming on plate boundary or salt-bearing slope settings.
- **Problem**: Little is still known about natural examples of three-dimensional geometry and growth of strike-slip faults.
- **Our study** document the two-and three-dimensional geometry to illustrate evolution of salt-detached strike-slip faults in the Outer Kwanza Basin, Offshore Angola.

2. Tectonic Setting



- Located above: (i) pre-rift relict of Angola-Gabon horst-graben system and Martin Faz transfer fault zone; and, (ii) between the extensional and contractional domain of salt provinces (Fig. 1).
- Deformations are influenced by gravity instability (i.e. gliding and spreading).

Figure 1. Location map and margin-parallel cross section (after Erdi and Jackson, 2021)

2. Methodology

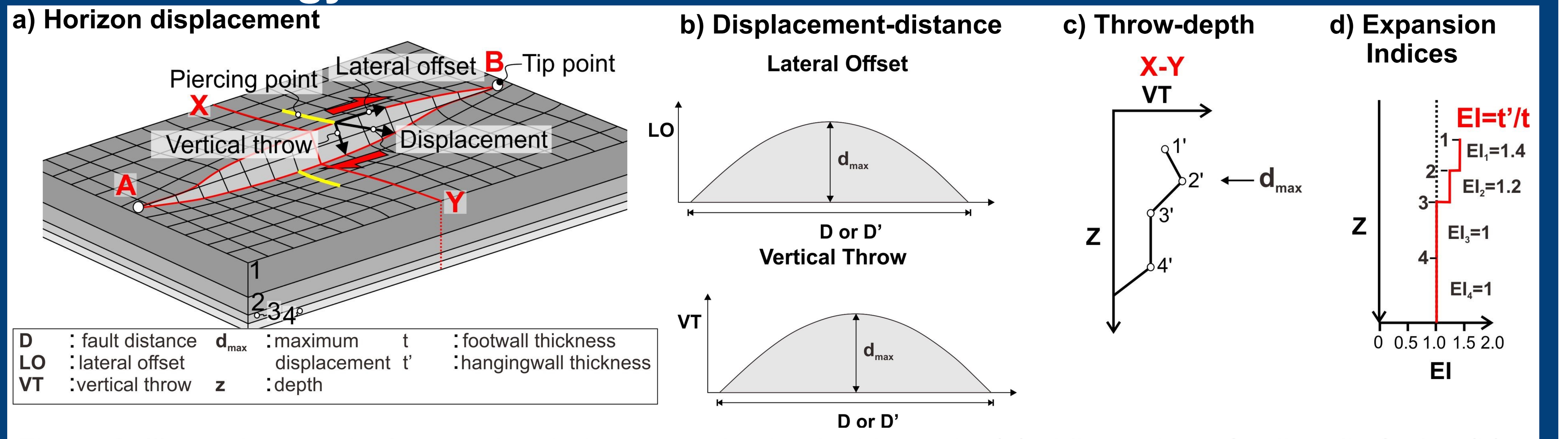


Figure 2. Illustration terminology and techniques conducting in this study: (a) oblique view of strike-slip faults, (b) lateral offset and vertical throw displacement profile to record displacement along strike of the fault, (c) vertical throw-depth, (d) Expansion Indices (e.g. Thorsen, 1963; Jackson and Rotevatn, 2013)

3. Two-dimensional geometries

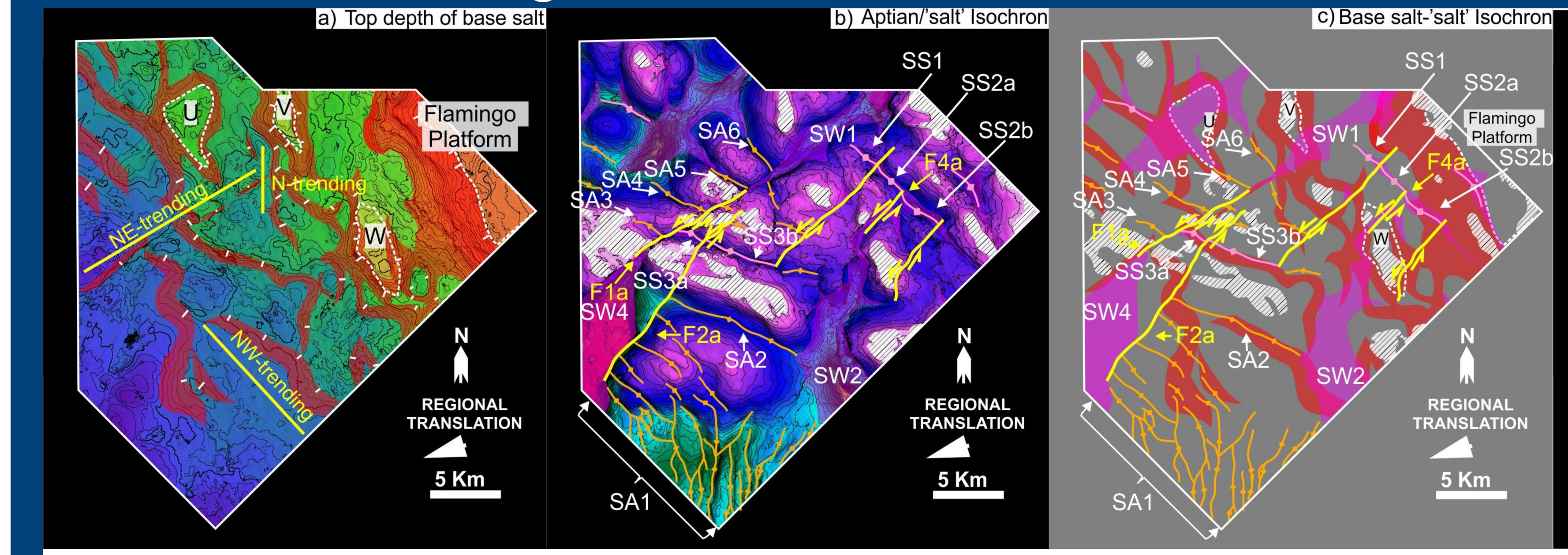


Figure 2. (a) Base-salt depth and (b) Isopach map illustrating sub-and salt structural framework. Both maps are overlaid (c) to illustrate spatial relationship between strike-slip faults and base-salt reliefs.

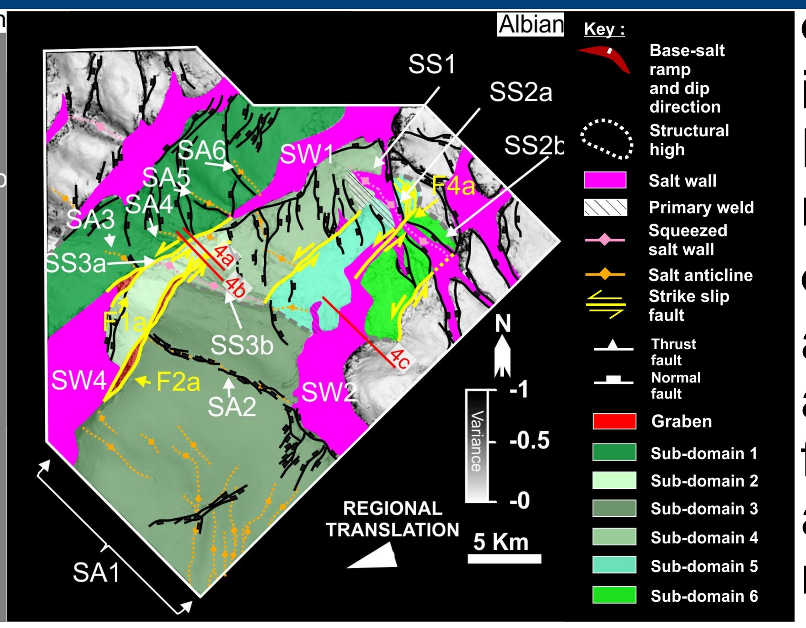


Figure 3. Albian variance map illustrating spatial relationship between strike-slip and other supra-salt faults.

- Base salt structure is characterized by NW-, N-, NE-trending ramps (Fig. 2a).
- Salt wall (SW, SS) and anticlines (SA), and the strike-slip fault are oriented parallel to the underlying ramps (Fig. 2b, c).

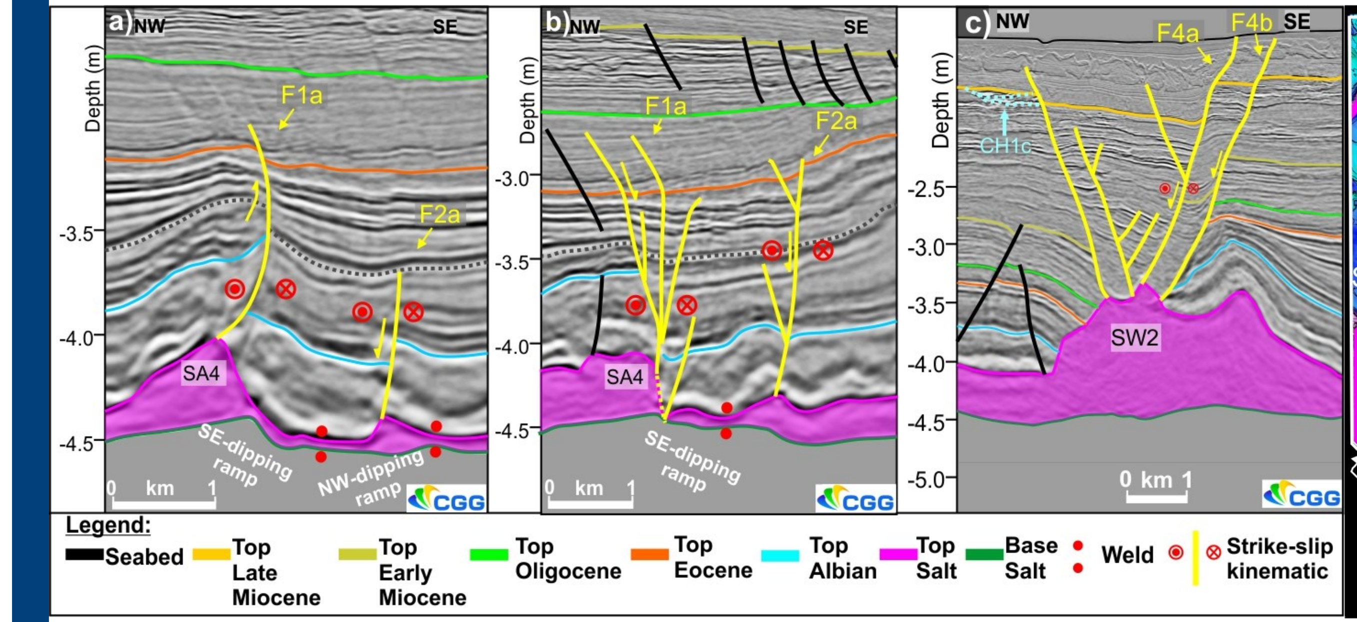


Figure 4. Cross section illustrating structural style of strike-slip faults in the study area (section location shown in Fig. 3 and 5).

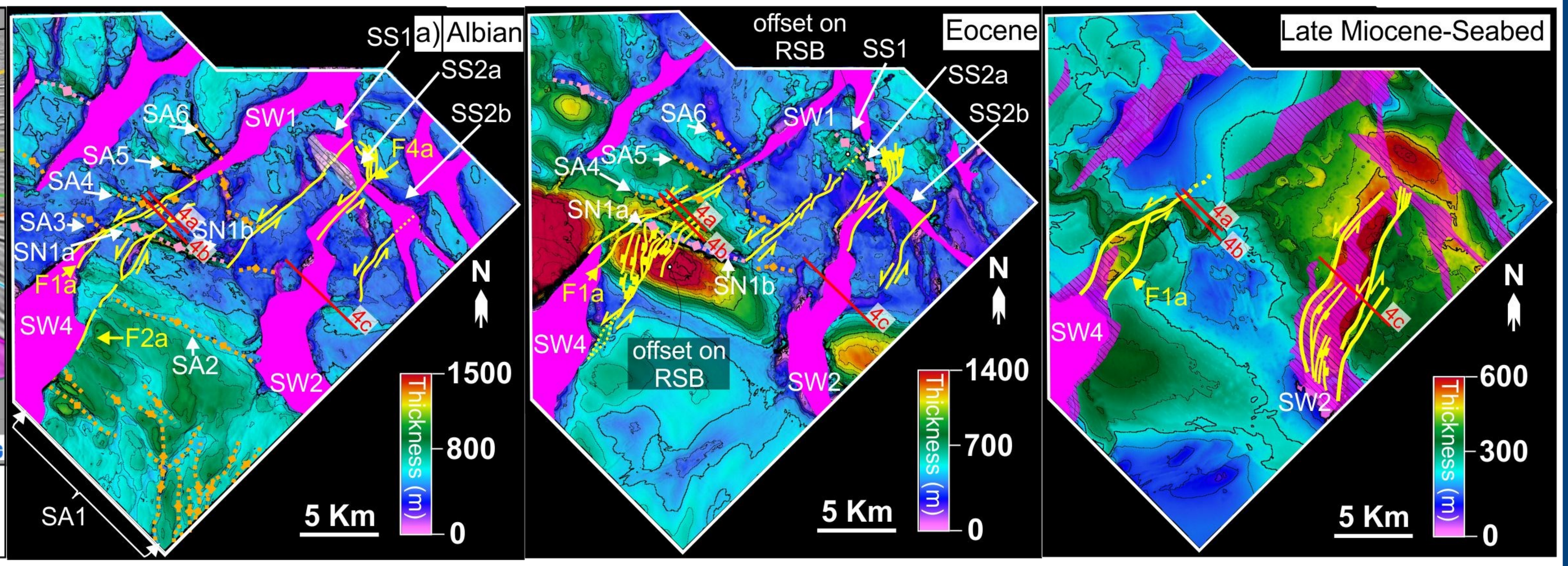


Figure 5. Isopach thickness map of (a) Albian, (b) Eocene, (c) Late Miocene-Seabed illustrating changes of subsidence and accommodation that may relate to growth of the strike-slip fault .

- The salt isopach and Albian variance map displays five left-lateral, NE striking, strike-slip faults (Figs 2b and 3). The faults bound salt anticline, connects and cut the salt wall into several segments.
- On 2D profiles, the faults are characterised by a planar, normal and/or reverse offset and, locally, a negative flower structure (Fig. 4).
- The Overburden maps show that the F1 and F4 accumulated its near final length early, in Albian and, relatively late in Miocene respectively (Fig. 5). Albian and Eocene isopach maps illustrate lateral separation on and/or difference of depocenters along strike-slip faults (Fig. 5a, b). The Late Miocene-seabed isopach maps show that the strike-slip fault growth was influenced by growth of salt walls (Fig. 5c).

4. Three-dimensional geometries

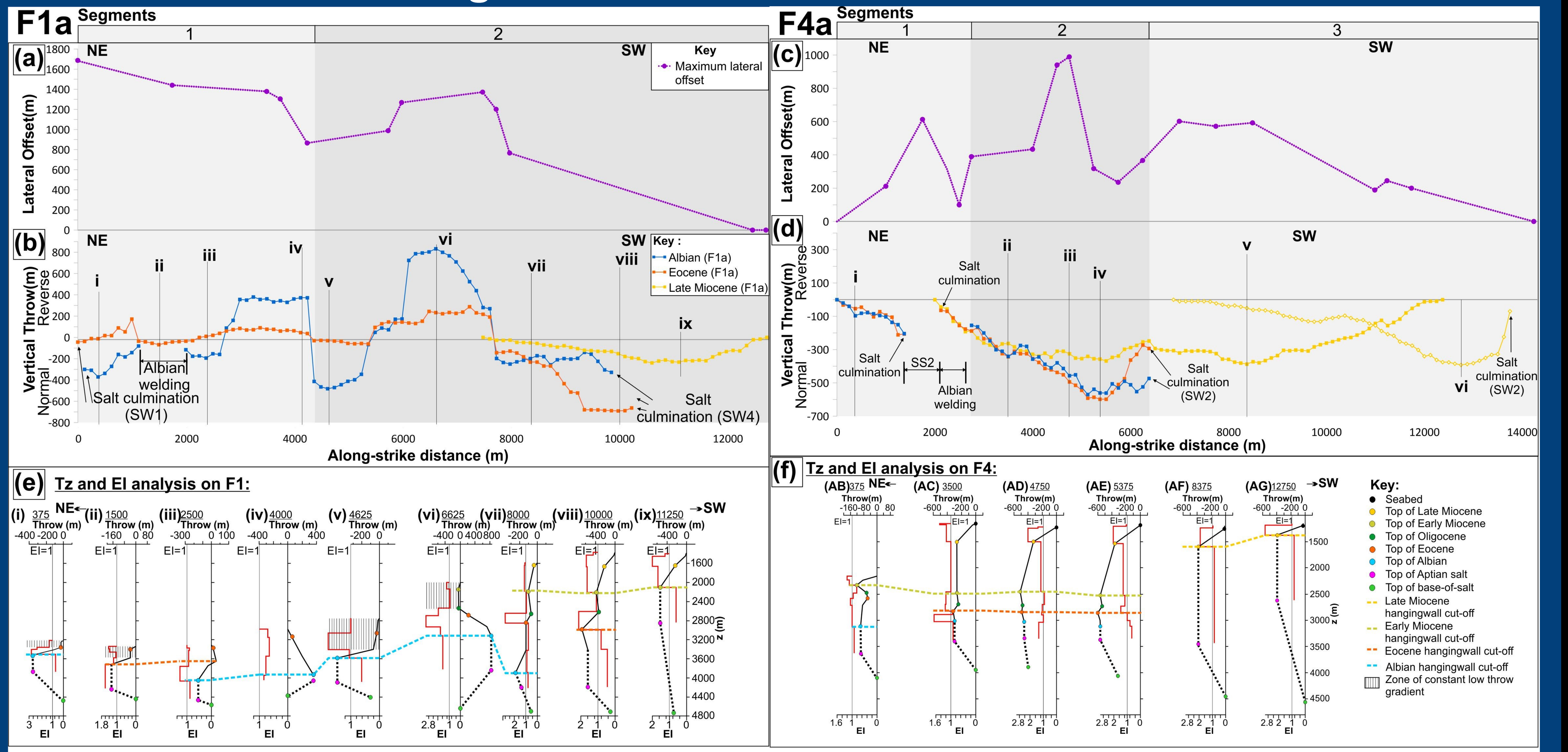


Figure 6. Displacement-distance for (a-b) F1a and (c-d) F4a,and Tz and EI for (e) F1 and (f) F4.

- The lateral offset-distance are characterized by up to 3 segments of either symmetric or asymmetric, broadly peak and locally flat top profiles (Fig. 6a, c).
- The vertical throw-distance are characterized by 3-to-10, now hard-linked sub segments that has polarity reversal (i.e. reverse and normal) along distance (Fig. 6b, d).
- The Tz profiles generally record throw maxima at the top of Albian and Eocene, and/or locally Early Miocene, (Fig. 6e, f), indicating nucleation in Albian and reactivation in Eocene or Miocene age. The profile also record low throw gradient in Eocene interval, reflecting propagations in Eocene age.
- The EI show complex patterns of relationship with Tz profiles, suggesting the lateral separation and/or differences of depocenters along strike of strike-slip faults. Still, at the Miocene-Seabed, the EI>1 is consistent with decreasing of Tz, reflecting graben-influenced by growth of the salt walls (Fig. 6e, f).

5. Summary

- Strike-slip faults in the Outer Kwanza Basin grew above either rugose or relatively flat base-salt surfaces.
- The strike-slip faults was evolved by combined effect of diapirism and translation via 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

References

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