WNW–ESE-striking Timanian faults in Svalbard

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Take-home messages

WNW–ESE-striking faults in Svalbard connect with Timanian (ca. 600 Ma) faults in the Barents Sea and Russia (Klitzke et al., 2019), and
-suggest that the basement terranes constituting Svalbard were accreted in the late Neoproterozoic (ca. 600 Ma.) or earlier;
-offset Caledonian folds and thrusts in a reverse-sinistral fashion (Caledonian reactivation; fig. 1);
-accommodated the deposition of thickened, coal-rich, Mississippian sedimentary deposits (Mississippian reactivation; Koehl, 2018);
-partly localized the intrusion of Cretaceous magmatism into the crust (Cretaceous magmatism);
-offset post-Caledonian core complexes (fig. 1) in a reverse-sinistral fashion (fig. 2) and are responsible for the arch shape of the West Spitsbergen Fold-and-Thrust Belt in Brøggerhalvøya (Eurekan reactivation);
-localized the formation of transform faults (fig. 3) and potential oceanic core complexes in the Fram Strait, and accommodated crustal shortening (folding and thrusting) responsible for the (c. 400 km) migration of Svalbard from next to Greenland to its present position (late Cenozoic reactivation; fig. 2), thus suggesting that the De Geer Zone does not exist;
-triggered gas seepage along the Vestnesa Ridge and recent earthquakes in Storfjorden and Heer Land (Quaternary; fig. 2).

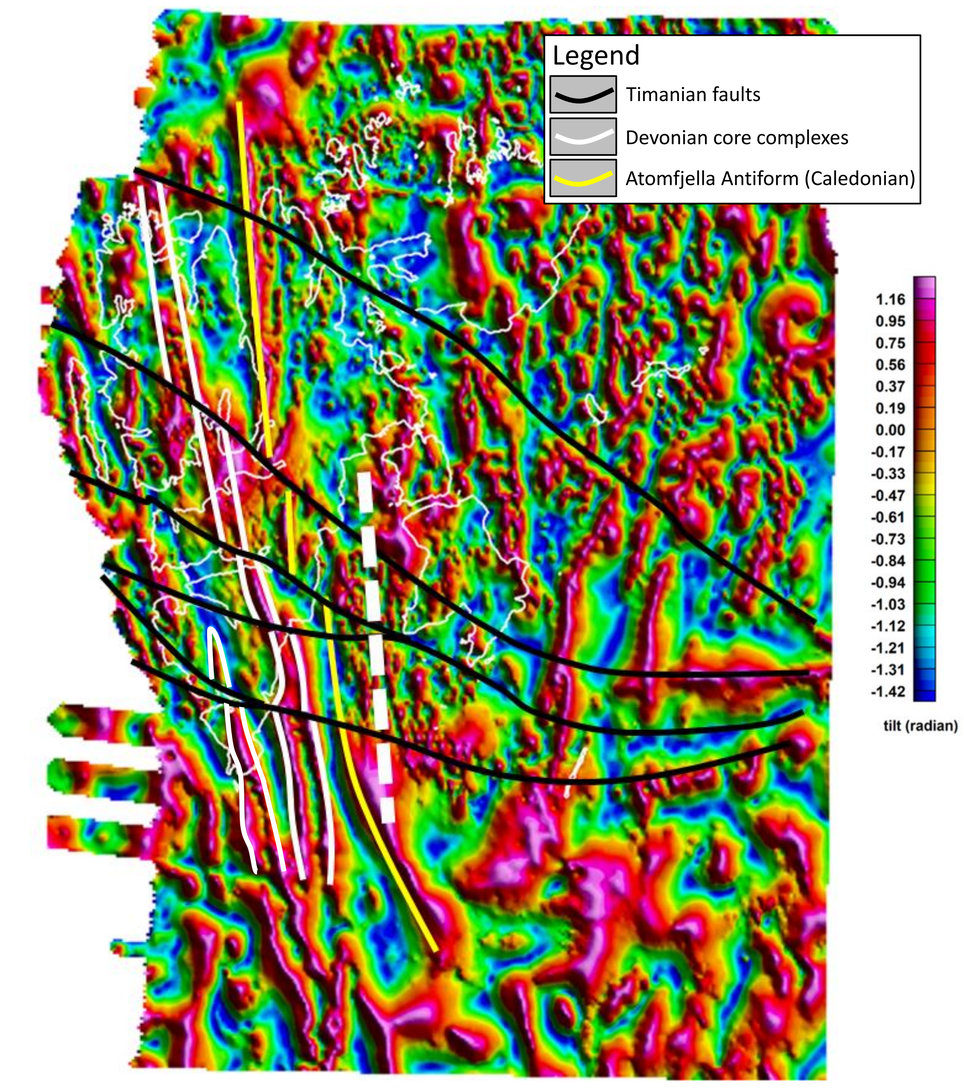

Figure 1: Tilt-derivative aeromagnetic data showing positive N–S-trending anomalies representing Caledonian structures (yellow; e.g., Atomfjella Antiform; Witt-Nilsson et al., 1998) and Devonian core complexes (thick white; e.g., Bockfjorden Anticline; Braathen et al., 2018) offset by inherited Timanian faults (black). Location of figure 2 is shown as a dashed white line and coastlines as thin white lines.

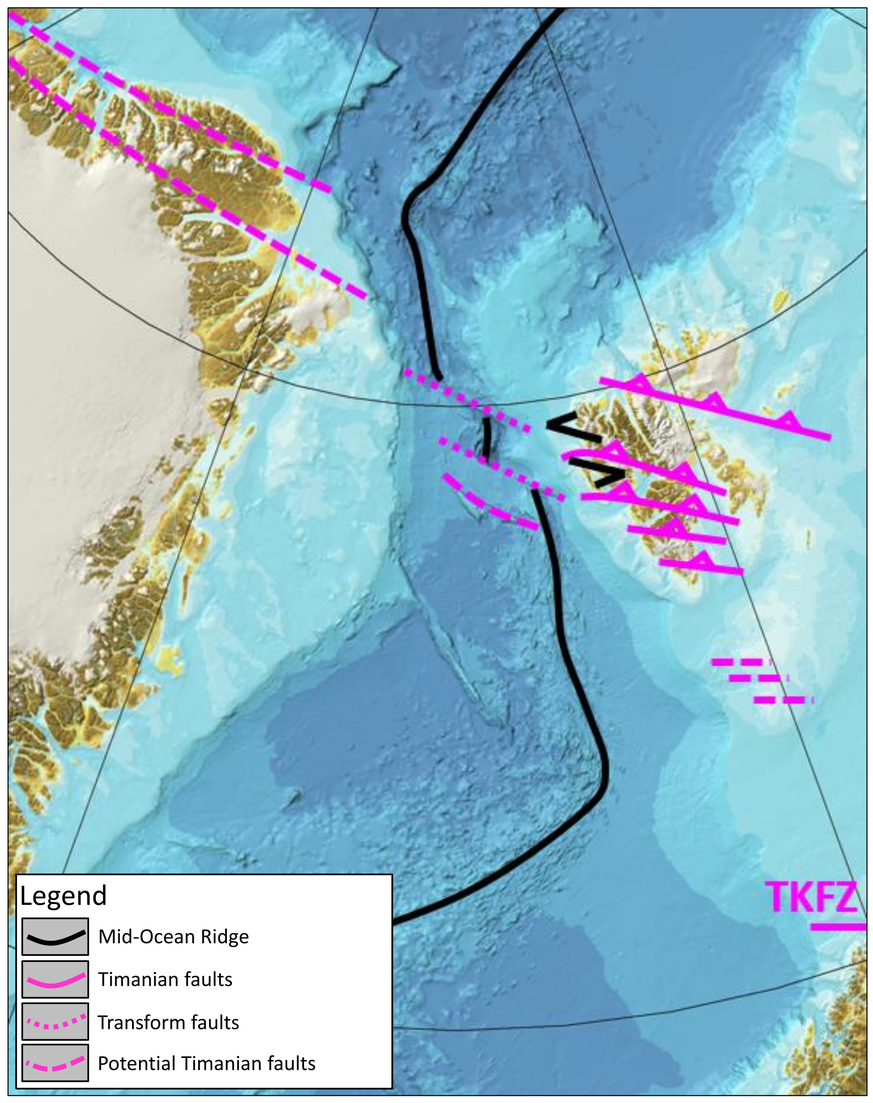

Figure 3: International Bathymetric Chart of the Arctic Ocean (Jakobsson et al., 2012) showing Timanian faults (purple), and possibly related structures (dashed purple), e.g., transform faults (dotted purple). Abbreviations: TKFZ: Trollfjorden–Komagelva Fault Zone (Siedlecka and Siedlecki, 1967).

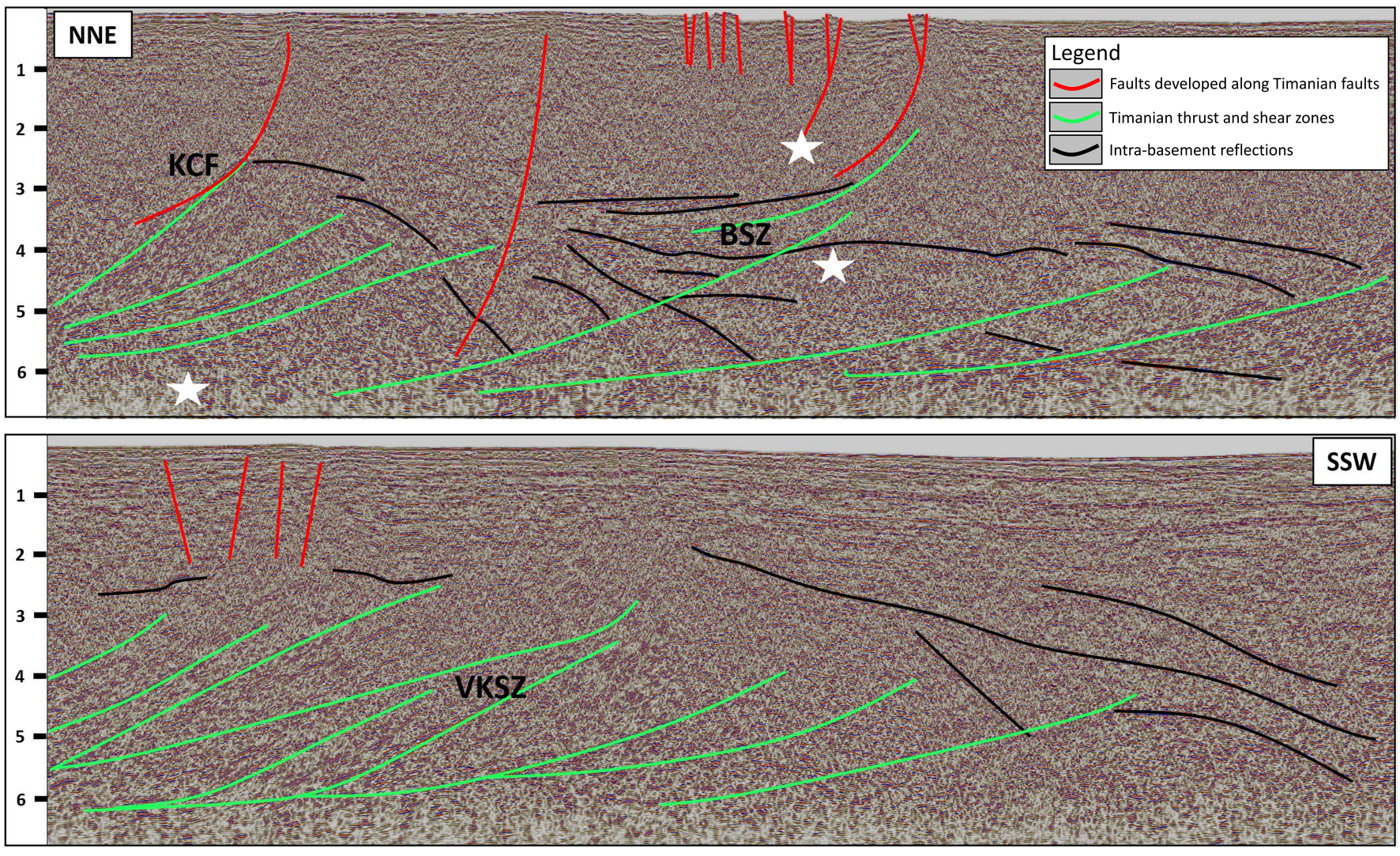

Figure 2: Seismic line showing top-SSW Timanian thrust systems in Storfjorden that reactivated in Caledonian, Devonian–Mississippian, Eurekan and late Cenozoic times. Estimated Cenozoic offset along the KCF is c. 4.5 km of sinistral and c. 10–12 km of top-NNE displacement. White stars represent (the projection of) the location of recent earthquakes in Storfjorden (Pirli et al., 2013) and Heer Land (Mitchell et al., 1990). Location is shown in figure 1. Abbreviations: BSZ: Bellsundbanken shear zone; KCF: Kongsfjorden–Cowanodden fault; VKSZ: Vimsodden–Kosibapasset Shear Zone (Mazur et al., 2009).

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