Fault reactivation and halokinesis: an example from the Penobscot 3D seismic volume, offshore Nova Scotia, Canada

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1. Geological Setting

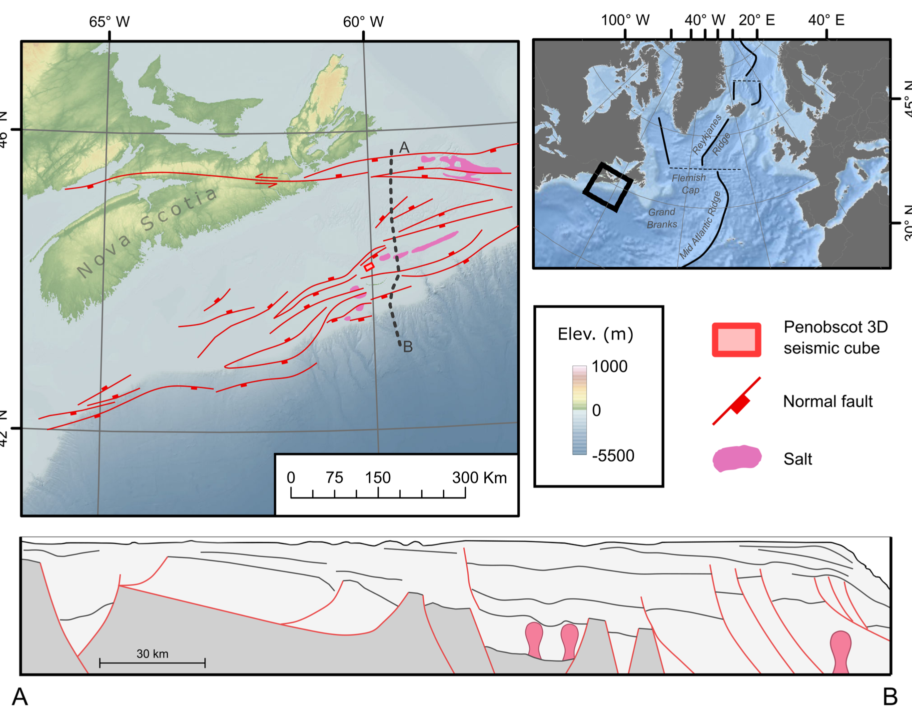

Fig. 1 Overview of the Nova Scotian Margin.

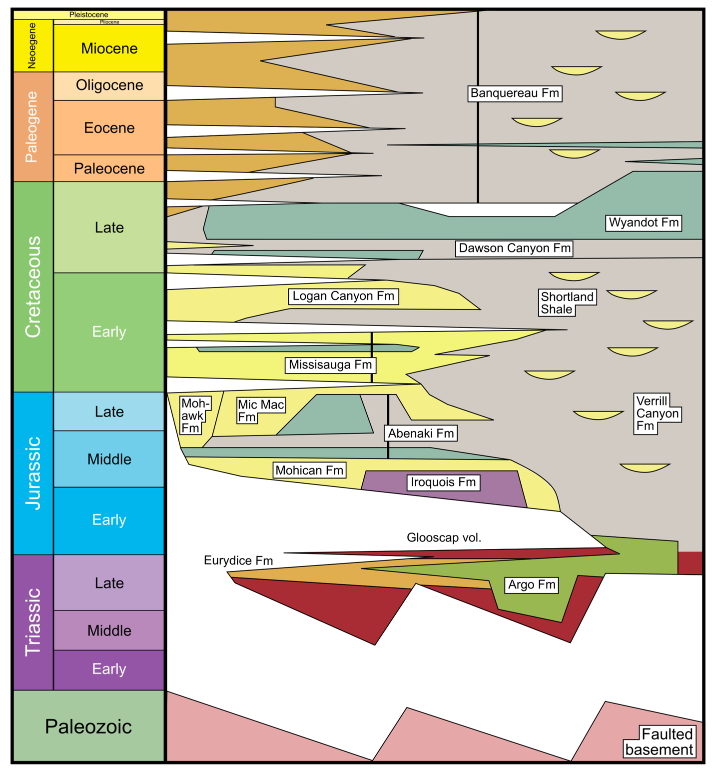

Fig. 2 Stratigraphy of the Nova Scotian Margin.

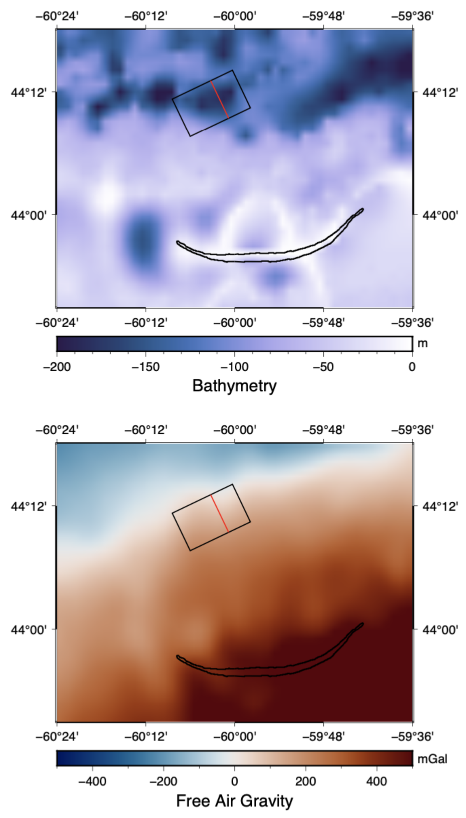

Fig. 3 Location of the Penobscot 3D volume.

Aim: To study the strutural style expressed in the Penobscot 3D and in particular the relationship between deformation and salt movement.

2. Seismic Interpretation

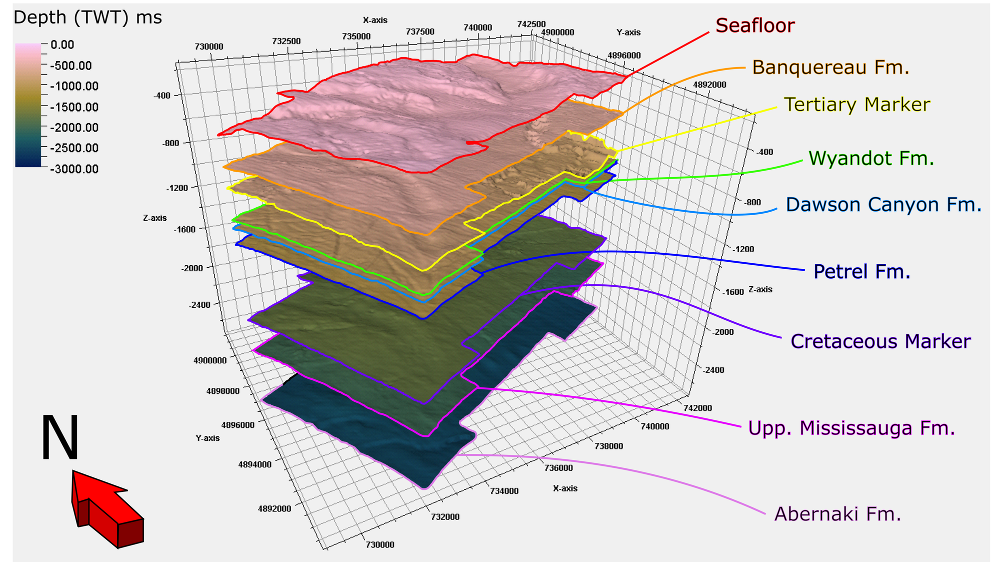

Fig. 4 Interpreted seismic surfaces.

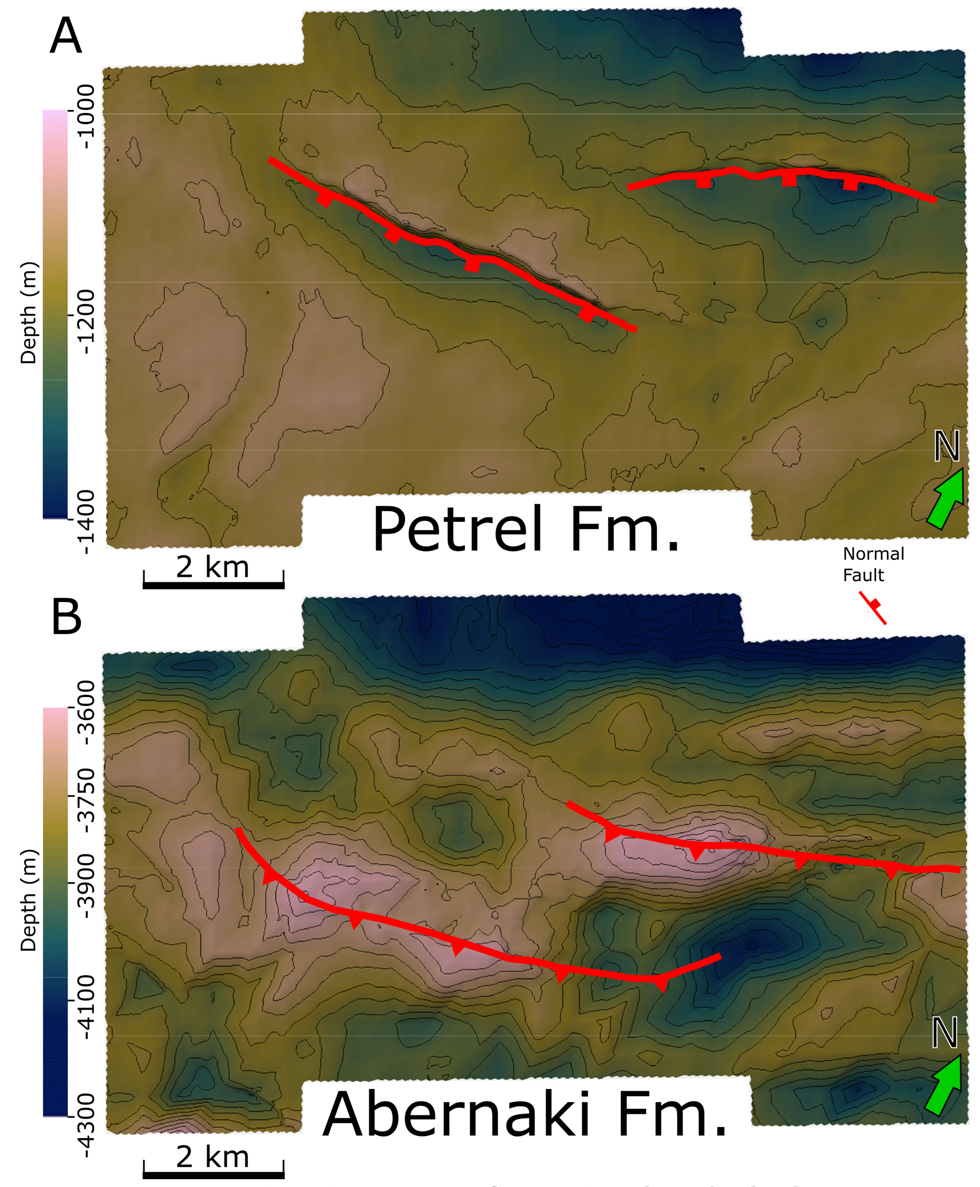

Fig. 6 Key surfaces in depth (m).

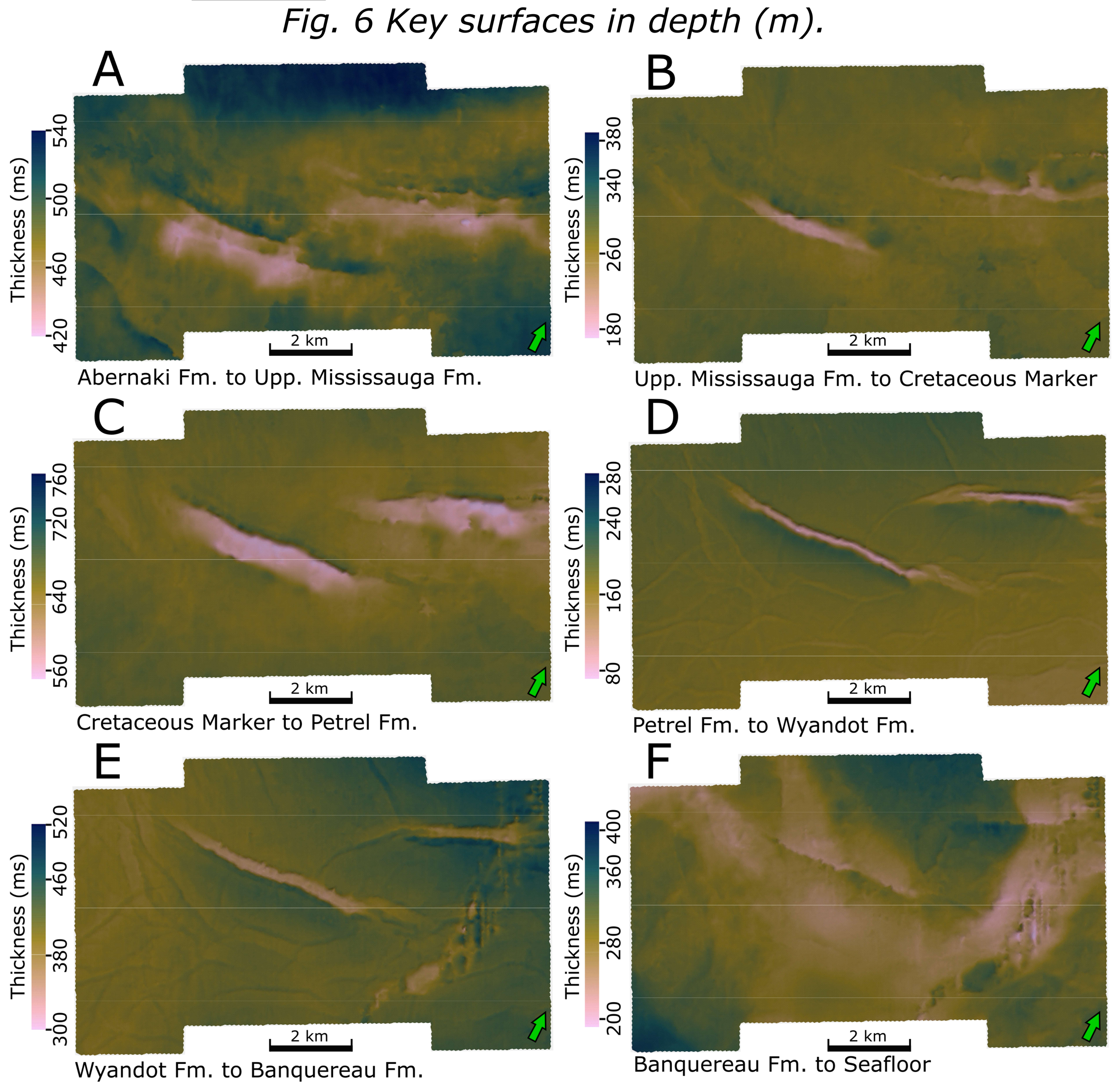

Fig. 7 Isochrons in TWT (ms).

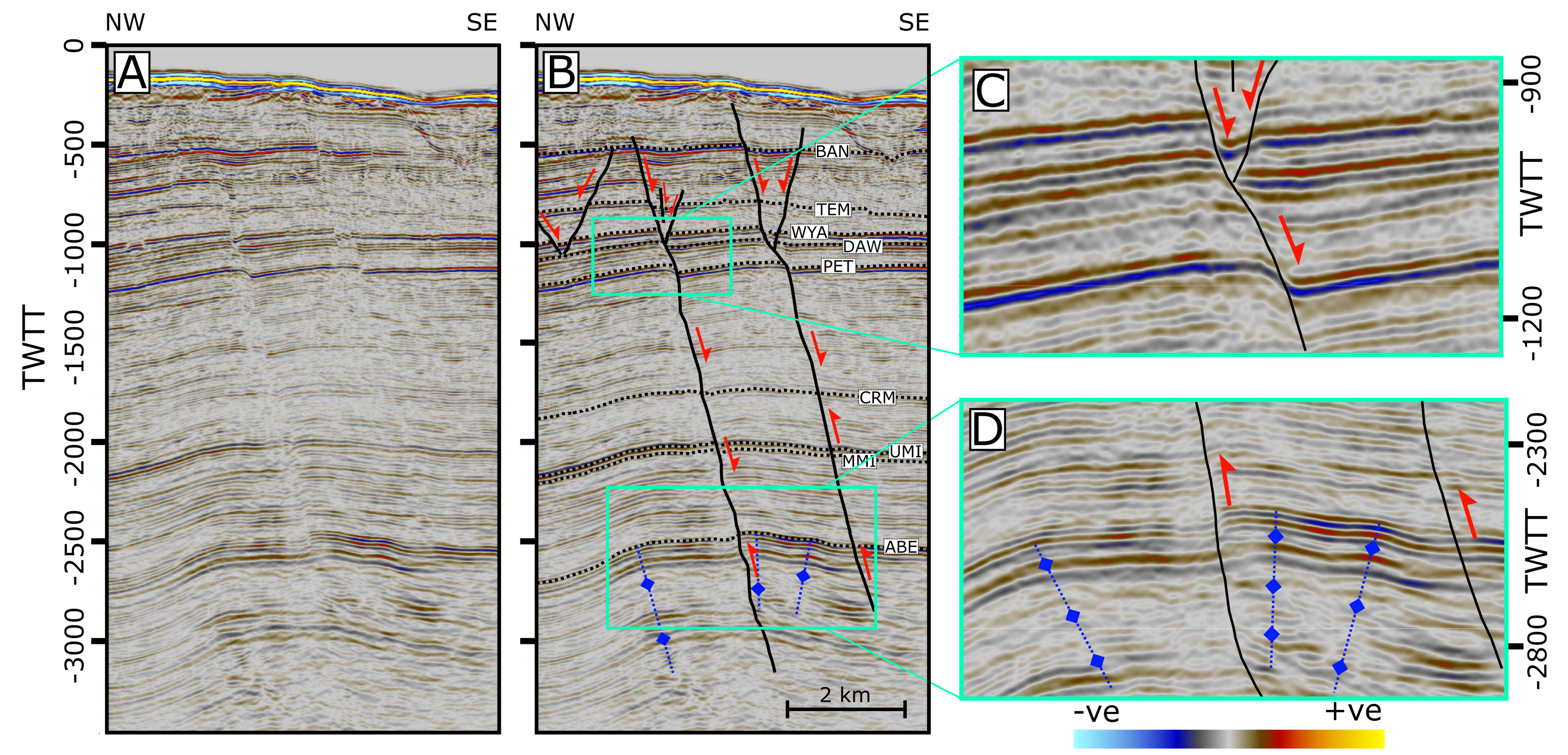

Fig. 5 Crossline 1307.

- Upper surfaces have widespread discrete brittle deformation.

- Two major faults are present, which overlap and show evidence of interaction at depth.

- Stratigraphically lower surfaces have low-amplitude folding.

- The two dominant faults are normal in upper portions but reverse in lower parts.

- Fold axis in lower horizons coincides with fault planes in upper horizons.

3. Faults

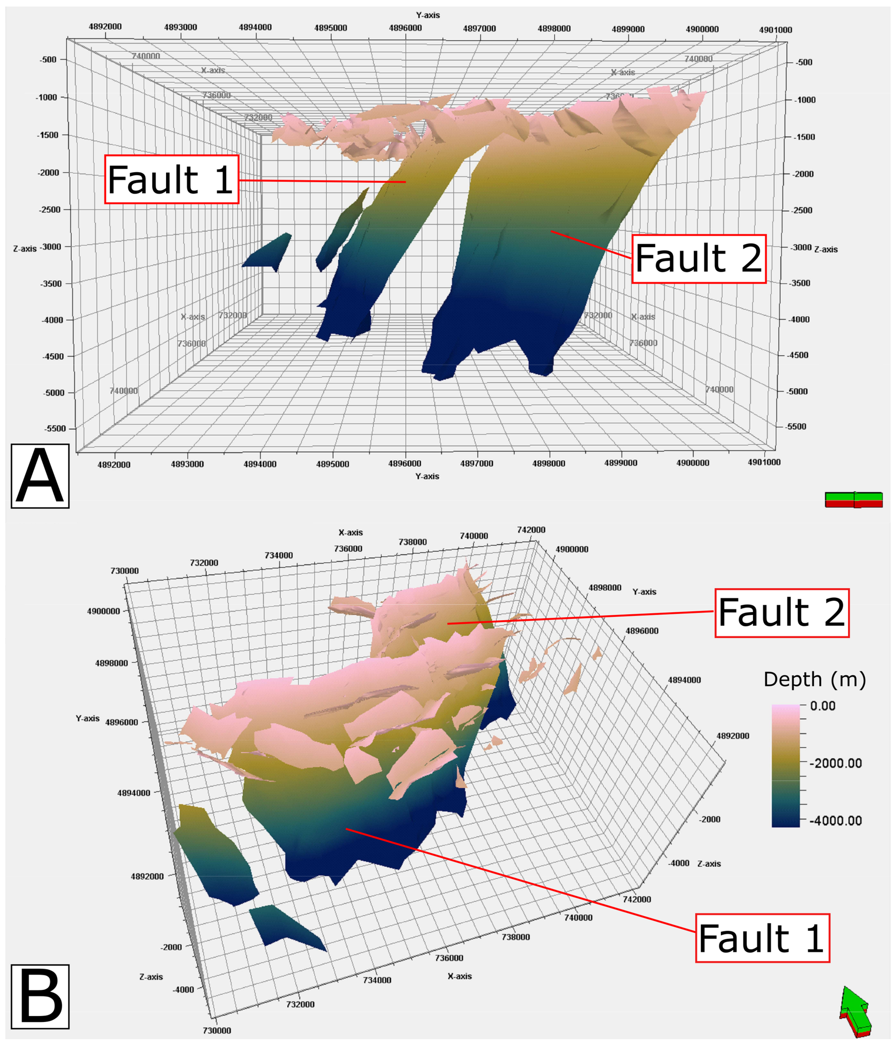

Fig. 8 Fault interpretations

- 51 faults interpreted in the Penobscot 3D

- Dominated by ENE-WSW fault set.

- Southward dipping faults are slightly more common than northward dipping.

- All smaller faults are normal.

- Reverse kinematics only observed on the two large faults.

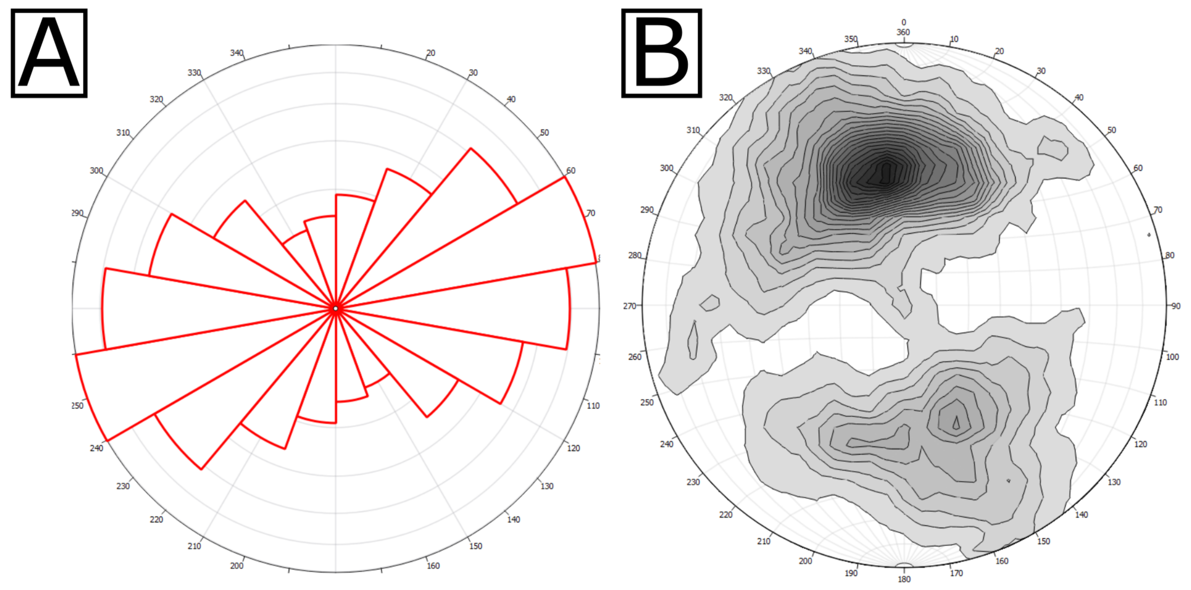

Fig. 9 Fault orientations.

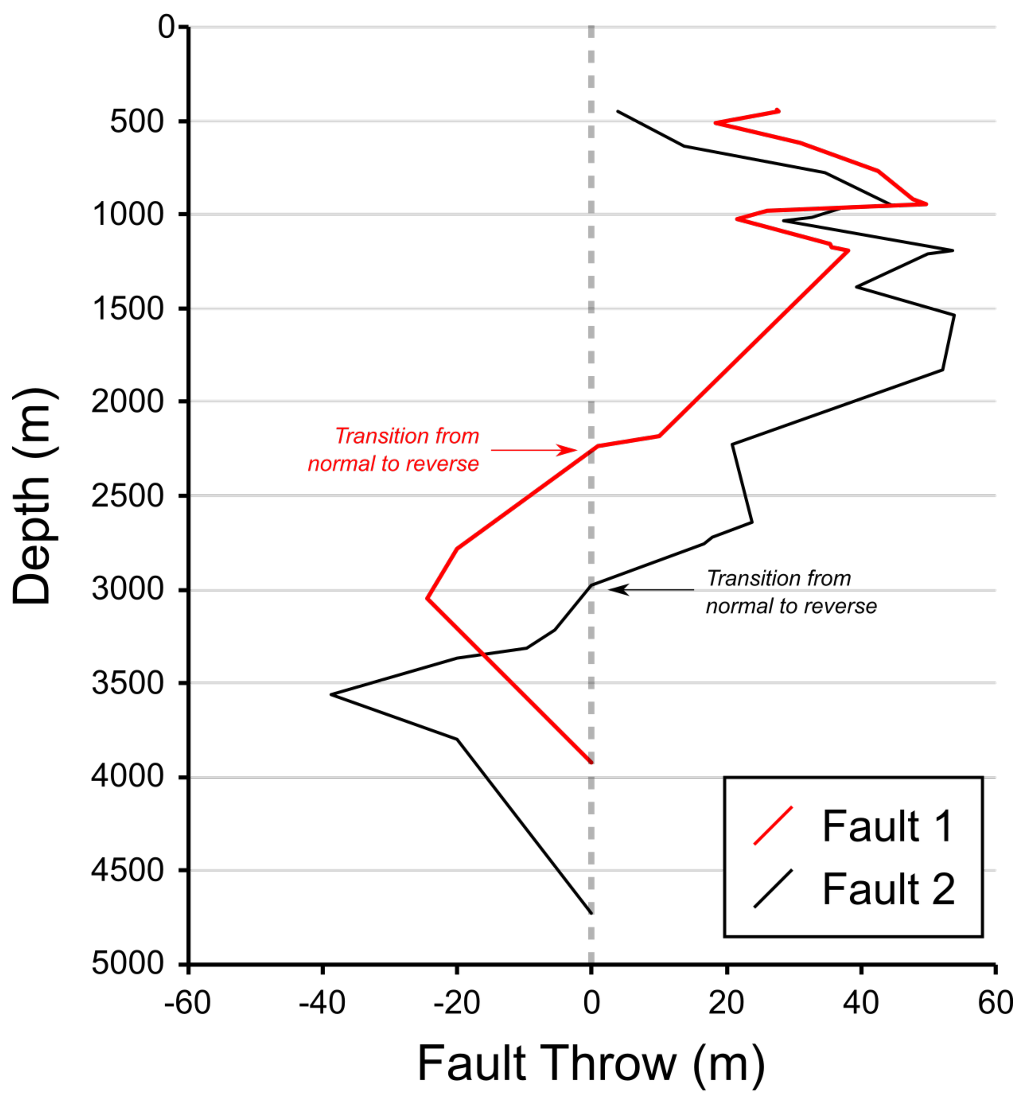

Fig. 10 Fault throw profiles on crossline 1307.

4. Model and conclusions

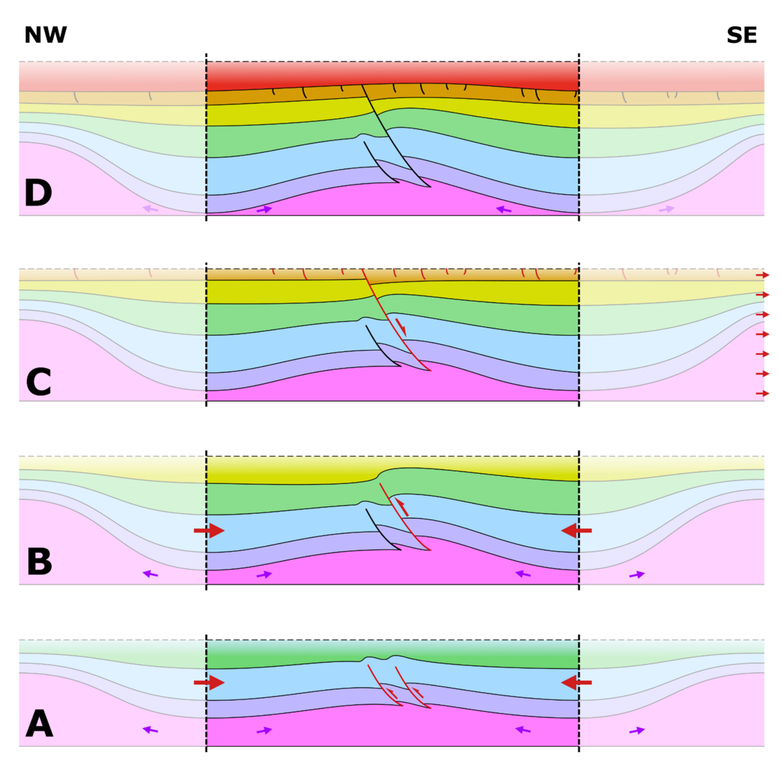

Fig. 11 Schematic evolution model.

- Deformation occurred due to normal, rift-related, reactivation of reverse faults that formed due to halokinesis driven by underlying salt.
- Timing of salt movement broadly corresponds to times of kinematic reorganisation on many Atlantic margins.
- Kinematic dichotomy with depth on faults may go unrecognised where seismic data does not image the full depth of a structure.
- Therefore, reactivation may be more widespread than previously thought if only upper parts of structures are imaged.
- Interpretation of salt as an important contributor to kinematic reactivation of faults is crucial as it likely provides a mechanism to explain inversion globally.

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References