The Enigma of the Albian Gap: lateral variability and competition between expulsion and extension

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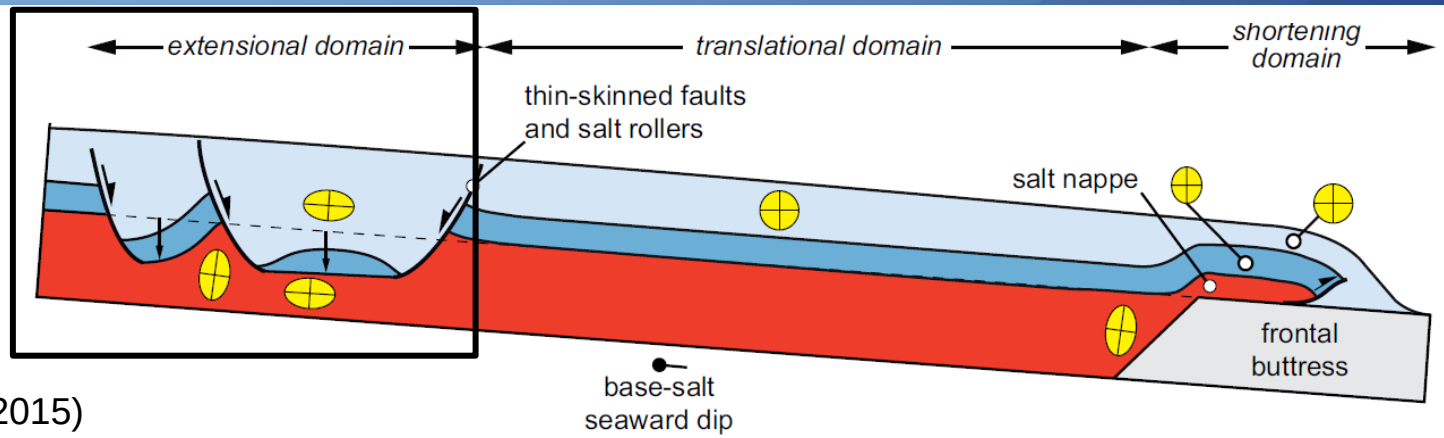
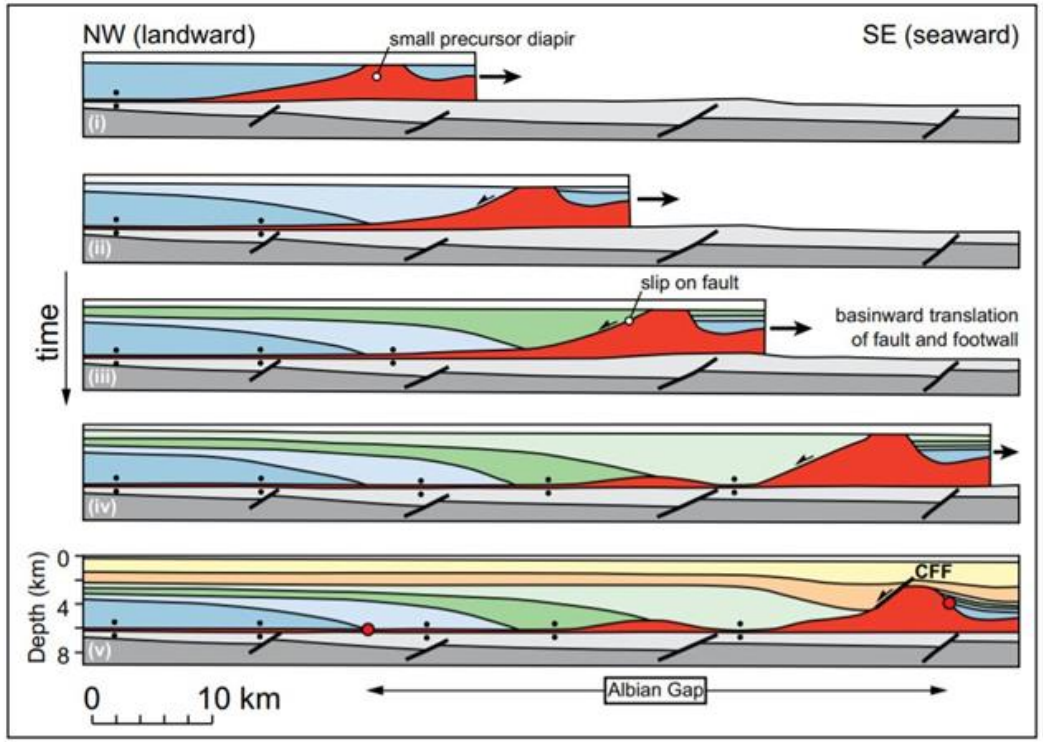
Competing Hypothesis



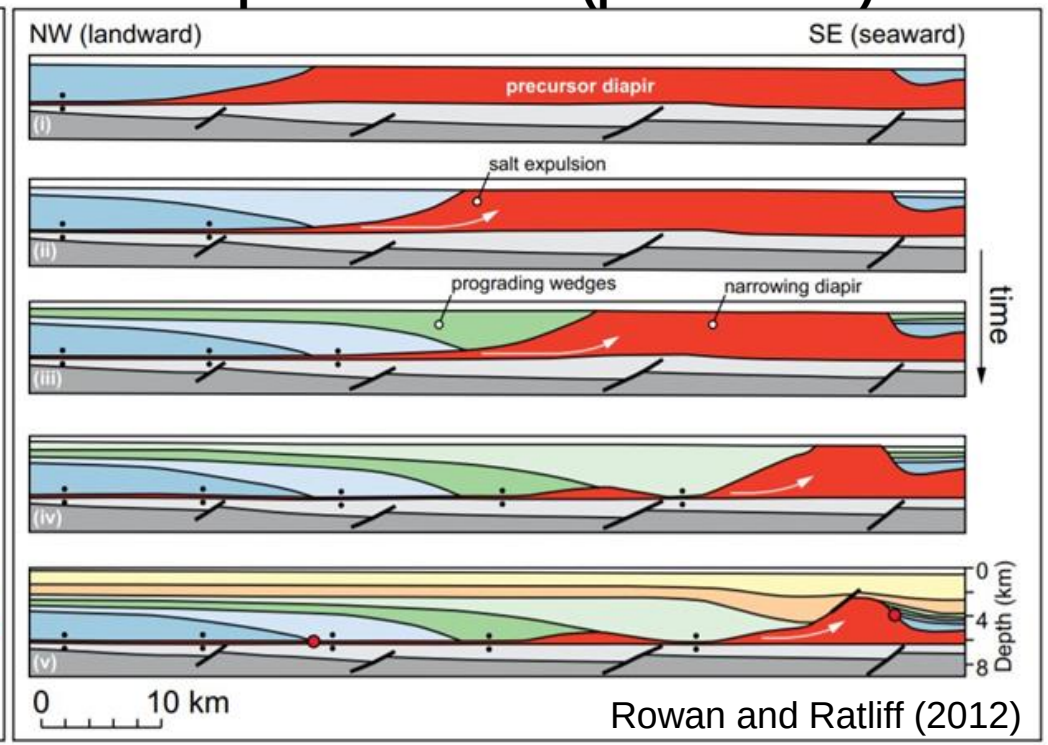
Jackson et al. (2015)

Salt-detached gravity-driven deformation:

Extension-driven (post-Albian)



Expulsion-driven (post-Albian)



Rowan and Ratliff (2012)

Albian Gap competing hypotheses (based on restorations)

Study area

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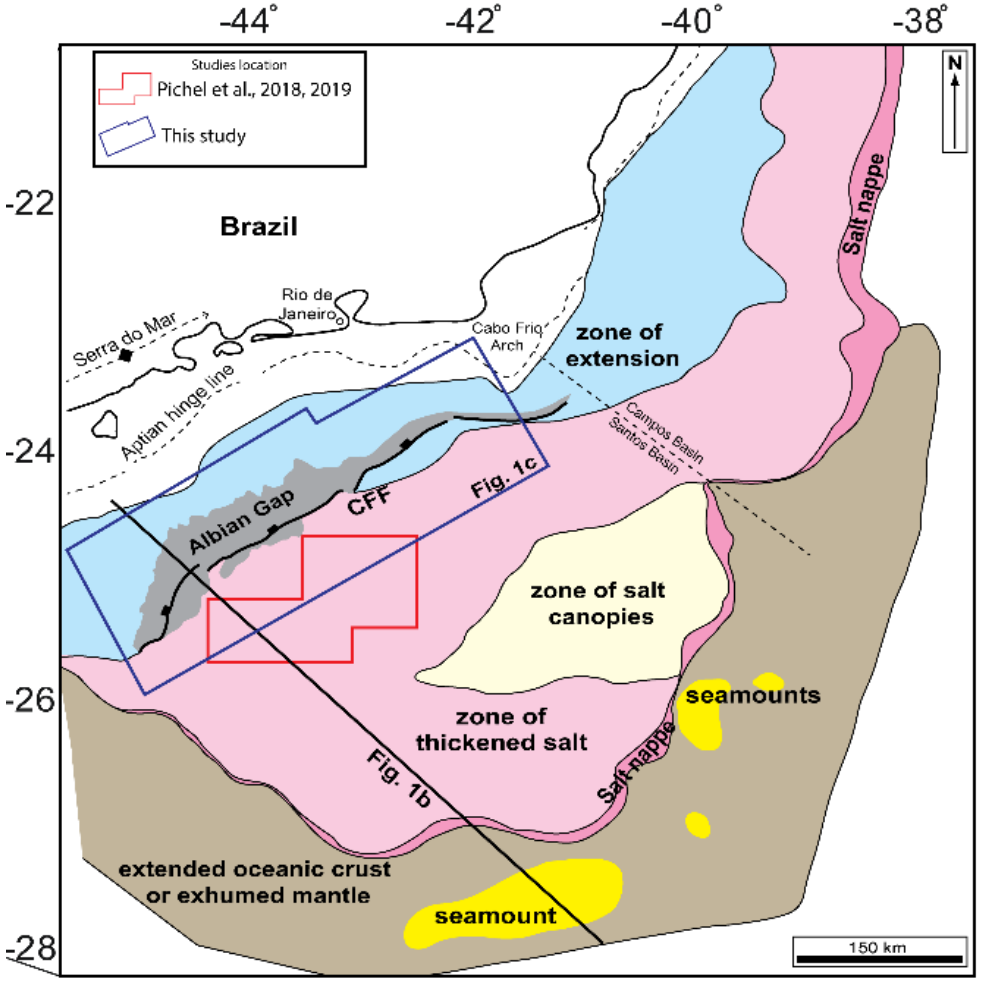
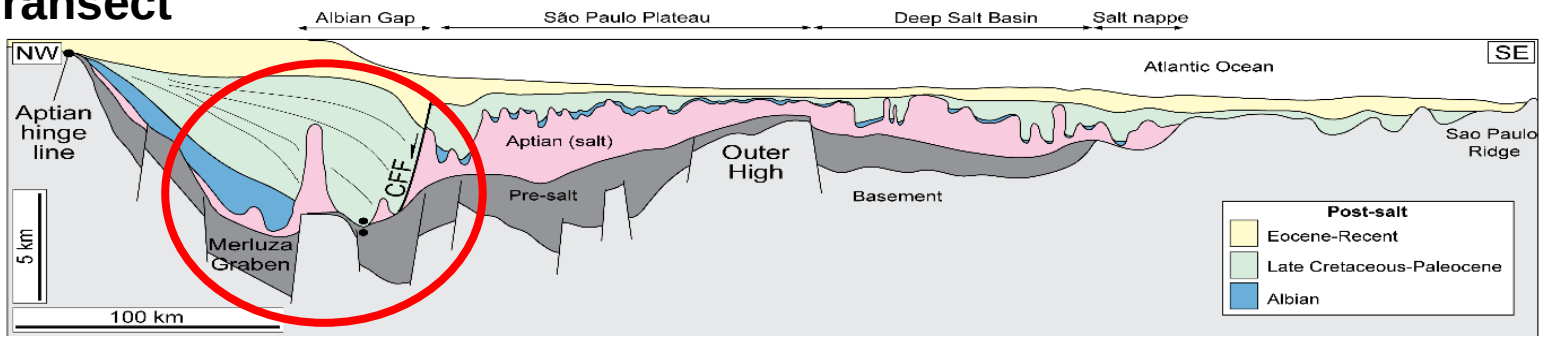
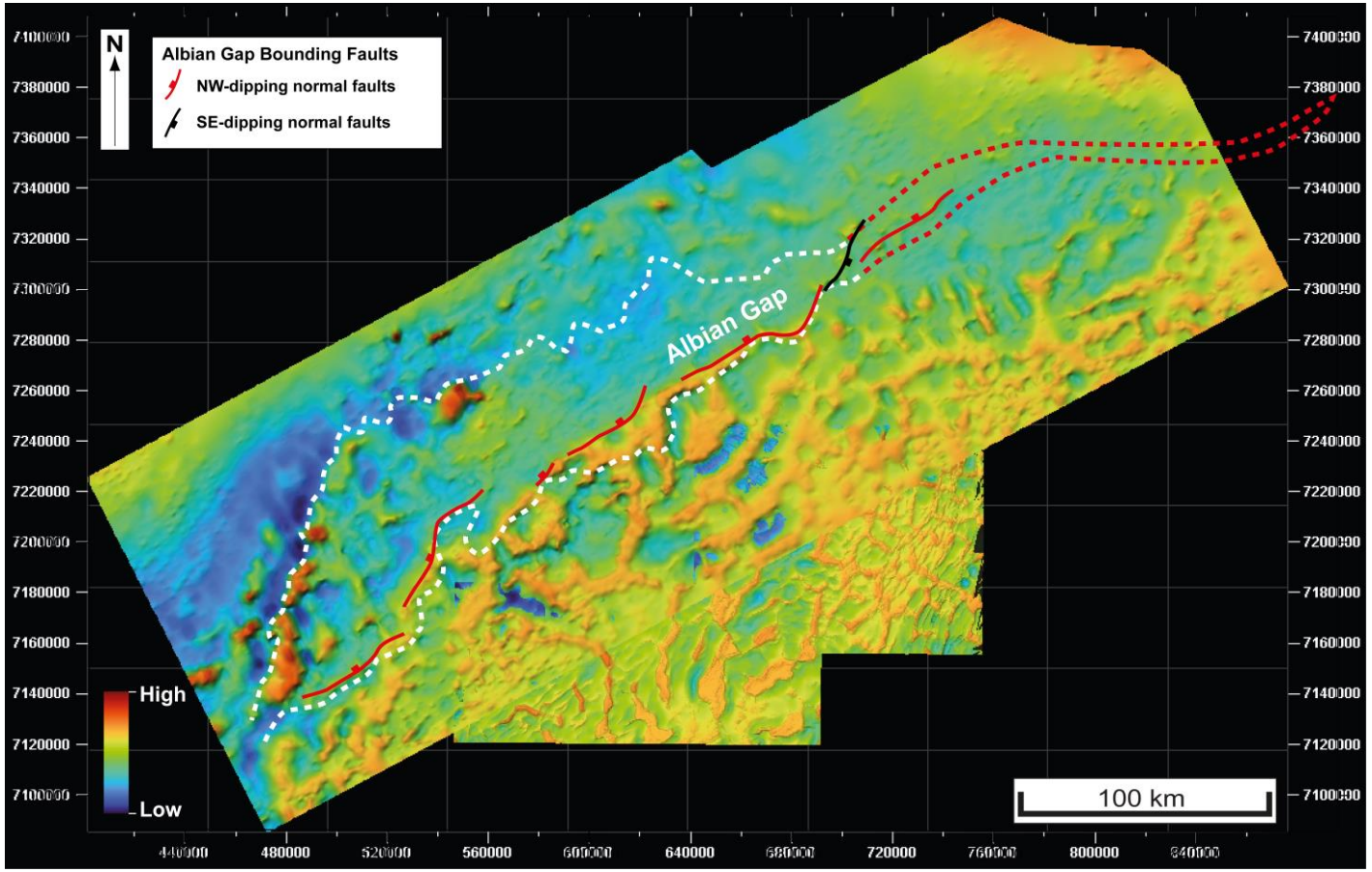
Location Map



Transect





Top Salt Map + Albian Gap outline

Albian Gap

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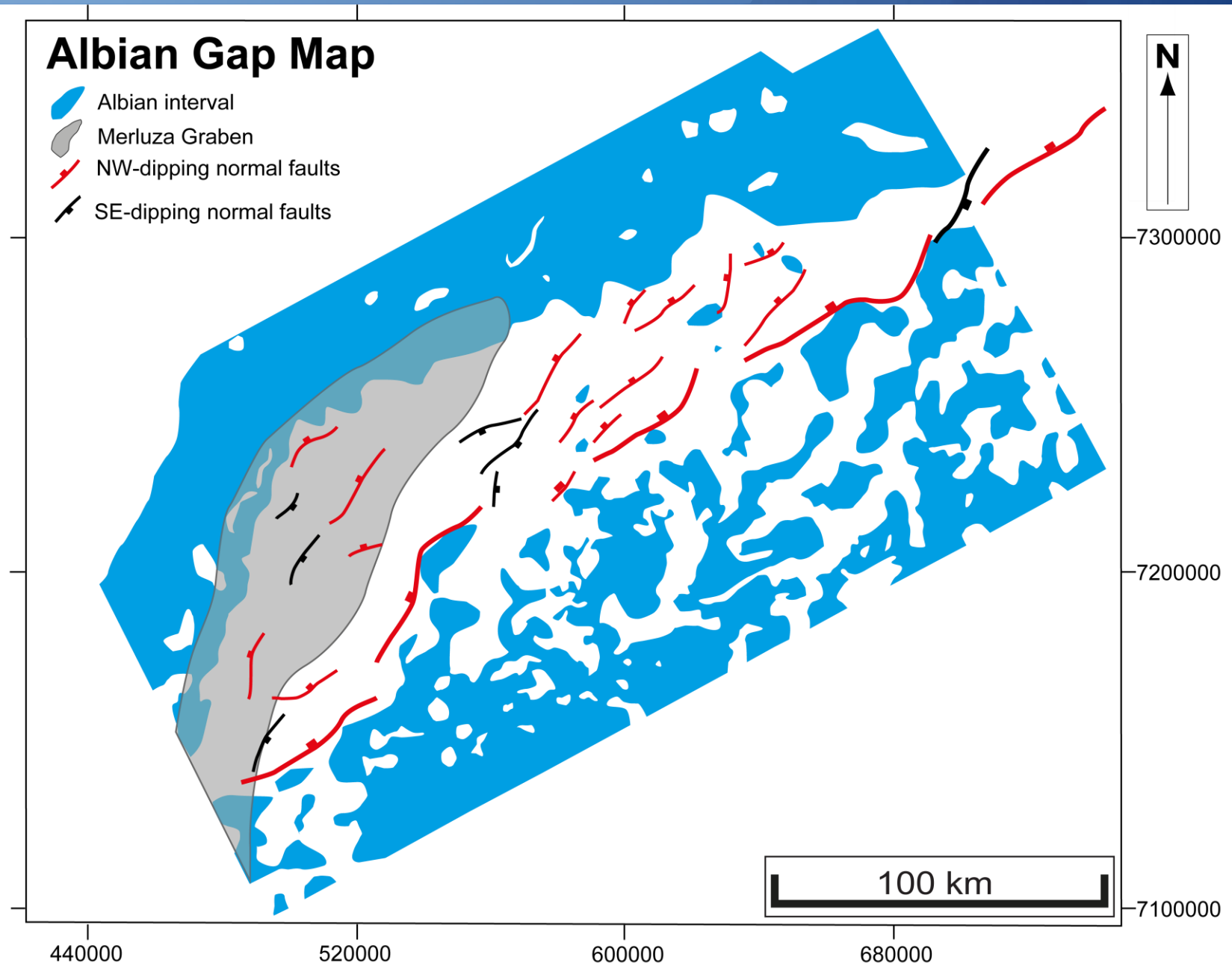

Variable Rollover Geometries

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EXTENSION

EXPULSION

Physical models - Jackson and Hudec (2017) by T. Dooley

Physical models - Ge et al (1997)

Seismic examples - Jackson and Hudec (2017)

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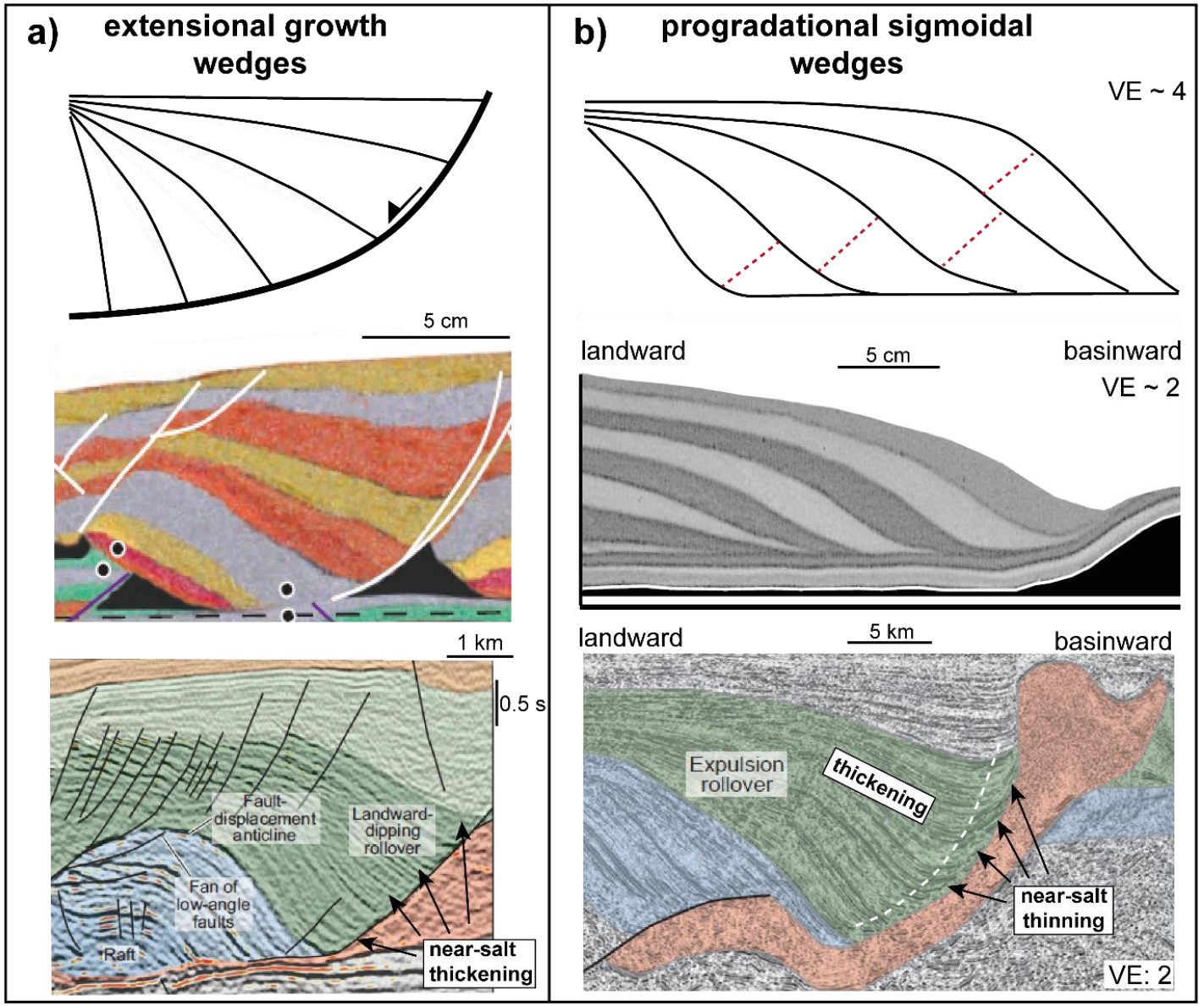

Albian Gap in cross-section

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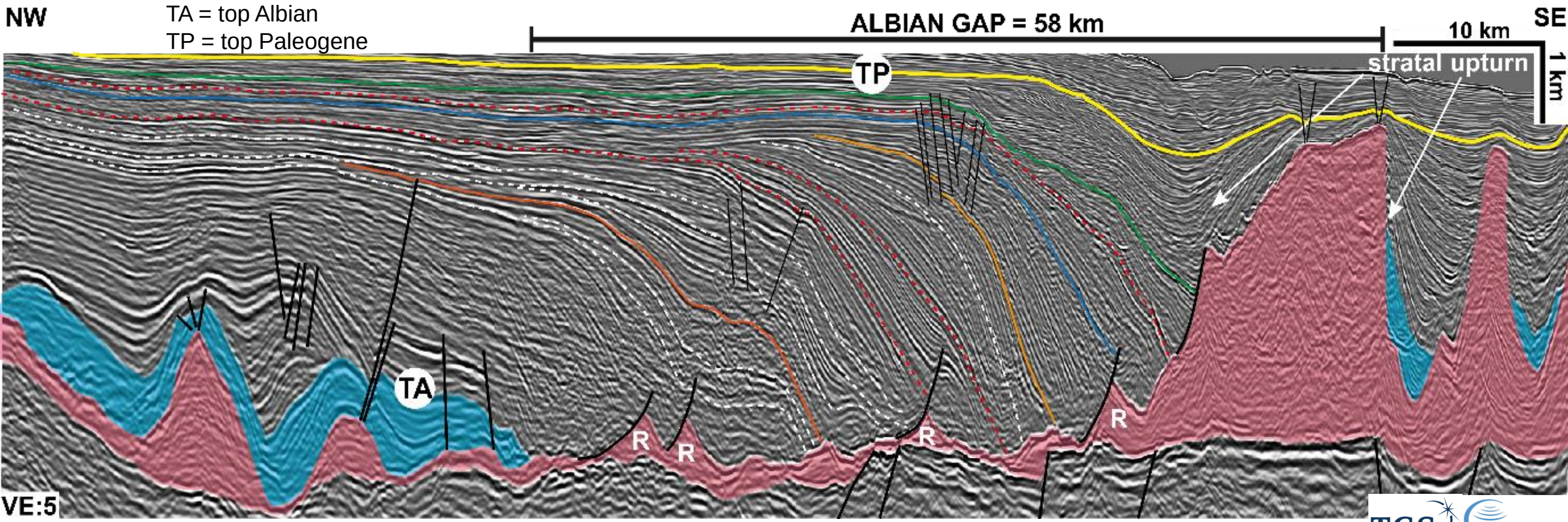

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Small (2-6 km of heave) landward-dipping listric faults, not a single trough-going fault (e.g. Cabo Frio Fault)
Rollers (R) and faults young basinward due to margin-scale progradation over inflated salt

Salt detachment dips gently (~1deg) landward and present small base-salt steps

Sigmoidal (basinward-thinning) (**WHITE**) vs. basinward-thickening (**RED**) wedges: **extension** vs **expulsion**
Diapir geometry itself cannot be purely explained by reactive diapirism (i.e. extension): near-diapir stratal upturn

Lateral variability (centre)

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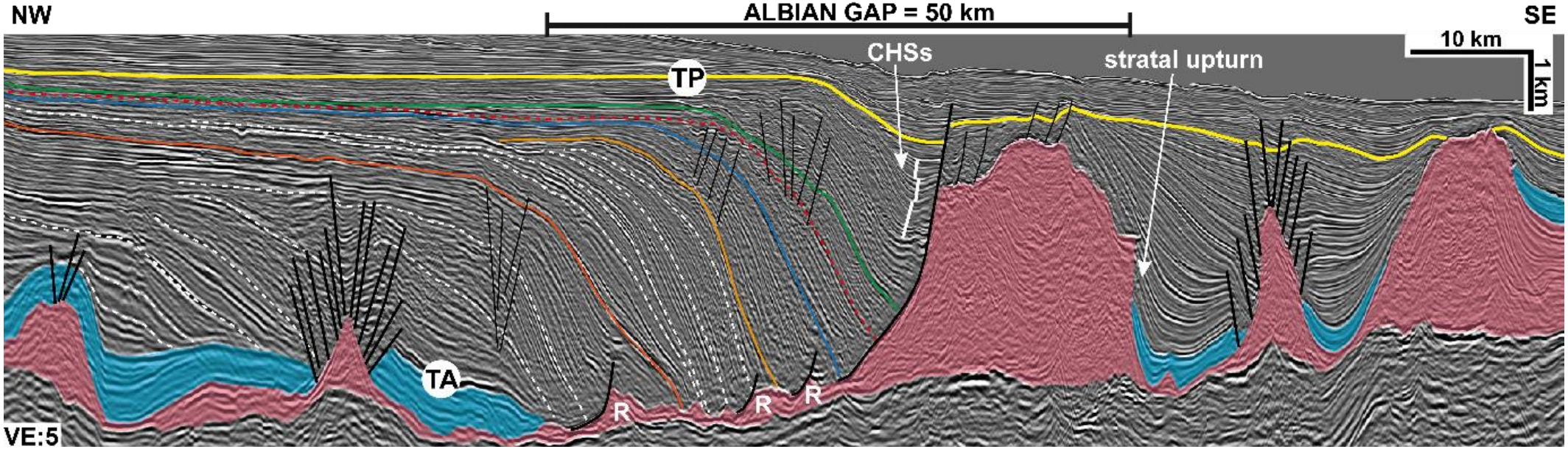
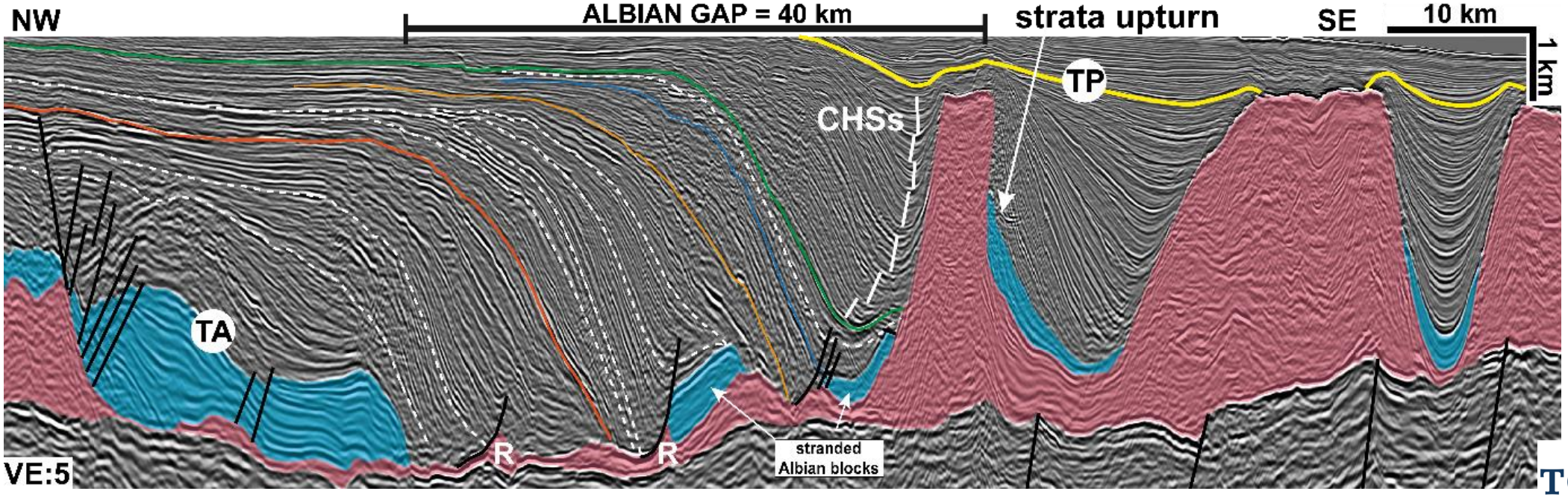


Sigmoidal wedges downlap Albian interval updip

Halokinetic Seq. and stratal upturn



Sigmoidal wedges downlap stranded Albian block

Bounding diapir is *not* extensional (post-Albian)

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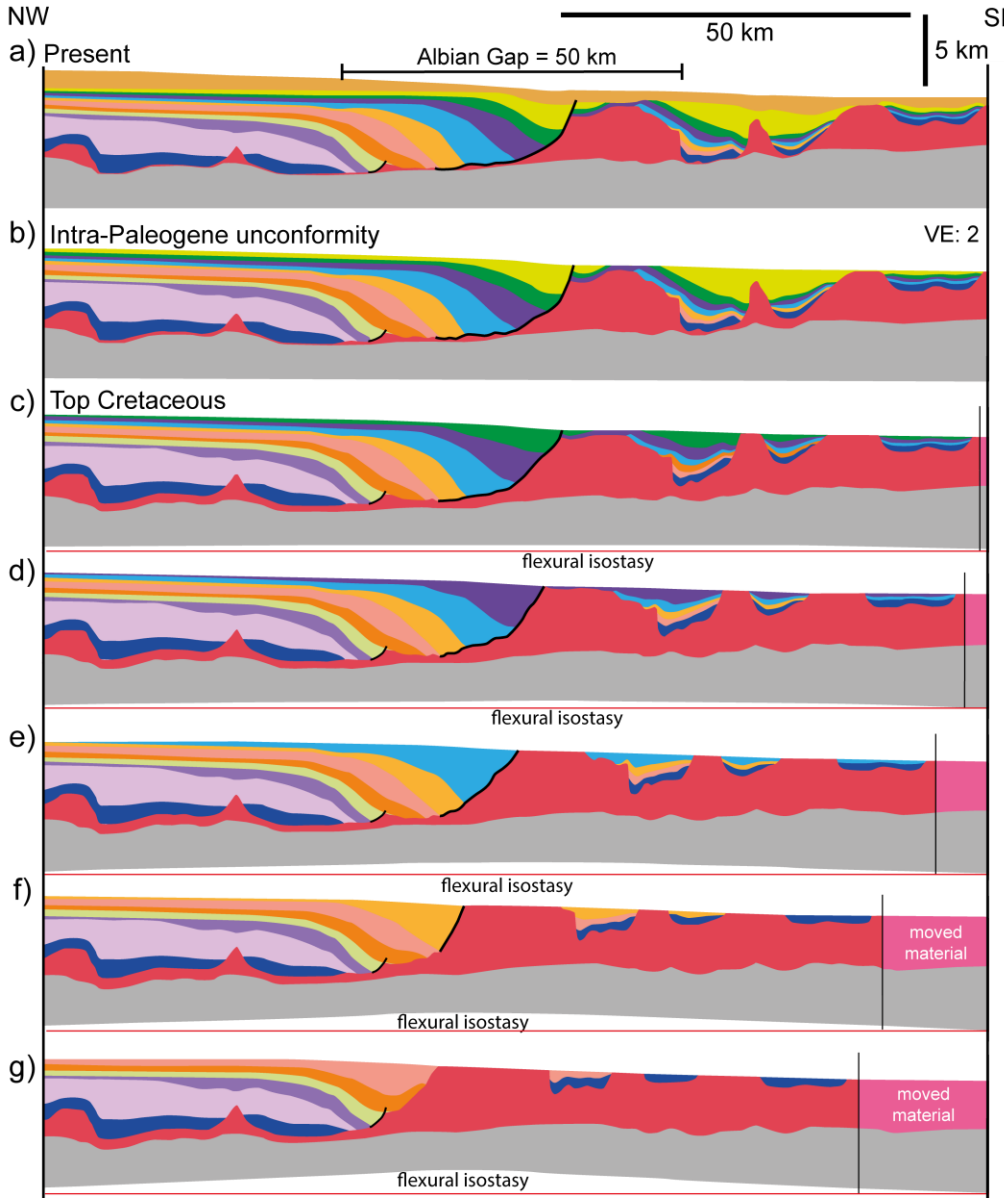
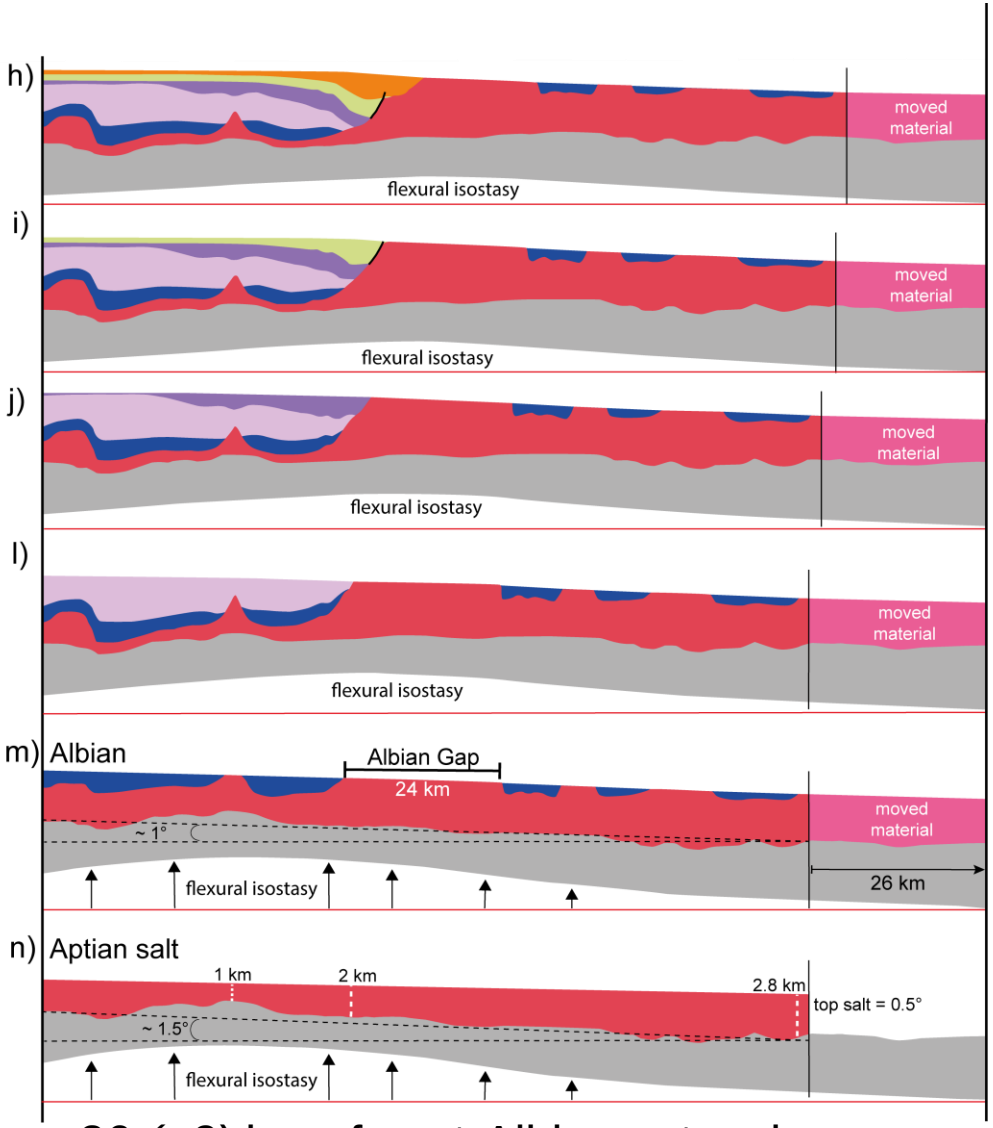
Restorations





Constraints

Extensional wedges
vs
Sigmoidal wedges

Downdip translation
(RSB, Pichel et al. 2018)

Flexural isostasy

Unfolding to a
gently-dipping top
(slope seabed)

26 *(±2)* km of post-Albian extension
24 *(±2)* km already present during Albian as a diapir
Base-salt reversal (landward-dip) due to loading and isostasy

Salt-detached Counter-regional faults?

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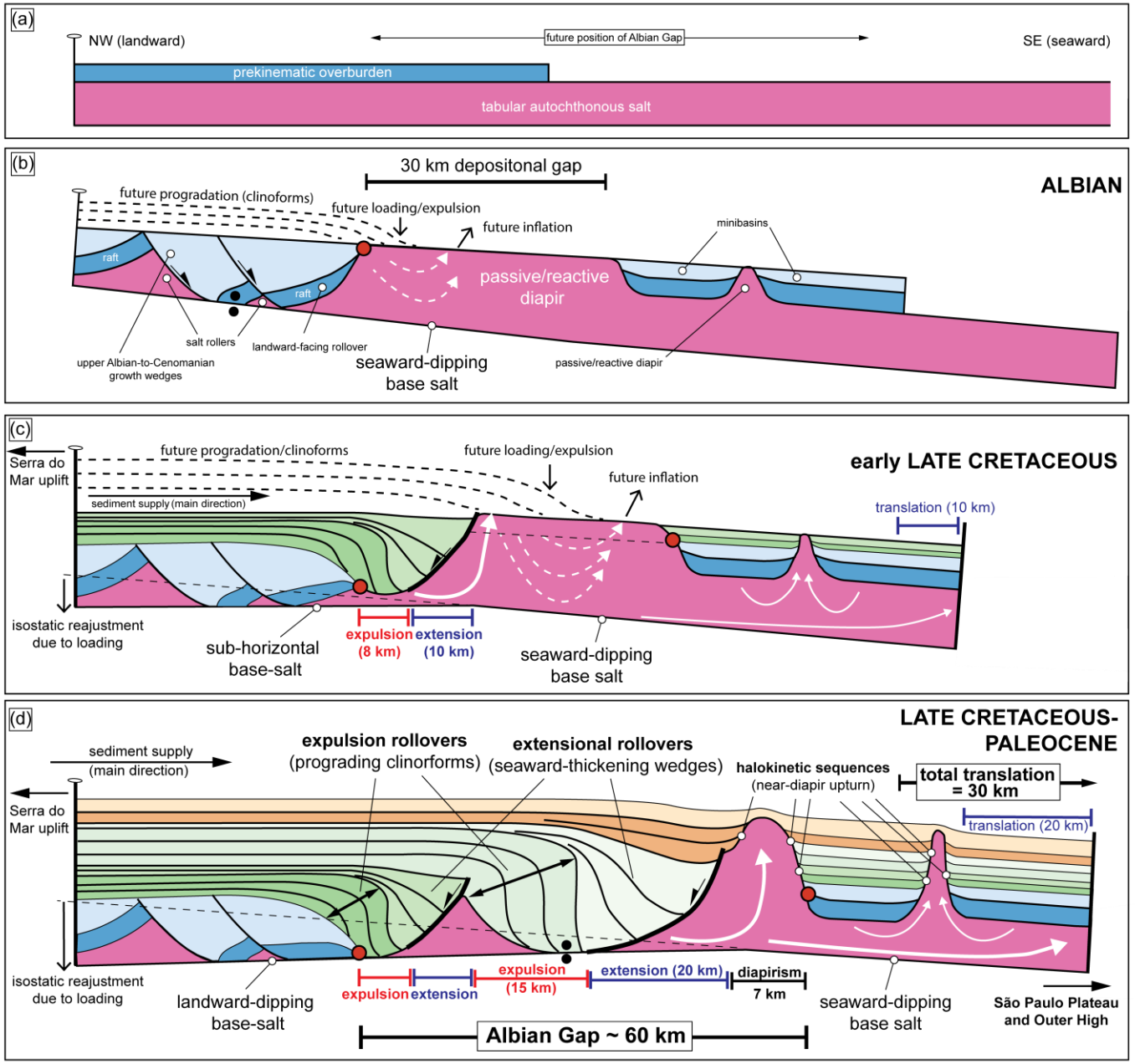
Synthetic Diagram

What controls the development of large gravity-driven counter-regional (i.e. landward-dipping) faults in Santos (and possibly other basins)?

1) Post-Albian progressive reversal of base-salt to a landward-dip (c-d)

2) Presence of landward-dipping base-salt steps

3) Post-Albian extension is driven by rapid margin-scale progradation above thick/inflated salt (b-c-d)



Conclusions

Albian Gap was formed by alternation of **extension** & **expulsion** with a broadly equal contribution (25-30 km) where the gap is wider (>50 km)

Evidence of **Extension**:

a) Salt rollers and reactive diapirs

b) Listric normal faults

c) Basinward-thickening wedges

Evidence of **Expulsion**:

a) Sigmoidal/clinoform-shaped wedges

b) Halokinetic sequences and upturned flaps

c) Inflated bounding diapirs

Where the Albian Gap is narrower (<30 km) extension dominates

Large counter-regional fault and basinward-dipping rollover formed primarily by margin-scale progradation above thick/inflated salt

Balances the amount of overburden translation further downdip (mega-footwall): 28-32 (± 2) km in post-Albian RSBs (Pichel et al., 2018)