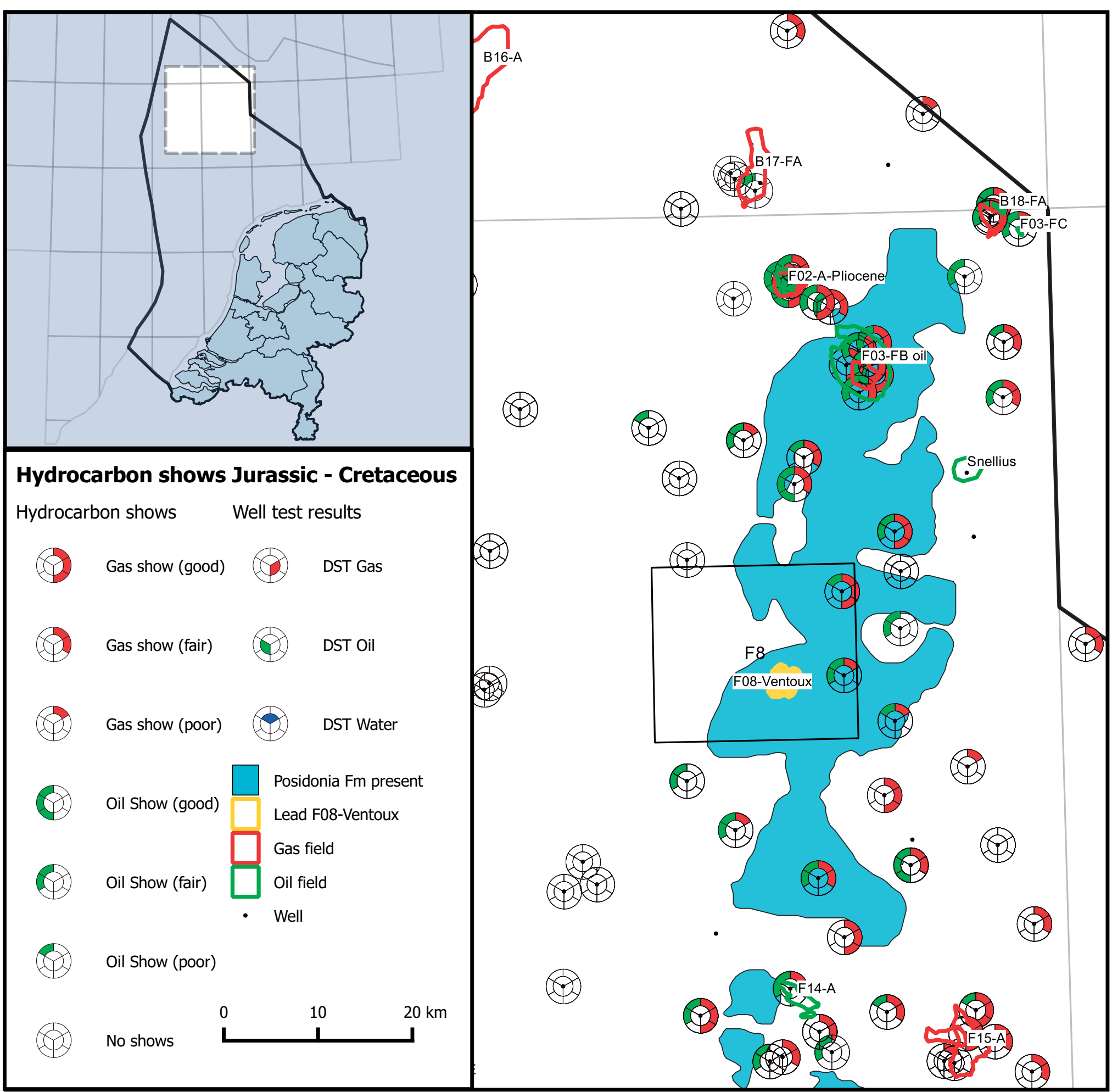


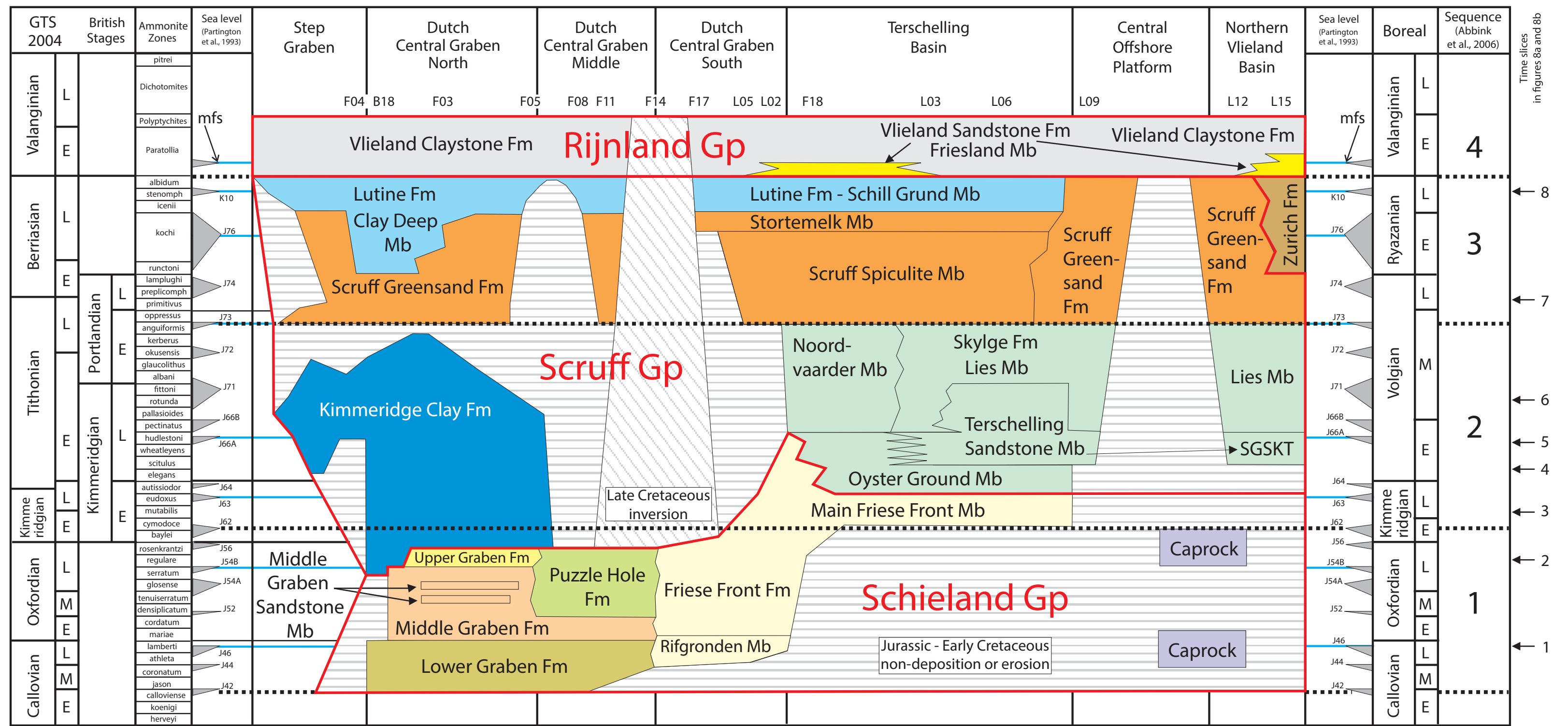
The Late Jurassic in the Central Graben

Further prospectivity in a proven play



- The Late Jurassic play: 11 Late Jurassic oil & gas fields in the Dutch Central Graben, including the 125 MMbbl STOIP & 21 bcm GIIP F03-FB field.
- Reservoir sands in F03-FB consist of regionally deposited sandstones in a fluvio-deltaic (Lower Graben Fm) to shallow marine (Upper Graben Fm) environment.
- Faults in F03-FB seal for sand/shale juxtaposition and are non-sealing for sand/sand juxtaposition.
- The Middle Graben shales are sealing for oil, but not for gas. The Kimmeridge Clay is an excellent regional seal.
- Oil and gas sourced from the Lower Jurassic Posidonia Fm. Multiple other stratigraphic intervals have source rock potential as well.
- Oil migration started in the latest Jurassic and gas charge occurred in the Tertiary.

Fig. 2:
Revised Middle Jurassic-Early Cretaceous stratigraphic framework (Munsterman et al., 2012).



Lead: F08-Ventoux

- Block F08 has only recently been covered by 3D seismic (DEF spec-survey).
- Multiple Late Jurassic targets that can be tested with one exploration well.
- Fault/dip closure formed during the Latest J/Early K. Up-dip well F08-02 has oil & gas shows in the Lower Graben Fm and Middle Jurassic sands. Shallow seismic anomalies visible.

Reservoir	STOIP range (MMbbl)	Geol. POS	Critical risk
1 Lower Graben Fm	5-15	35%	Trap
2 Upper Graben Fm	5-20	28%	Charge
3 Kimmeridgian sands	5-30	21%	Charge & Reservoir
Total Volume	(15-65)		

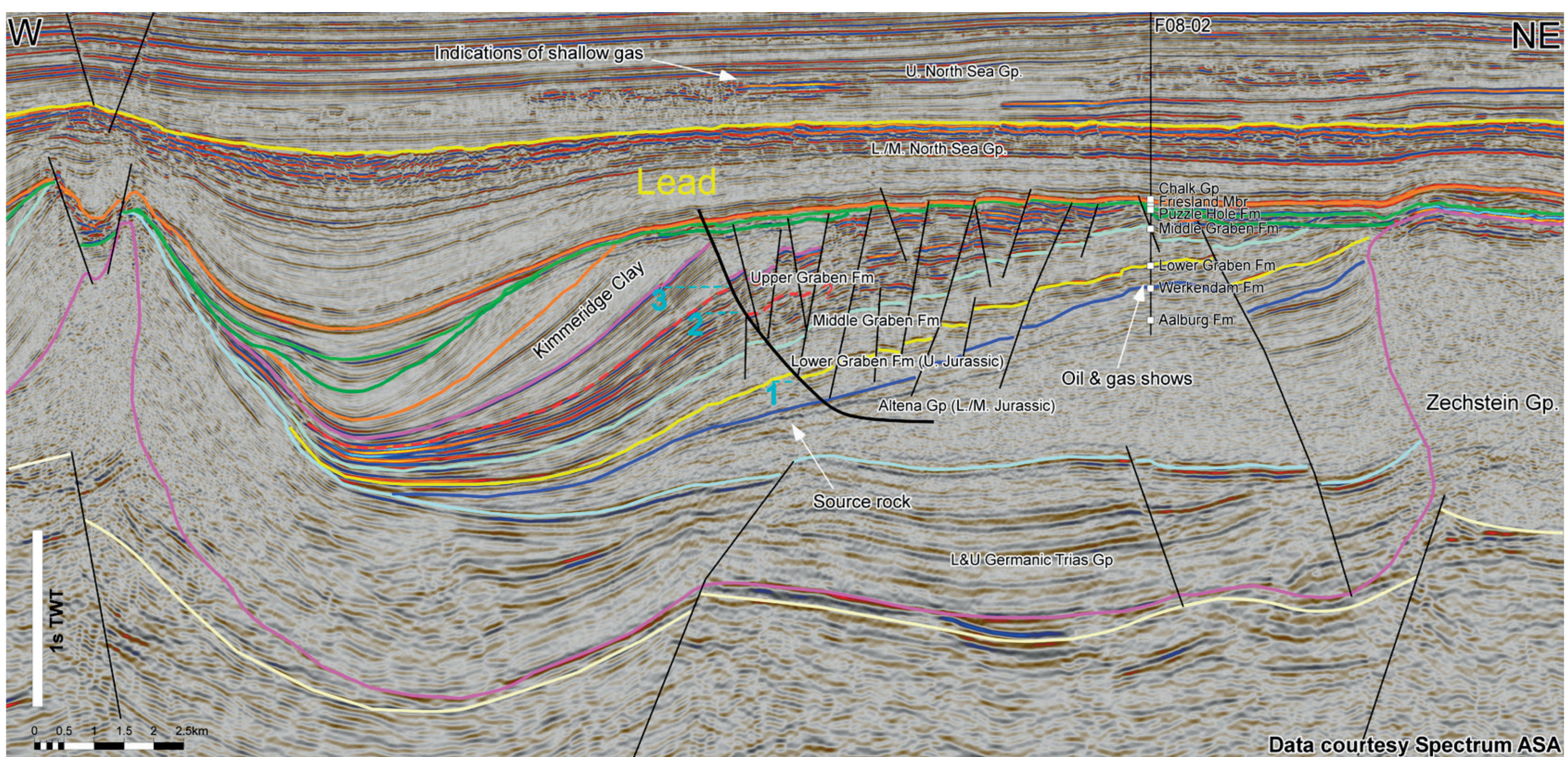


Fig. 3: dip line through the lead showing complex faulting is soft-linked to deeper extension faulting. Upside: Pinch-out and truncation trapping possible to the west of lead.

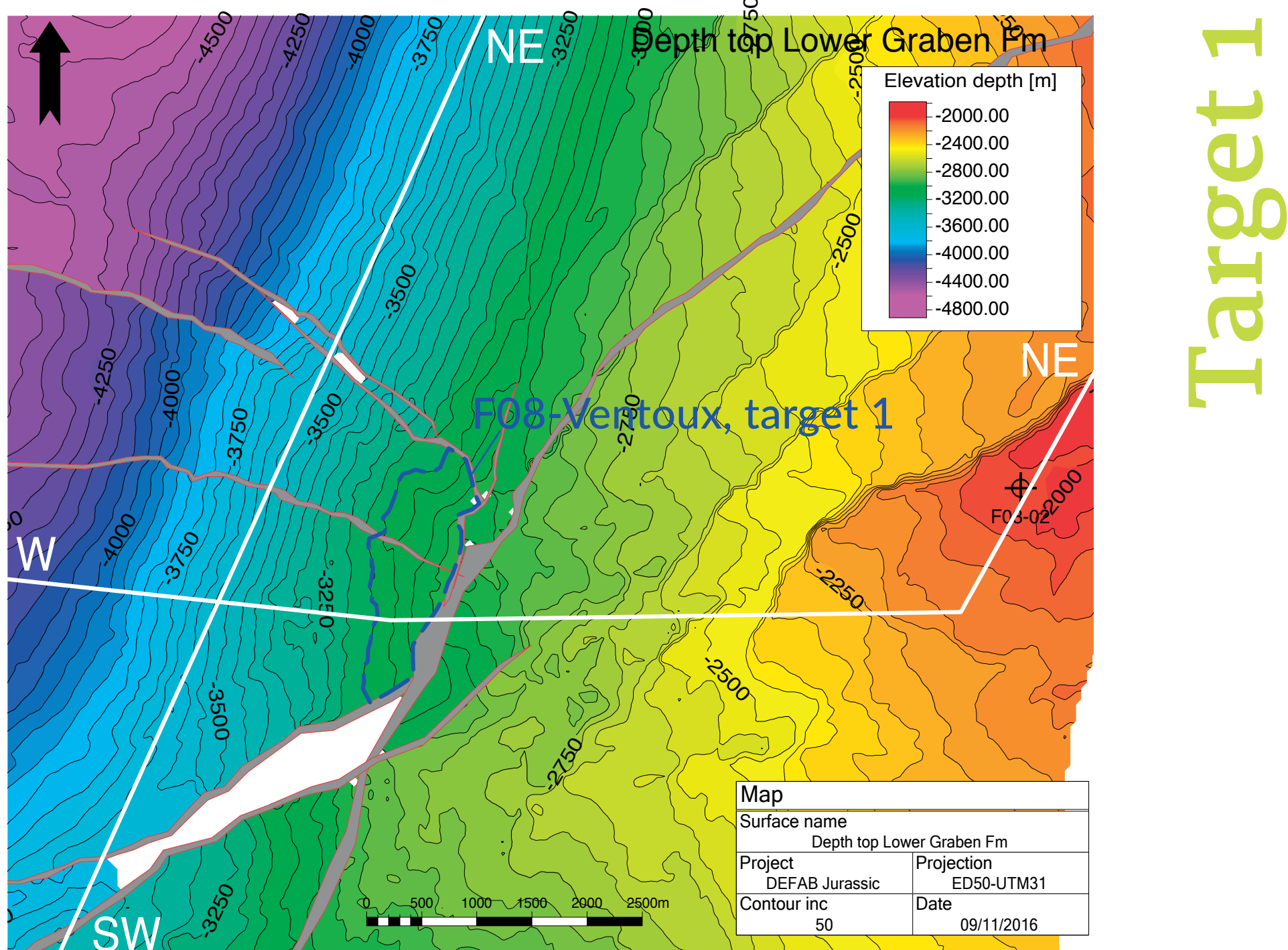


Fig. 4: Lower Graben Fm (fluvio-deltaic).

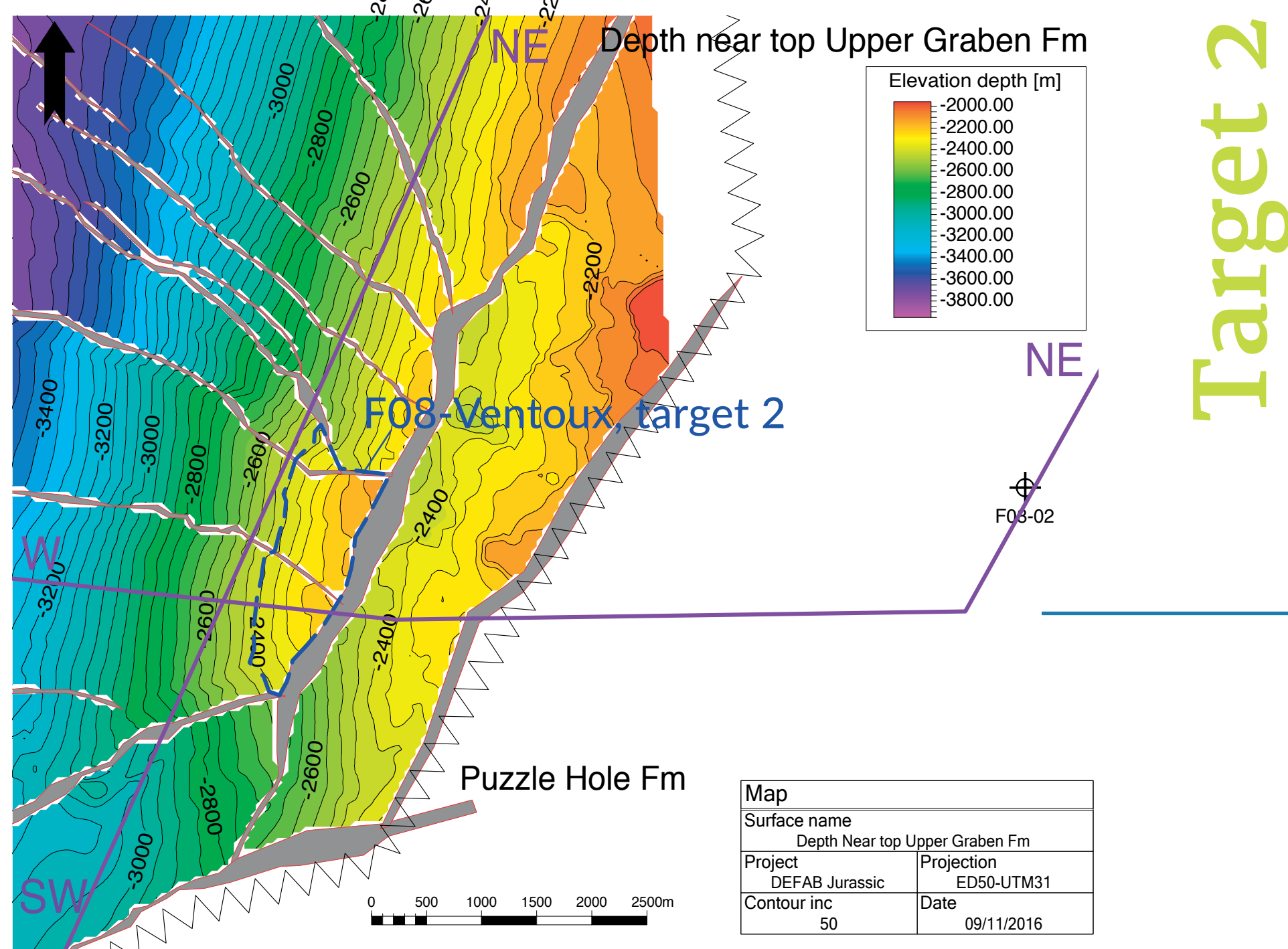


Fig. 5: Upper Graben Fm, grading up-dip into delta plain sediments of the Puzzle Hole Fm.

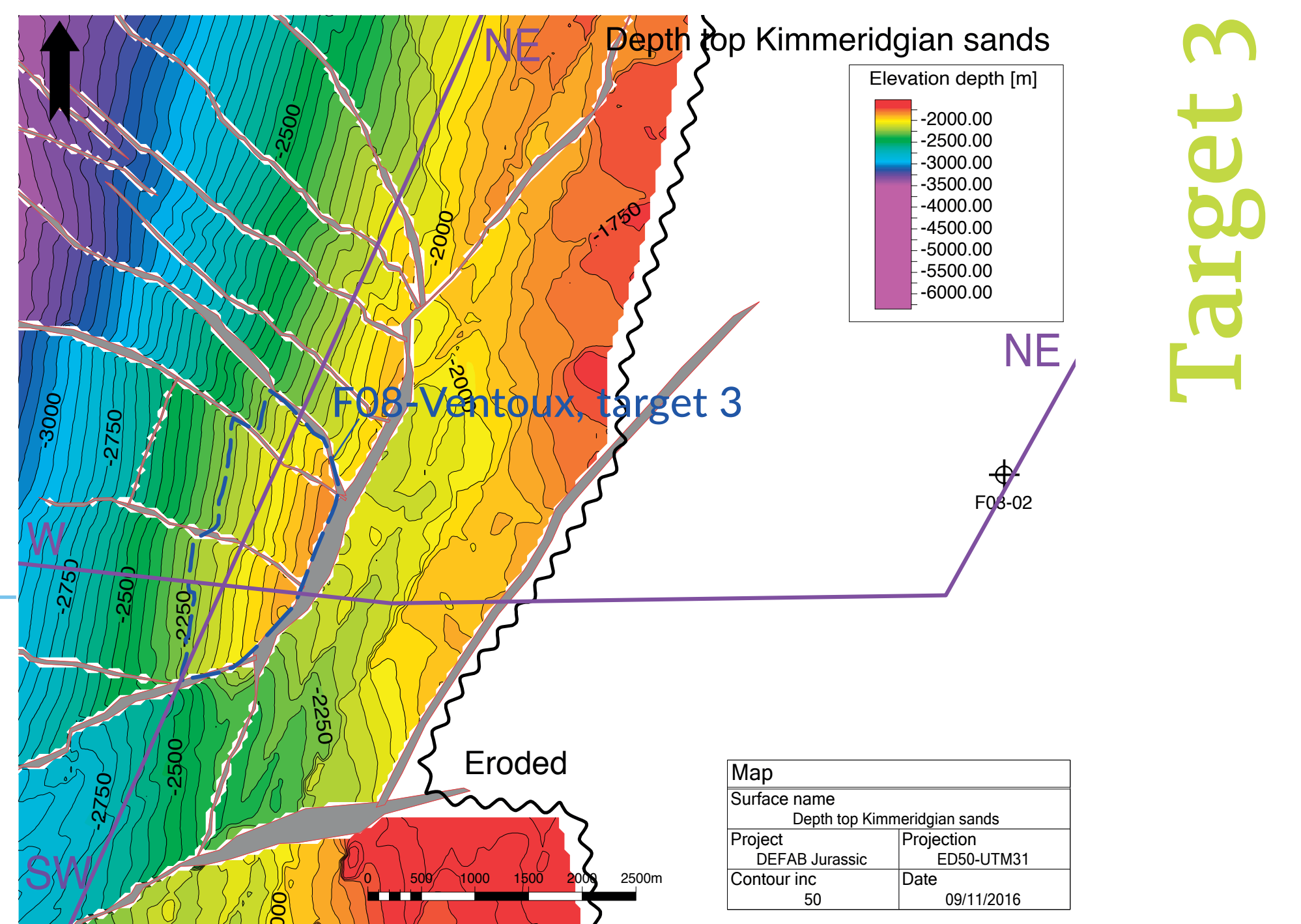
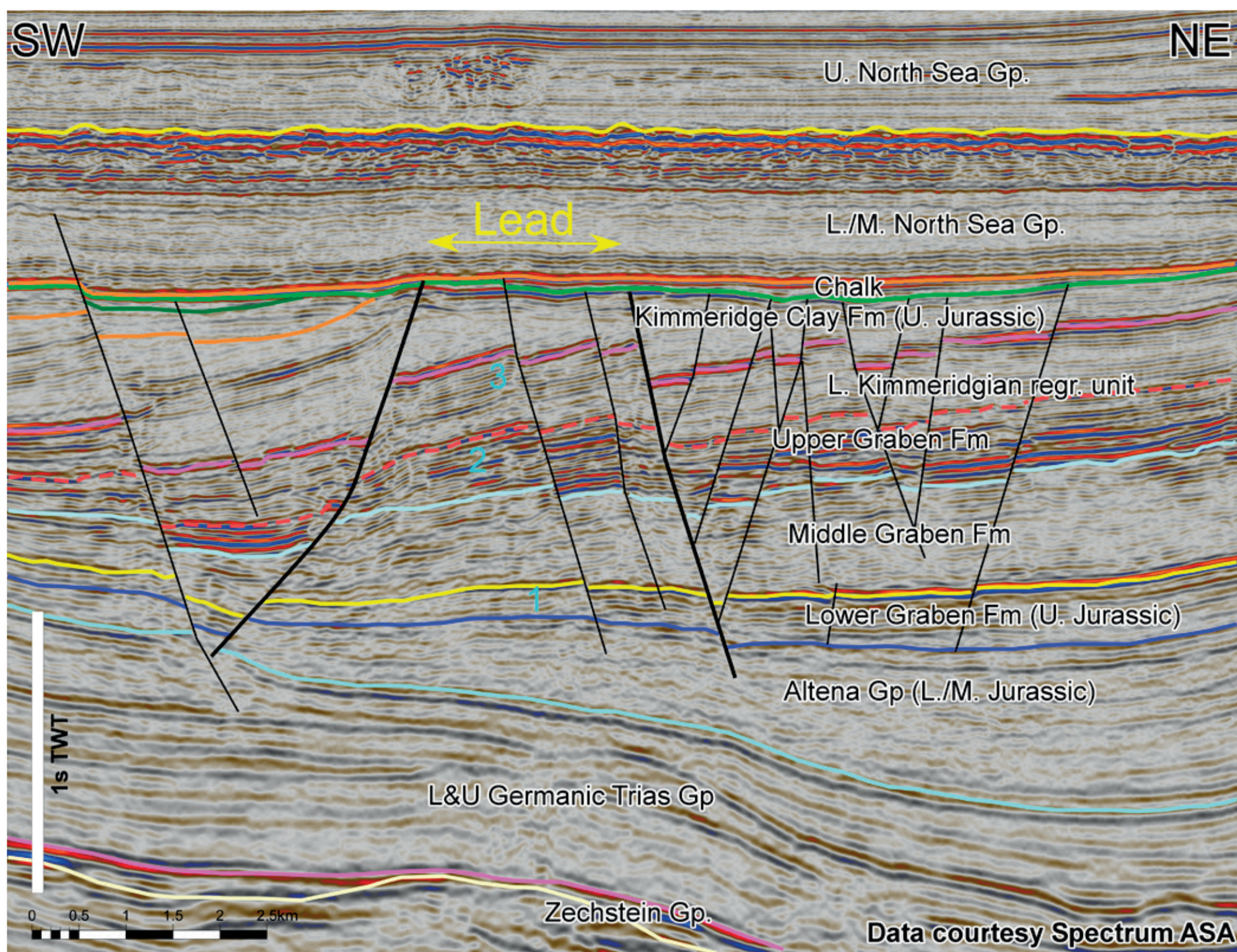


Fig. 6: Kimmeridgian sandstones: Increased seismic amplitudes below this reflector could be an indicator of the presence of sand during a regressive period (Fig. 8).



- To de-risk the lead it is recommended to:
- PSDM re-process the seismic to improve the imaging of the complex faulting, increase resolution and to reduce the multiples at the J-K boundary
 - Investigate DHI's and AVO behaviour of the reservoir intervals
 - Further investigate timing/movement of faulting and fault juxtaposition

Fig. 7: SW-NE Line through lead F08-Ventoux.

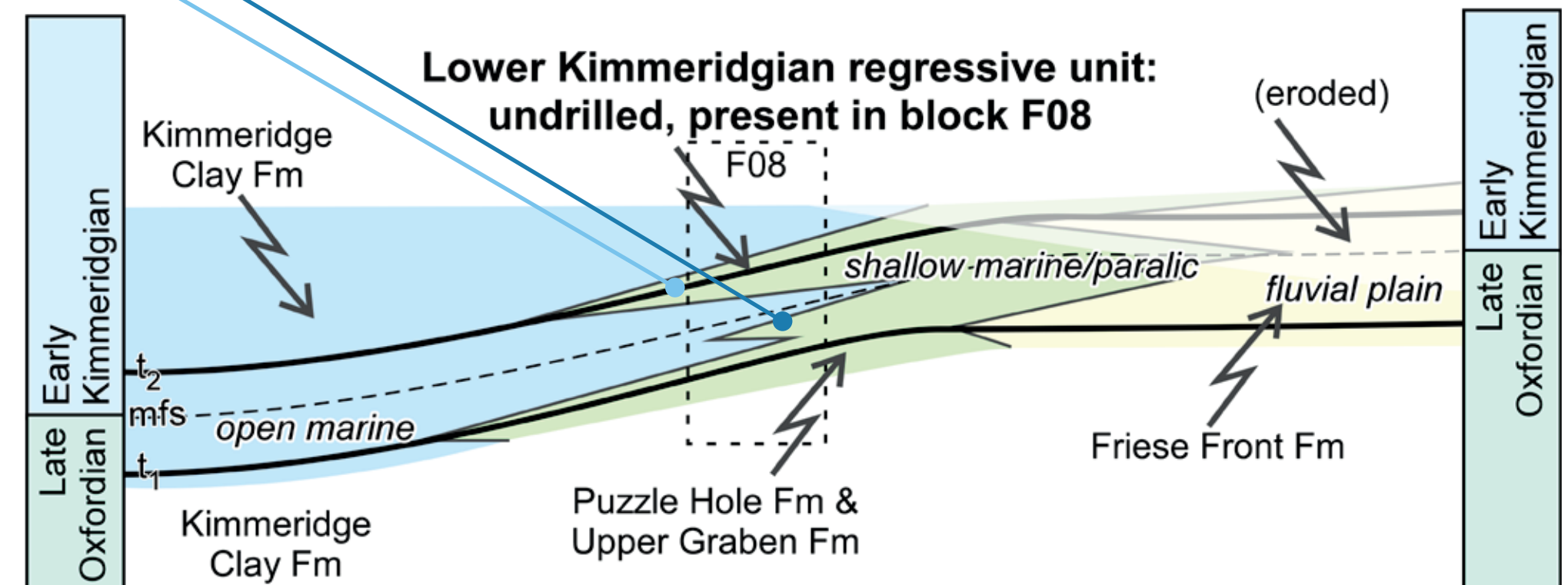


Fig. 8: Cartoon illustrating potential of Lower Kimmeridgian sands: this stratigraphic interval has not been drilled in the area, but the seismic signature suggests this is a regressive unit that may well contain sands.