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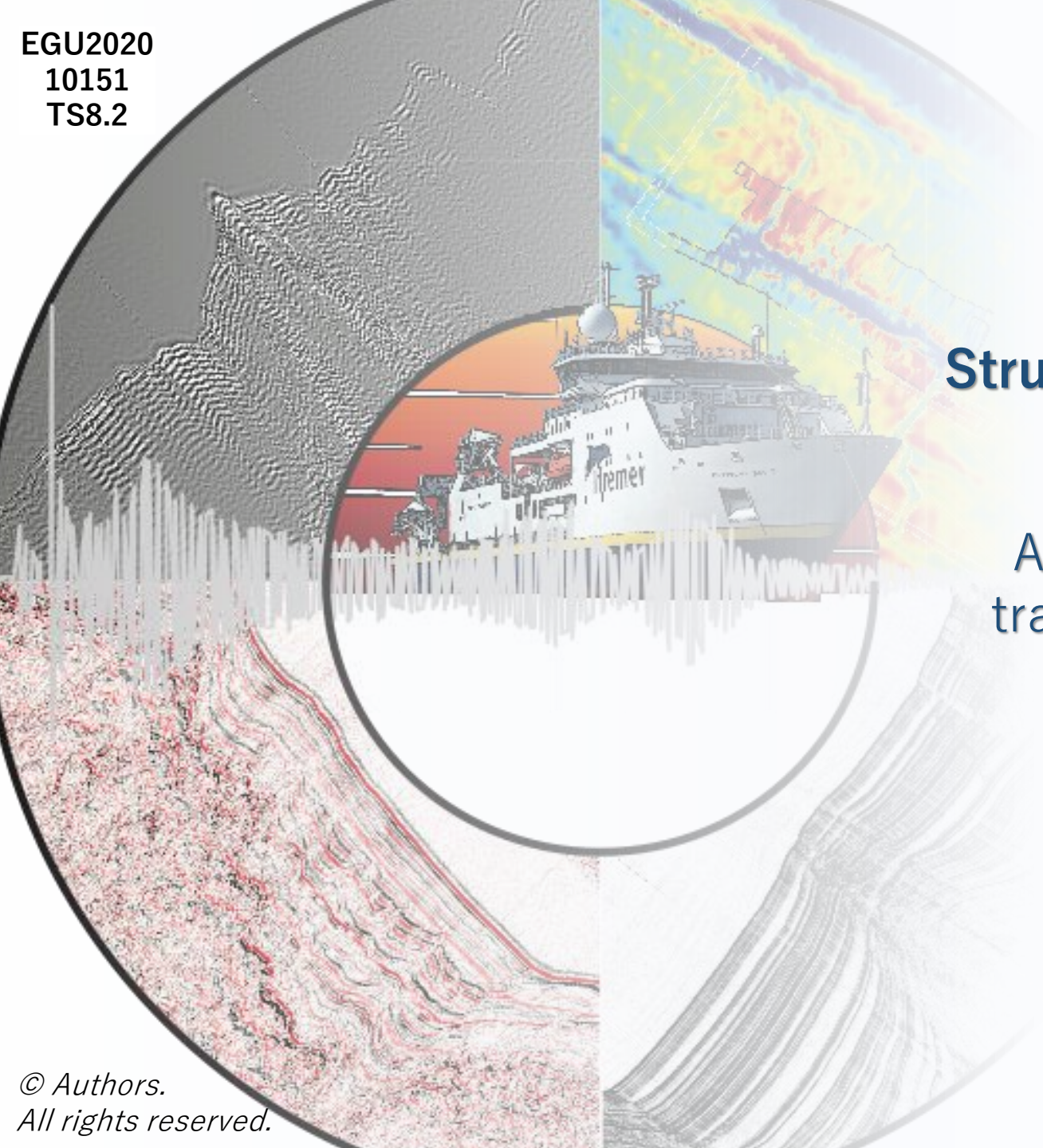

Structure and composition of large-offset Atlantic transform faults

An extreme example at the Romanche transform from wide-angle seismic data

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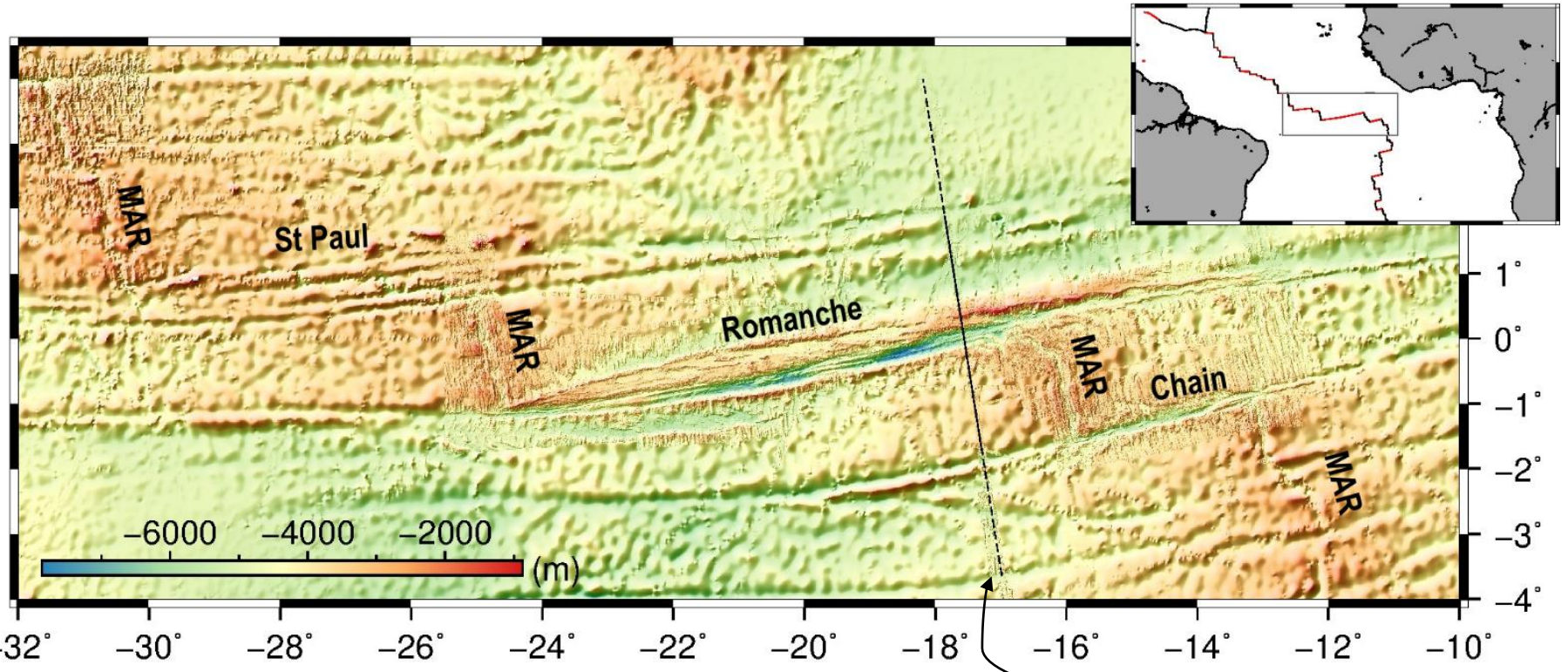
Equatorial Atlantic & ILAB-SPARC Project

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):

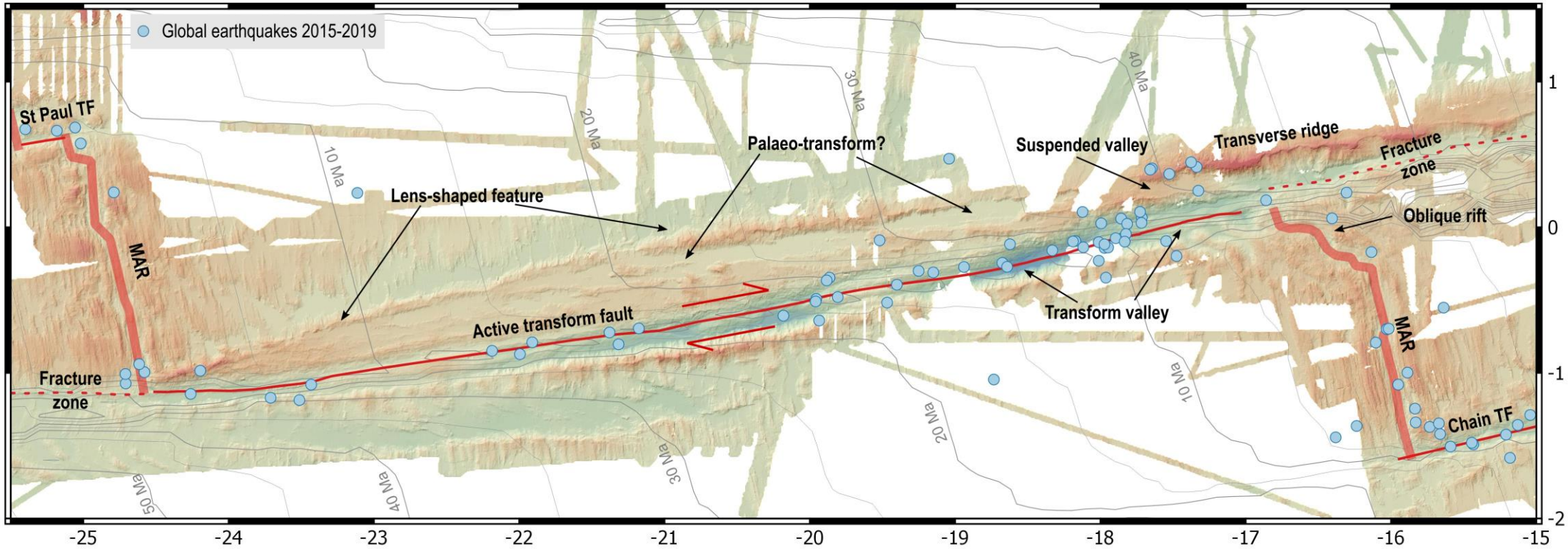
St Paul – 630 km offset

Romanche – 950 km offset

Chain – 300 km offset

Romanche Transform Fault

- 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)

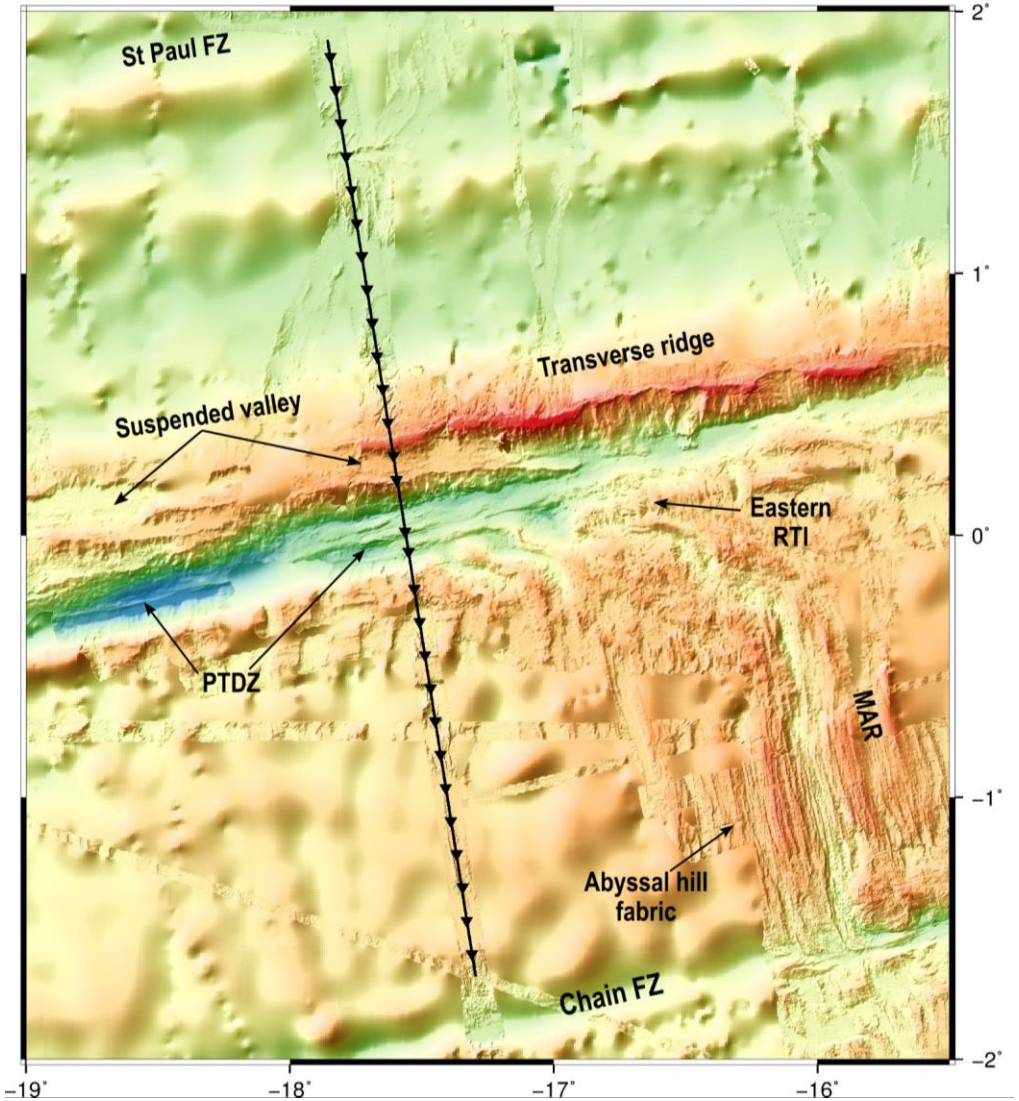


Bathymetry data: Bonatti et al., 1994, 1996, 2001

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)

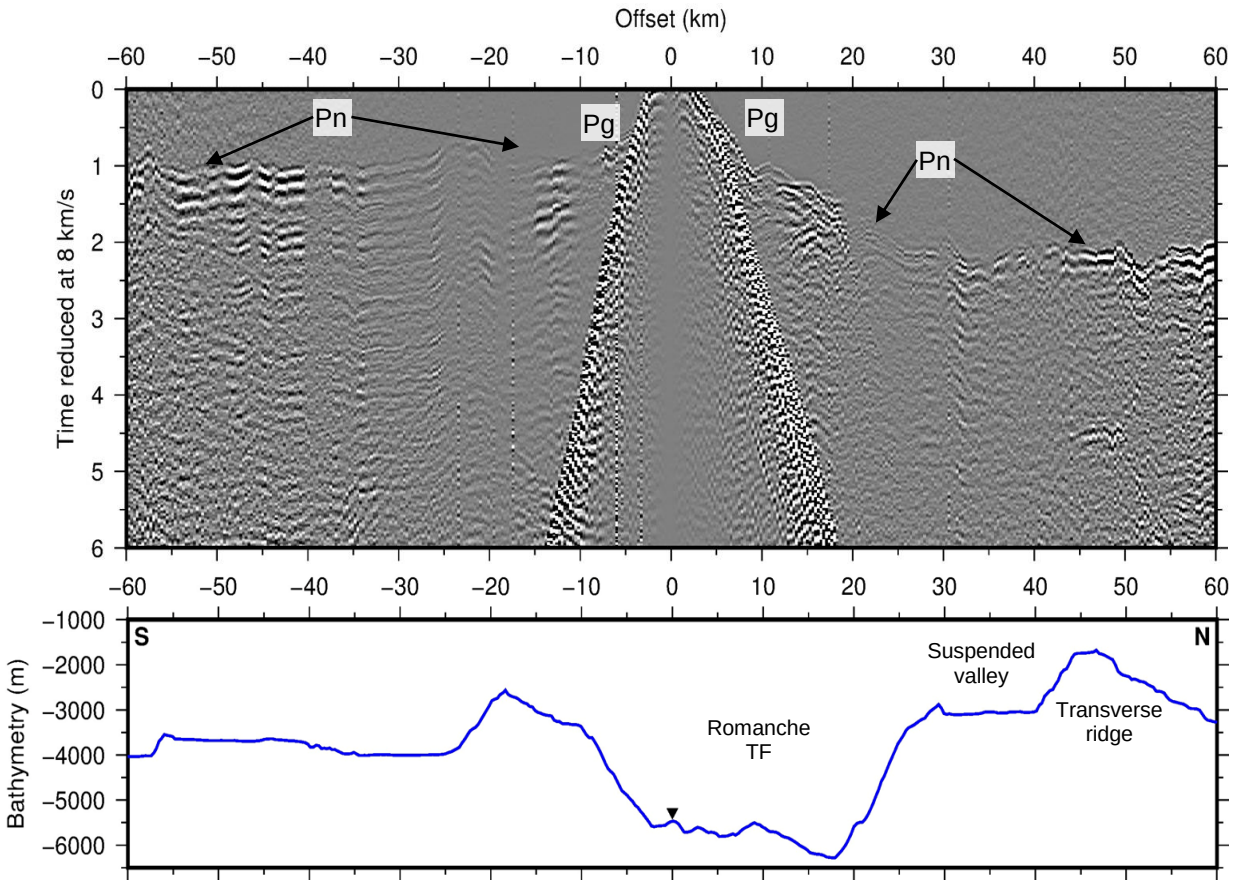
- 400 km-long profile (Romanche section*)
- 28 ocean-bottom seismometers (OBS)
- Average OBS spacing: ~14 km
- Shot spacing: 300 m
- Crosses transverse ridge, suspended valley and principal transform displacement zone (PTDZ)

—— Shooting line
▼ OBS

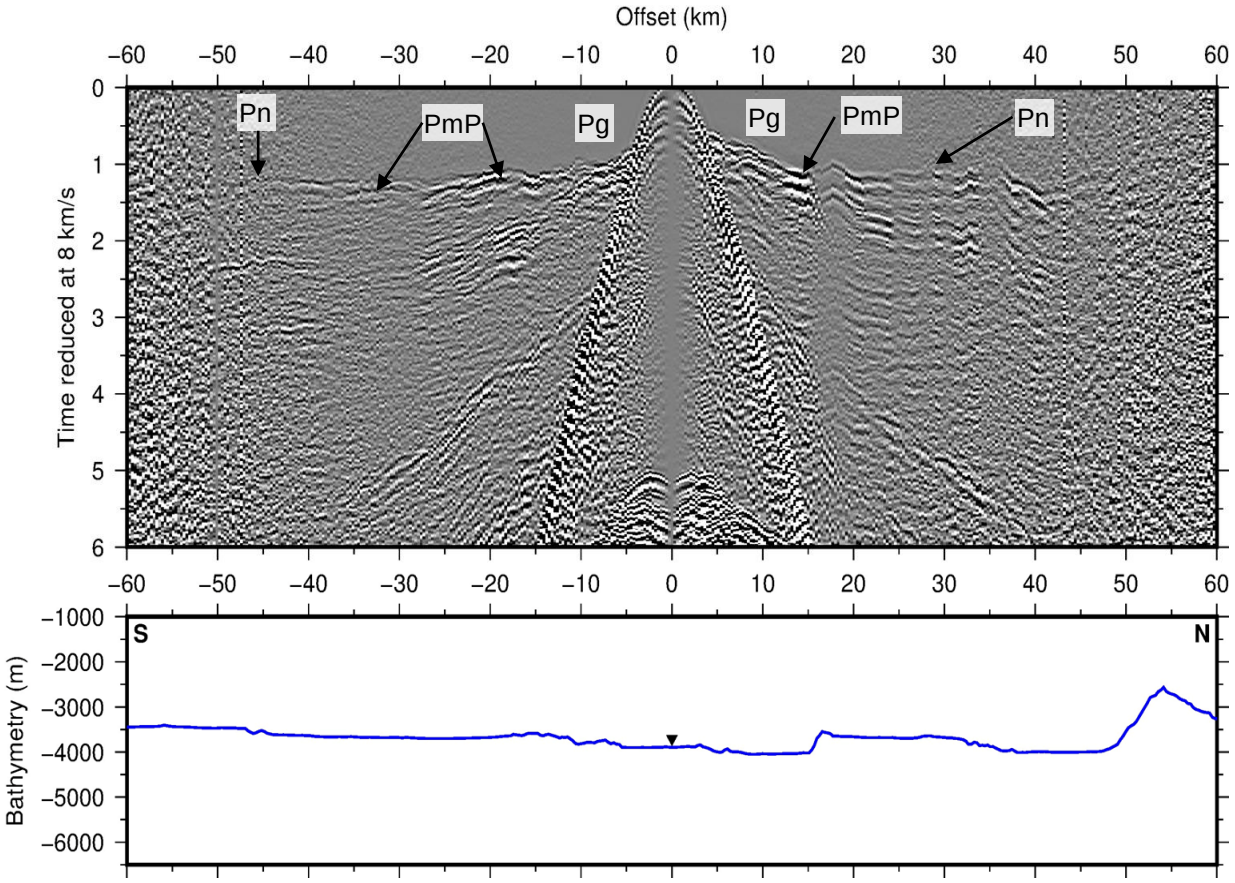
**Only the Romanche section of the ILAB-SPARC profiles is shown. Other sections are the subject of separate studies.*

OBS data

OBS 26
Within Romanche TF

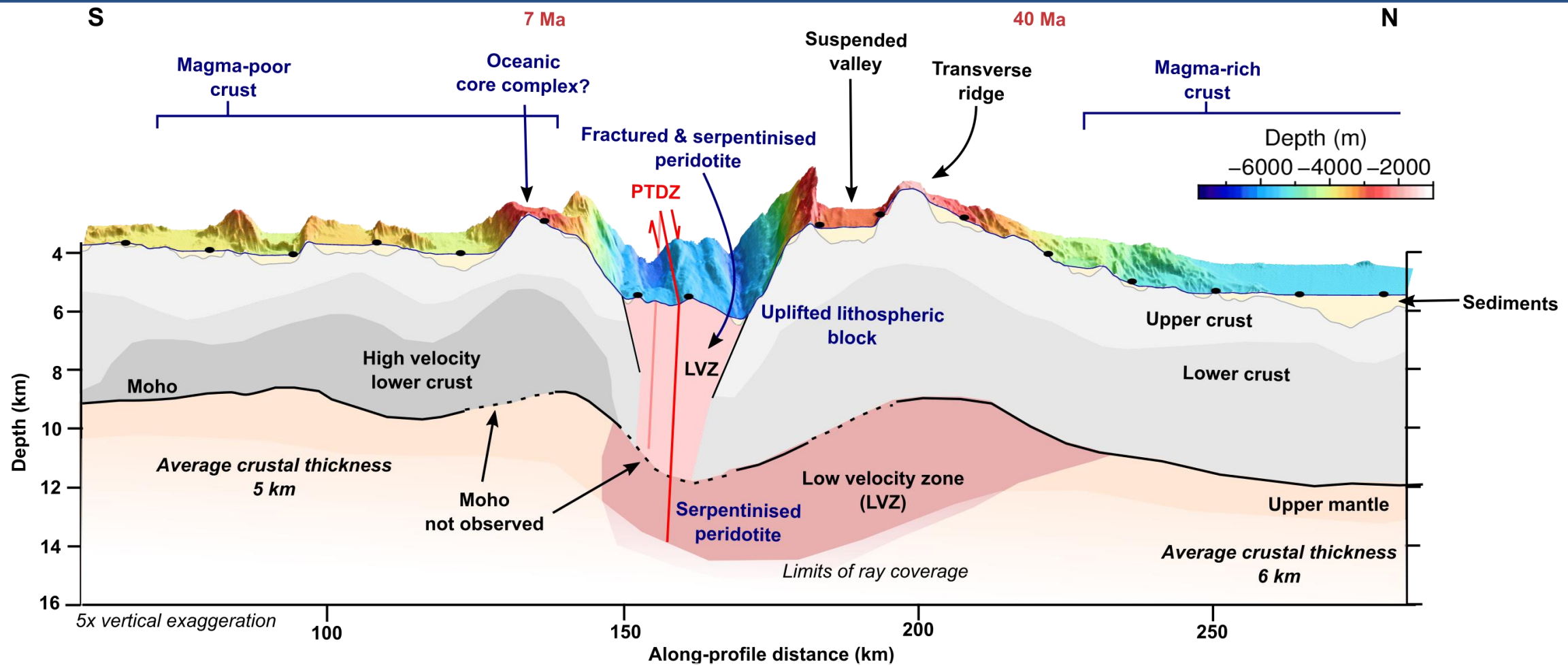


OBS 31
South of Romanche



Data have been deconvolved, bandpass filtered, and had the bathymetric effect removed for phase identification.

Velocity model interpretation



- 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.

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