

A structural framework for the Mid North Sea area, Palaeozoic to present

Marten ter Borgh, Bastiaan Jaarsma and Eveline Rosendaal

EBN B.V., Daalsesingel 1, 3511 SV Utrecht, the Netherlands, e-mail: exploration@ebn.nl

- **Recent UK gas discoveries north of the proven Rotliegend and Carboniferous fairways have triggered fresh interest in the Mid North Sea area**
- **New seismic data was used to develop a structural framework for the Dutch part of the area**
- **The new framework sheds new light on hydrocarbon potential**

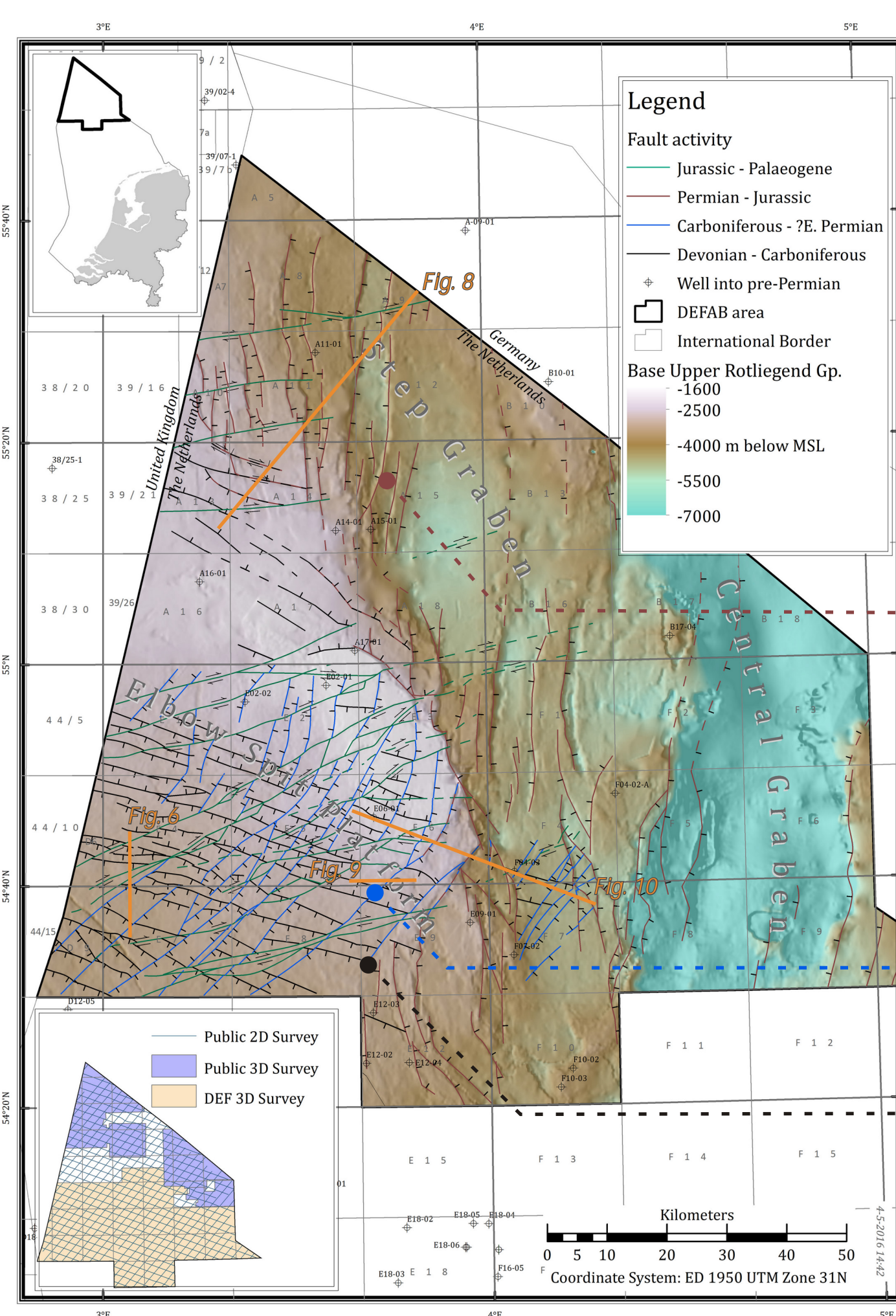


Fig. 1 - Structural framework for the northern Dutch offshore. Faults are shown at base Permian level, or, in case of older fault activity, at the topmost affected horizon.

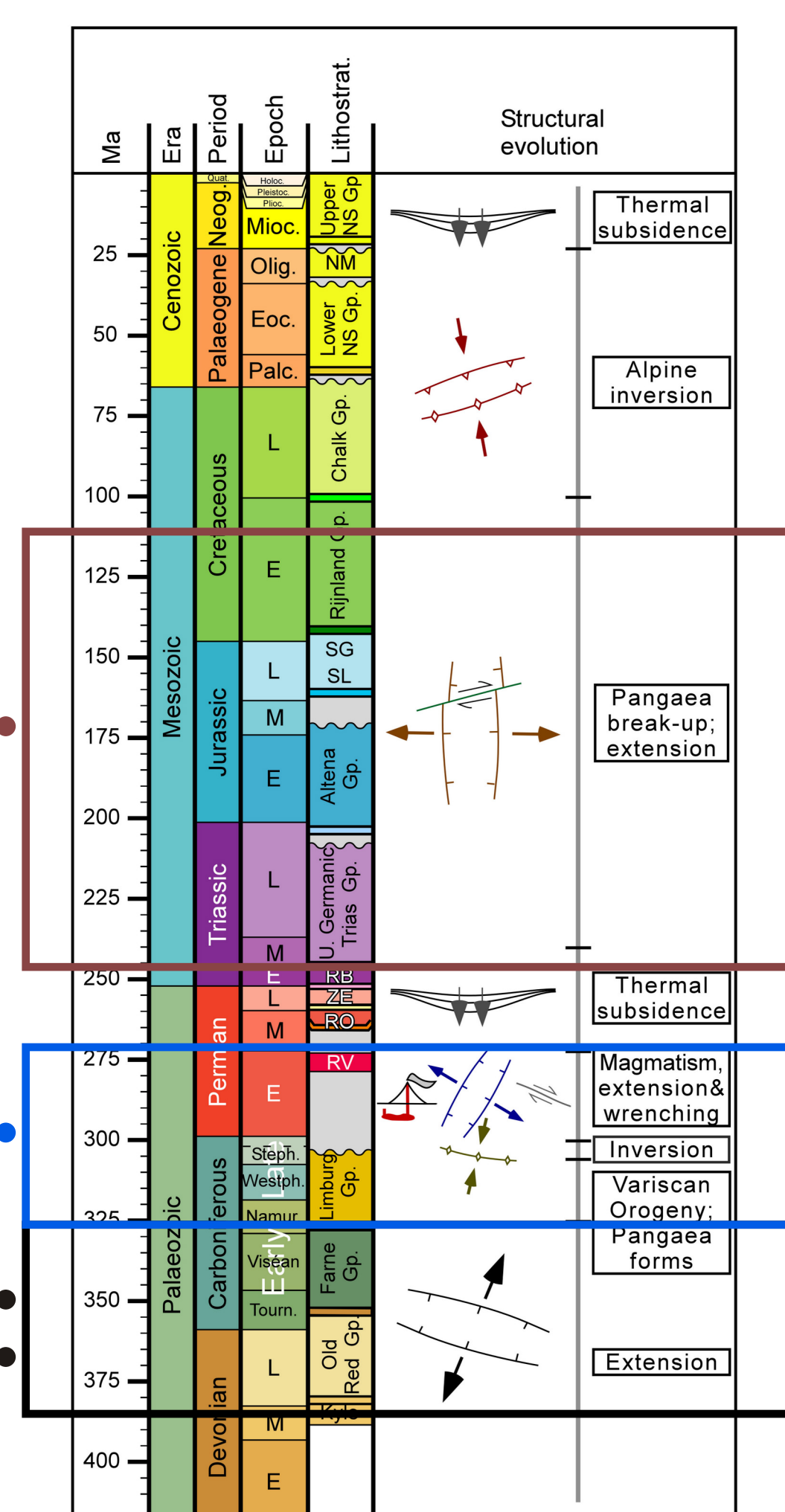


Fig. 2 - Stratigraphy/event chart. NM: Middle North Sea Group, SG: Scruft Group, SL: Schieland Group, RB: Lower Germanic Trias Group, ZE: Zechstein Group, RO: Upper Rotliegend Group, RV: Lower Rotliegend Group.

Triassic – Palaeogene

- Extension along N360-trending normal faults
- Trap formation example: closures in footwalls in A quad
- N060-N080 trending strike-slip system forms local closures

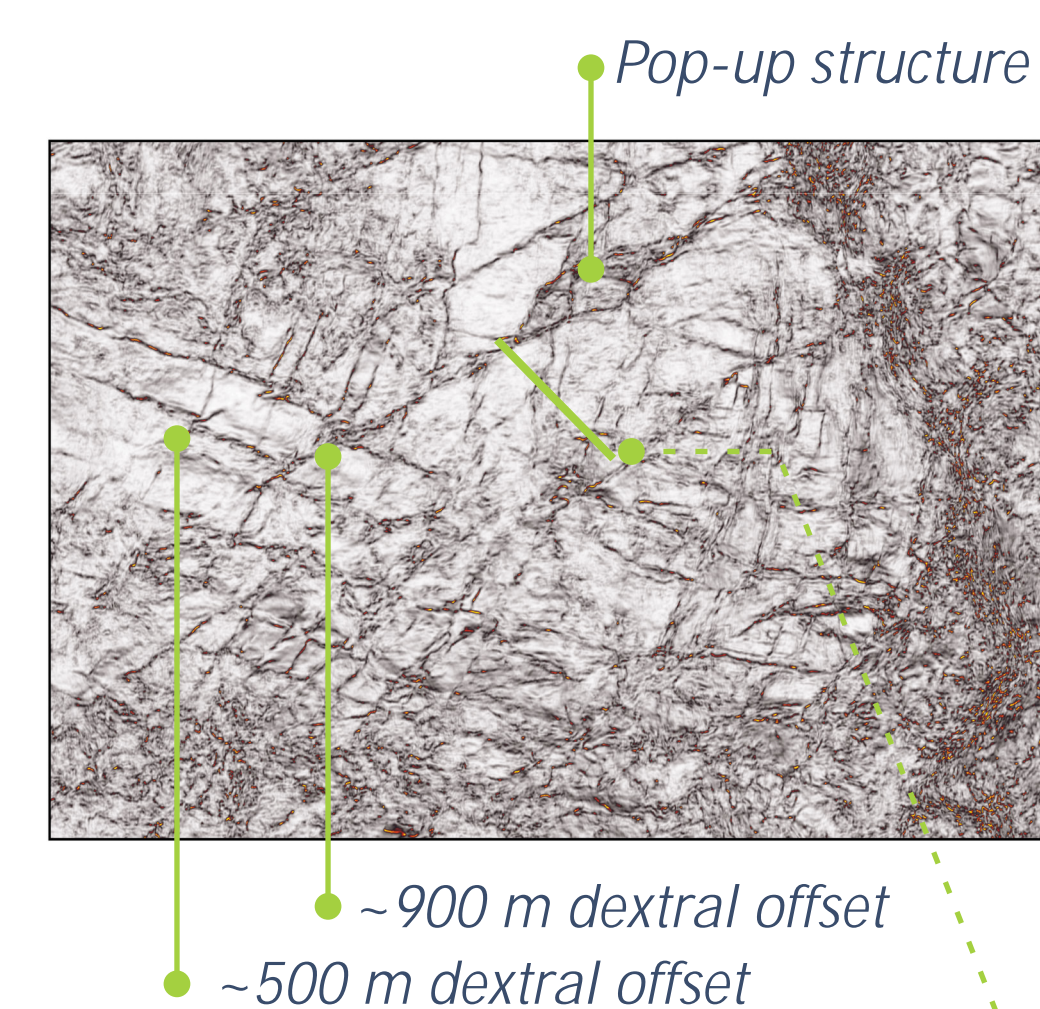


Fig. 3 - Coherency cube extraction 200 ms TWT below the Base Permian Unconformity, showing the main fault trends observable on the Elbow Spit Platform. DEF 3D survey, data courtesy Spectrum ASA.

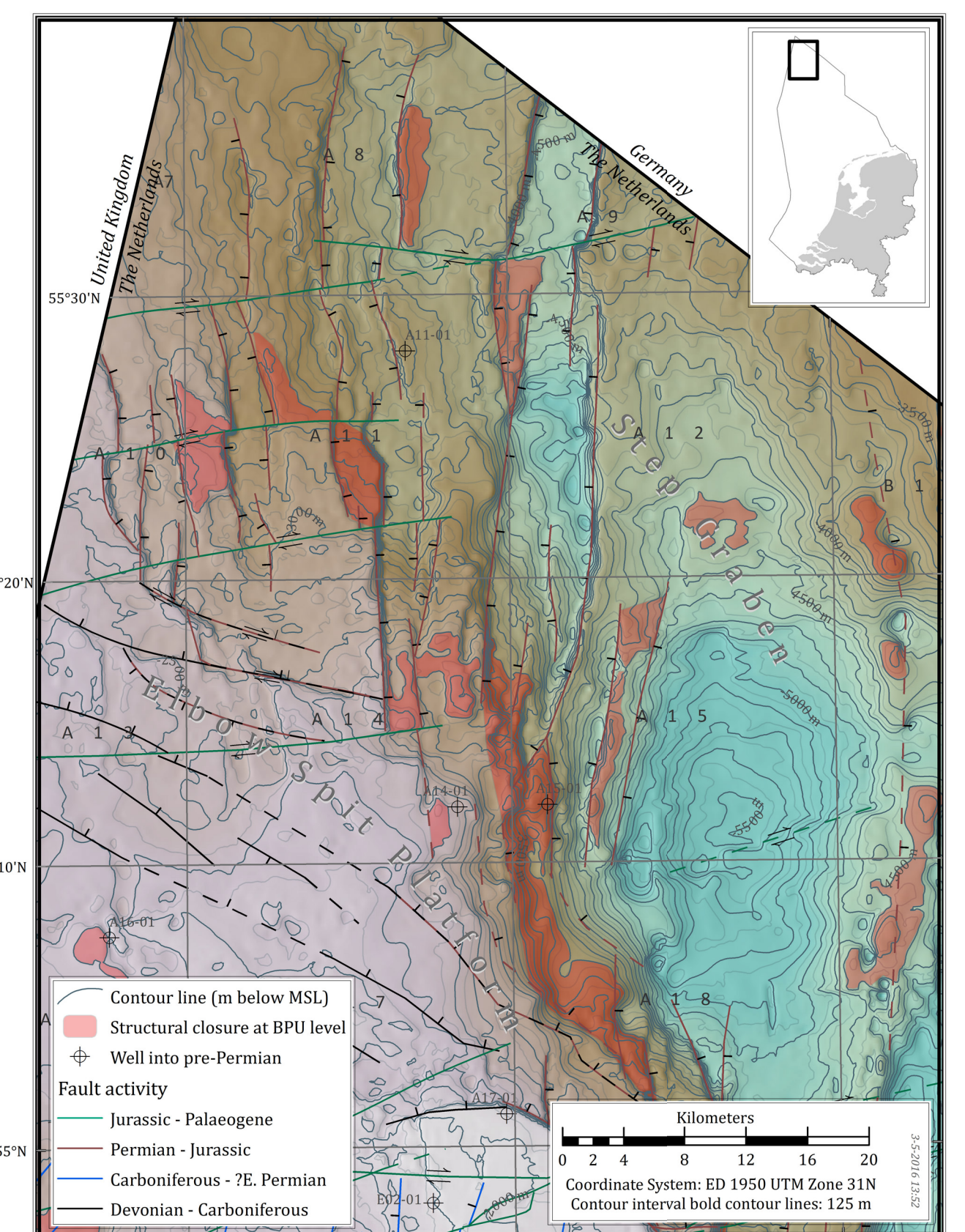


Fig. 4 - Closures and faults at BPU level in the A quadrant. Where the Rotliegend is absent the base of the first post-Rotliegend unit is shown.

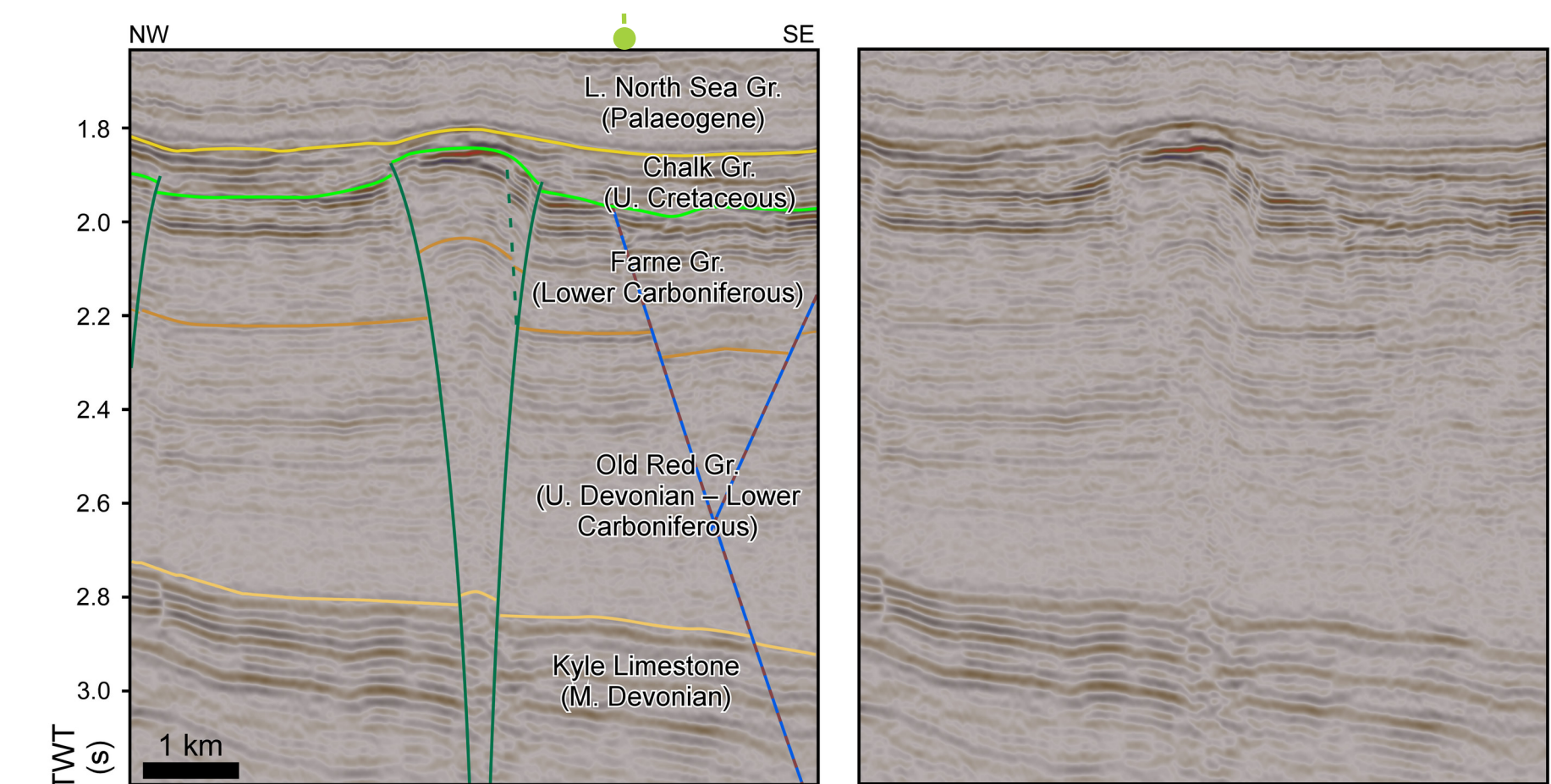


Fig. 5 - Pop-up structure in the E2 and E3 blocks, which offsets units as young as the Late Carboniferous. Legend to horizons in Fig. 2. DEF 3D survey, data courtesy Spectrum ASA.

Devonian – Early Carboniferous

- Extension along N120-trending normal faults
- Faulting affects depositional environments
- Significant low present in Dutch A quad, where Lower Carboniferous source and reservoir rocks have likely been preserved
- N120-trending faults commonly have no offset in Permian and younger strata

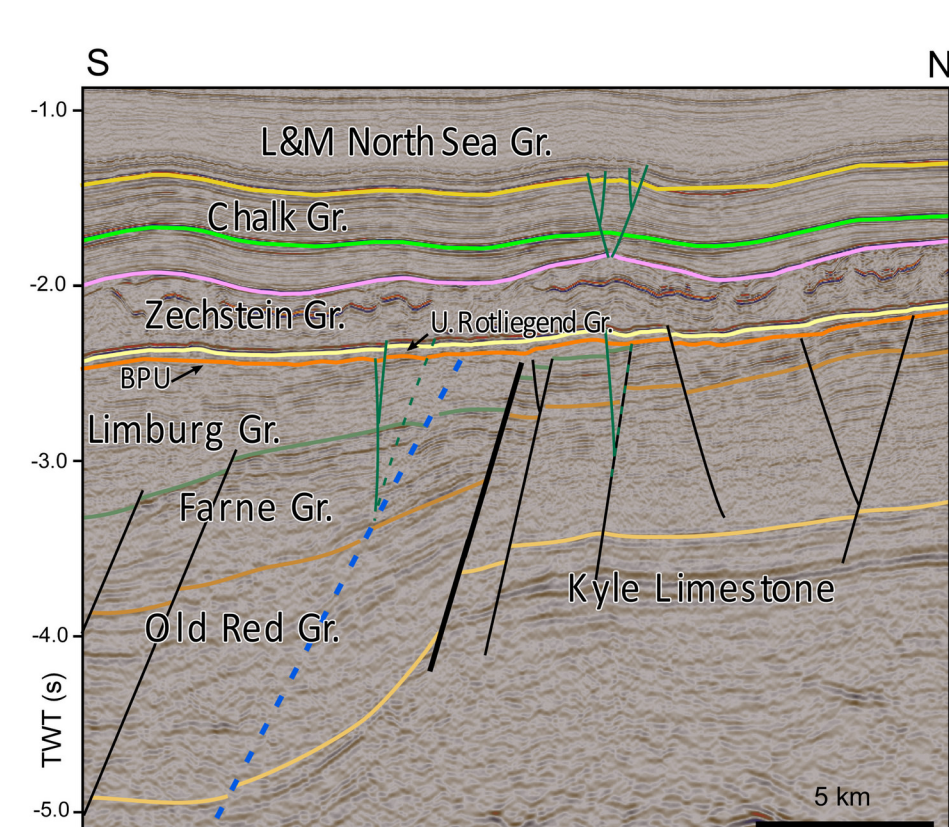


Fig. 6 - Late Devonian / Early Carboniferous faulting on the southern flank of the Elbow Spit Platform. Legend to horizons in Fig. 2. DEF 3D survey, data courtesy Spectrum ASA.

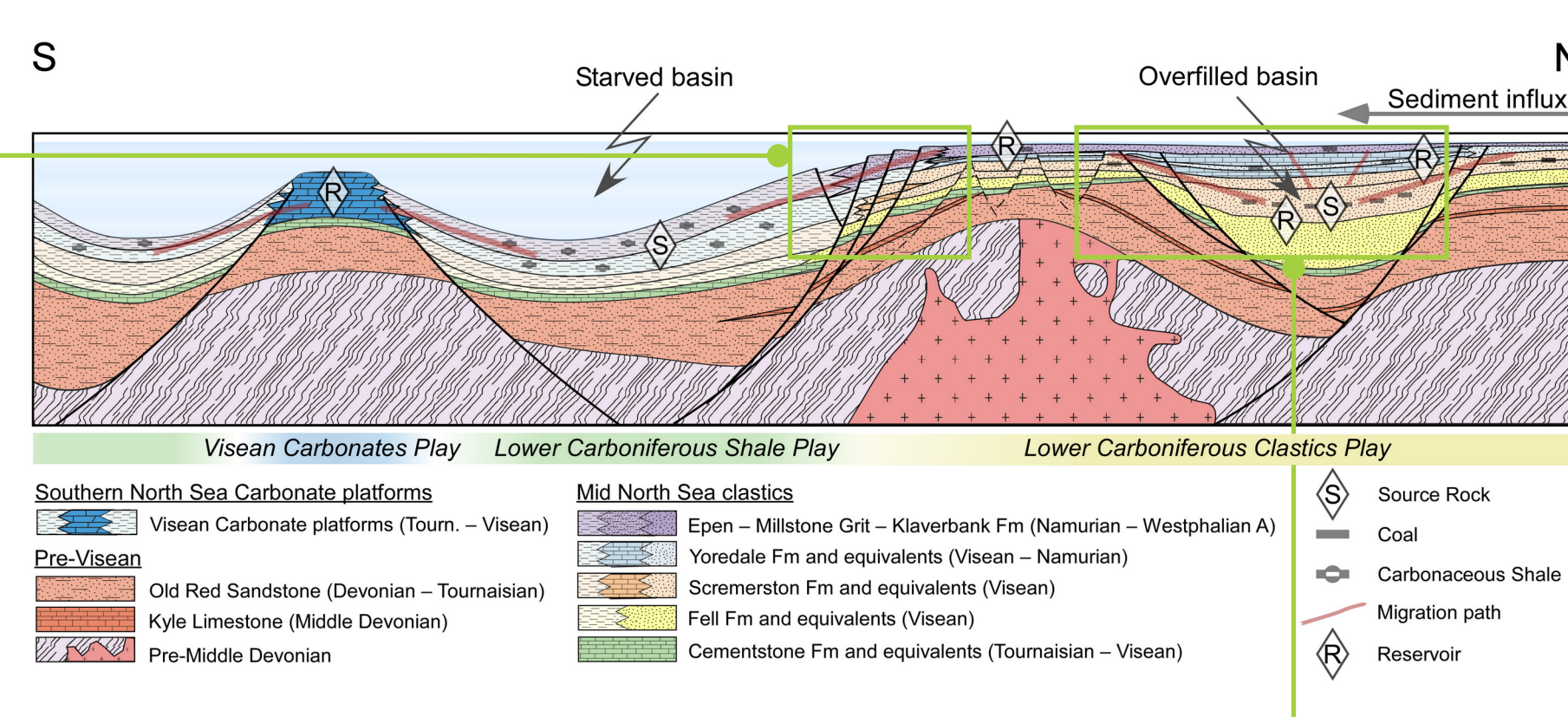


Fig. 7 - Diagram illustrating structure and play elements of the Lower Carboniferous

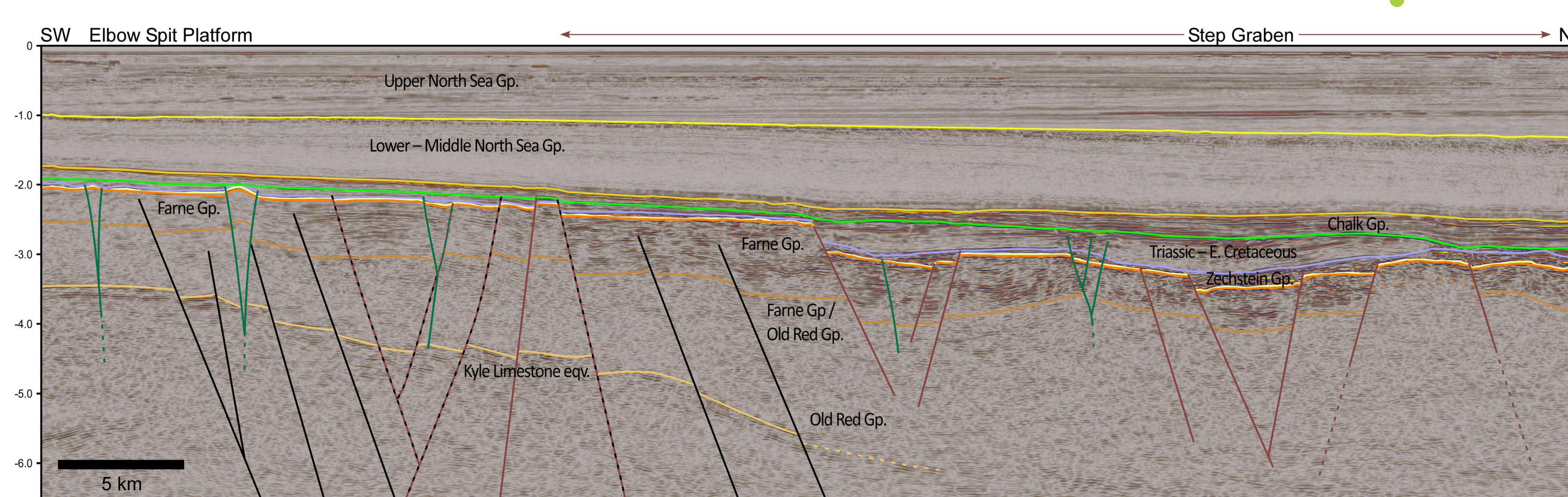


Fig. 8 - Seismic section across the North Elbow Low: a major low that lies hidden within the Step Graben. The Lower Carboniferous Elbow Fm. (part of the Fame Gp.; see Fig. 2) has a high contrast seismic facies which is likely caused by the presence of Scremerston coals. Legend to horizons in Fig. 1. Public seismic line NSR32294.

Late Carboniferous – Early Permian

- Extension along N040-trending normal faults
- Large Late Carboniferous to ?Early Permian graben system in eastern E and western F blocks: the Urania Graben
- New exploration target for Upper Carboniferous reservoirs and traps?

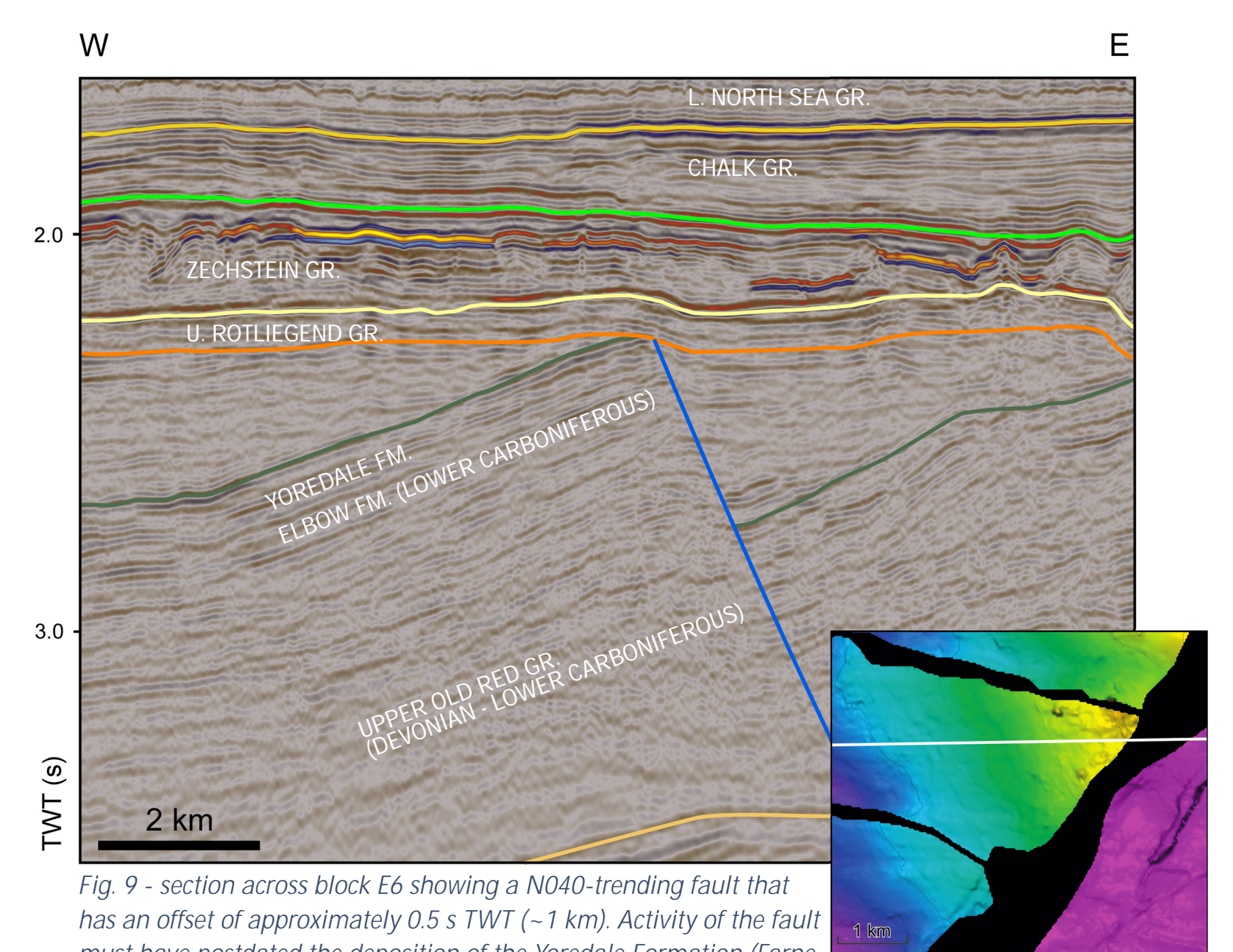


Fig. 9 - Section across block E6 showing a N040-trending fault that has an offset of approximately 0.5 s TWT (~1 km). Activity of the fault must have postdated the deposition of the Yoredale Formation (Fame Gp. see Fig. 2) and predated the deposition of the Permian Upper Rotliegend Group. Legend to horizons in Fig. 2. DEF 3D survey, data courtesy Spectrum ASA.

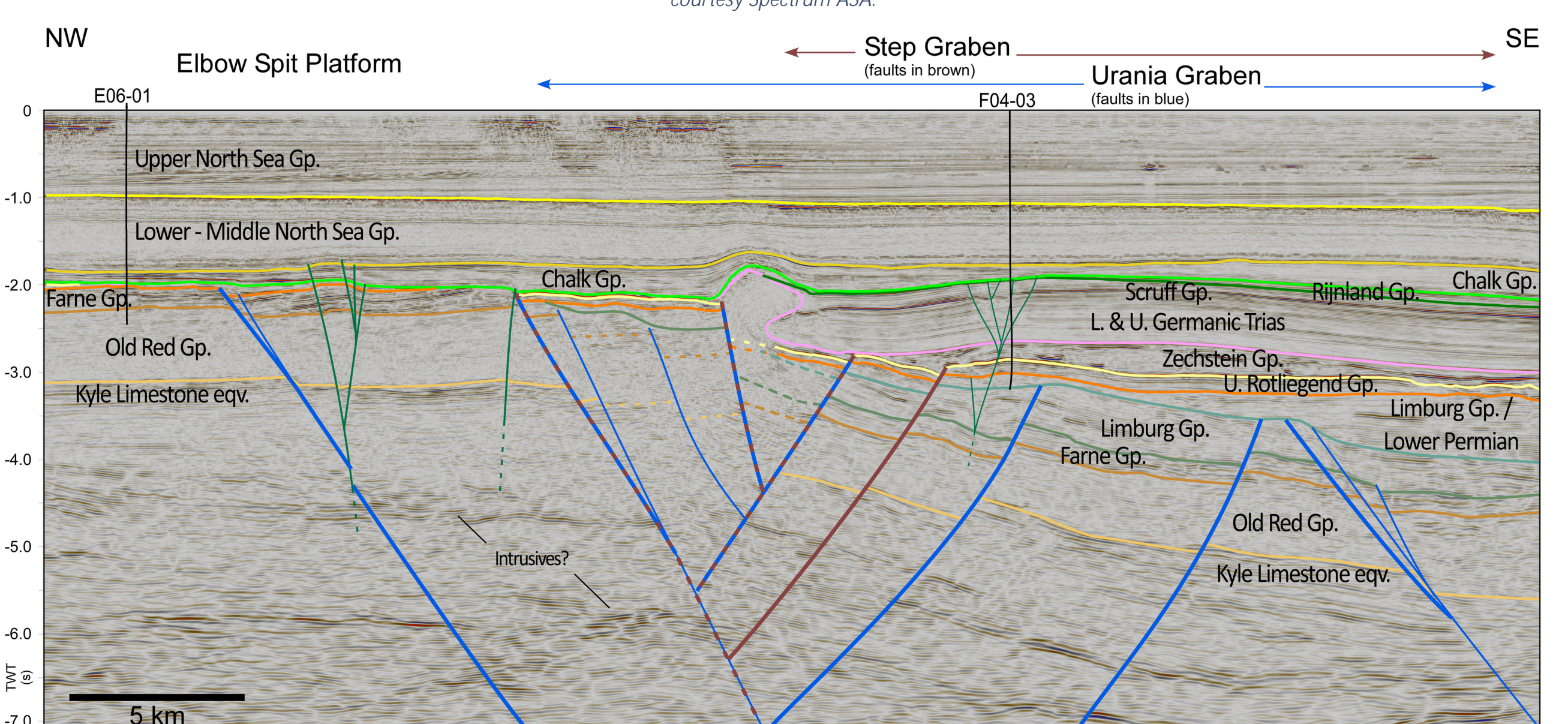


Fig. 10 - Seismic section from the Elbow Spit Platform (left) into the Step Graben (right). The section reveals that an older structure is present below the Step Graben: the Urania Graben, which is at a marked angle to the Step Graben trend (N040 vs. N360). Faults are colored according to the period that they were active: legend in Fig. 1. Legend to horizons in Fig. 2. DEF 3D survey, data courtesy Spectrum ASA.