Structure and composition of large-offset Atlantic transform faults
An extreme example at the Romanche transform from wide-angle seismic data

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Imaging the Lithosphere Asthenosphere Boundary – St Paul, Romanche and Chain

2018 – N/O Pourquoi Pas? – Wide-angle seismic experiment

Three large offset transform faults separating the Northern and Southern Mid-Atlantic Ridge (MAR):

- St Paul – 630 km offset
- Romanche – 950 km offset
- Chain – 300 km offset

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• Longest-offset active transform fault (950 km)
• Active since the opening of the Atlantic (>100 Ma)
• Slow-slipping (1-2 cm/yr)

• Extreme bathymetry (7800 m to 900 m)
• Wide transform valley (30-40 km)
• Large earthquake potential (e.g. 2016 M7.1)
Key project questions

• What causes the extreme topographic features at Romanche?
• How do transform faults influence lithospheric formation and structure – tectonically and thermally?
• What is the extent and importance of fluid-crust interaction at transform faults?
• Does this have any relation to earthquake occurrence?
• How do slow- and fast-slipping transforms compare?
Seismic experiment

Located at eastern ridge-transform intersection (RTI)
- 400 km-long profile (Romanche section*)
- 28 ocean-bottom seismometers (OBS)
- Average OBS spacing: ~14 km
- Shot spacing: 300 m
- Crosses transverse ridge, suspended valley and principal transform displacement zone (PTDZ)

*Only the Romanche section of the ILAB-SPARC profiles is shown. Other sections are the subject of separate studies.
Data have been deconvolved, bandpass filtered, and had the bathymetric effect removed for phase identification.

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• Thin, tectonically-formed crust to south of Romanche (5 km thick), thicker, more magmatic crust to the north.
• Large and deep zone of fracturing and serpentinization, and little-to-no magmatic crust within the transform valley. Potentially up to >50% serpentinization (Bonatti et al., 1996; Dewandel et al., 2003).
• Model suggests deep (>12 km) penetration of fluids.
• Transverse ridge is an uplifted sliver of lithosphere from plate/ridge rotation.

