Strain localization in abyssal peridotites from a magma-starved mid-ocean ridge: a microstructural study

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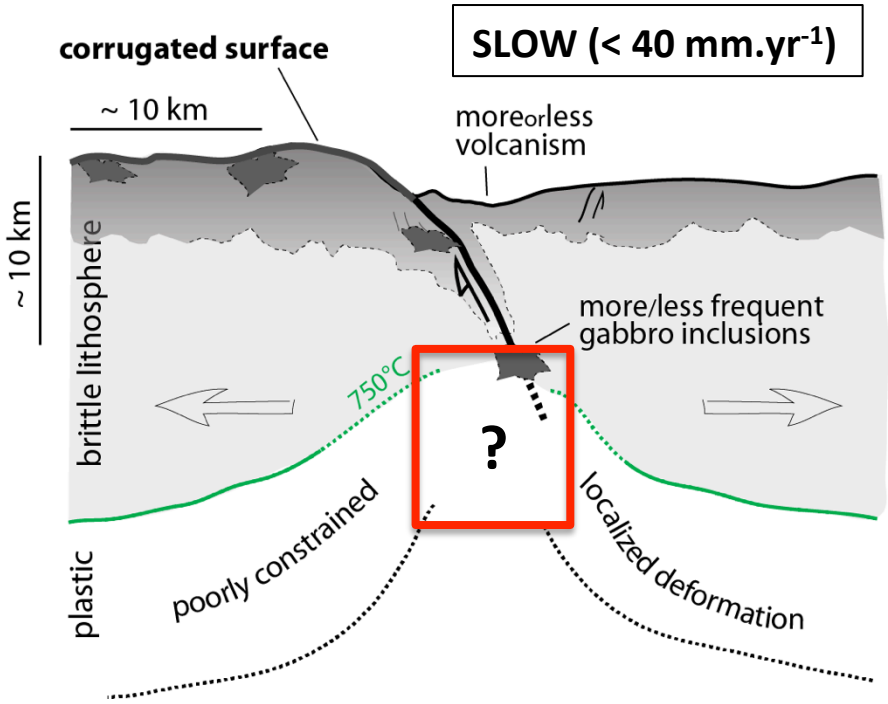
Detachment faults exhume mantle-derived rocks from the base on the brittle lithosphere to the seafloor.

- *What are the strain localization mechanisms in the deep axial lithosphere when there is **no magma** ?*
- *How do axial detachment faults root into the plastic part of the lithospheric mantle in **nearly amagmatic spreading contexts** ?*



[modified from Cannat et al., 2008]

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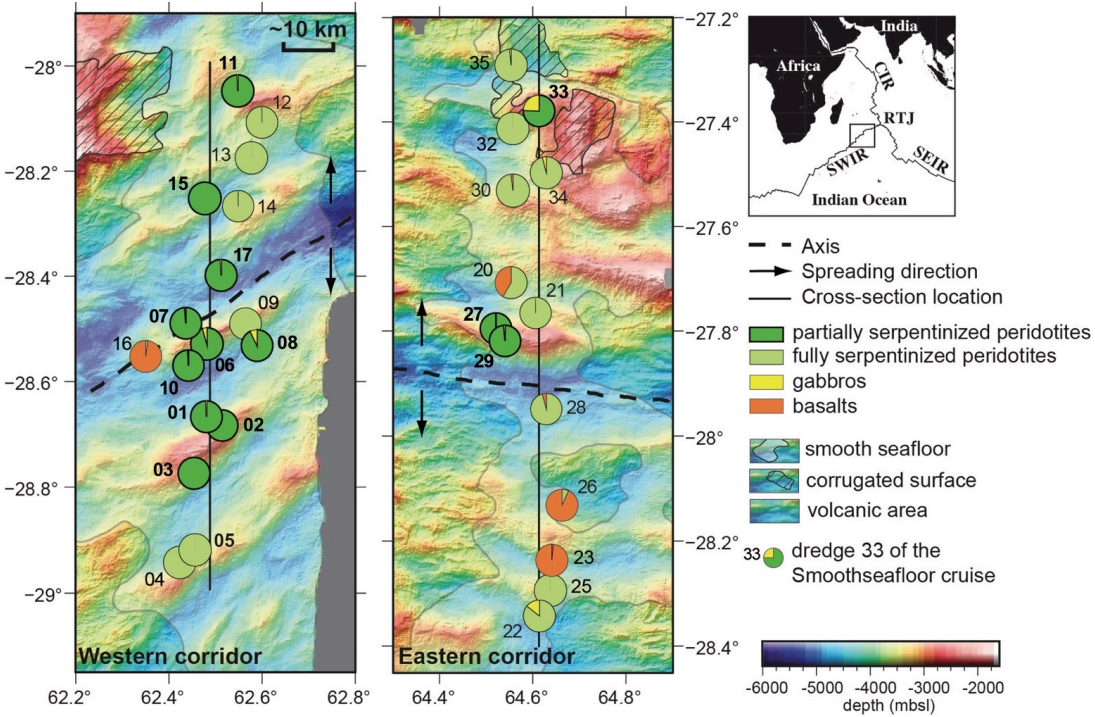
The Eastern SouthWest Indian Ridge (SWIR)

Dredges realized on and off-axis recovered **variably serpentinized peridotites**, with minor amounts of gabbros (< 4%) and basalt (16%).



[Bickert et al., to be submitted]

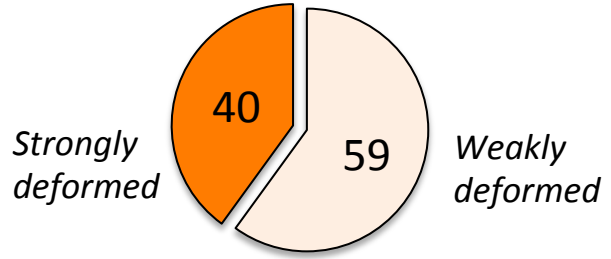
385 samples of ultramafic rocks

↓

99 partially serpentinized samples

↓

Partially serpentinized samples (99)



40% of the samples are **strongly deformed,** with **planar fine-grained zones.**

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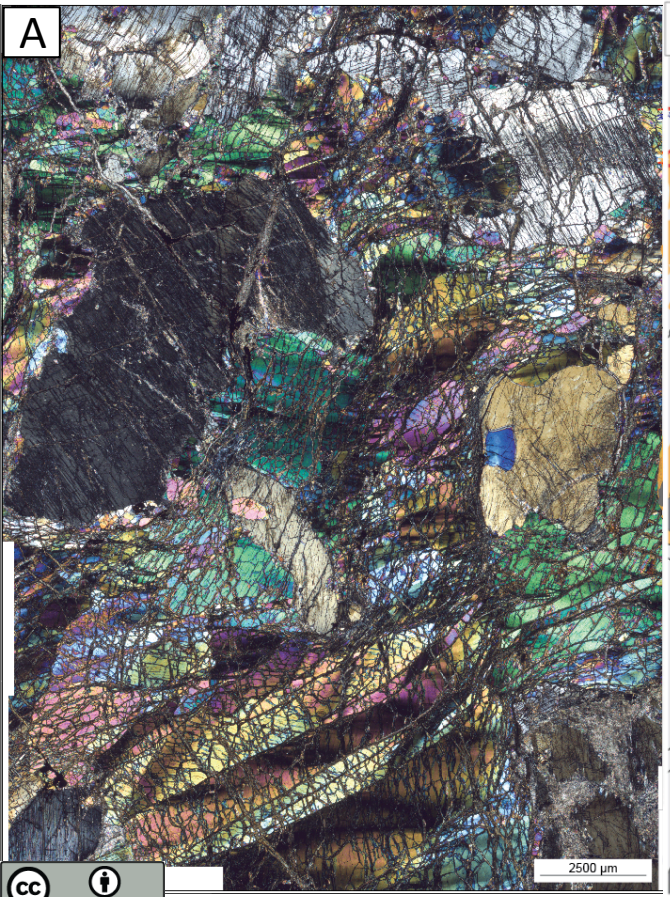
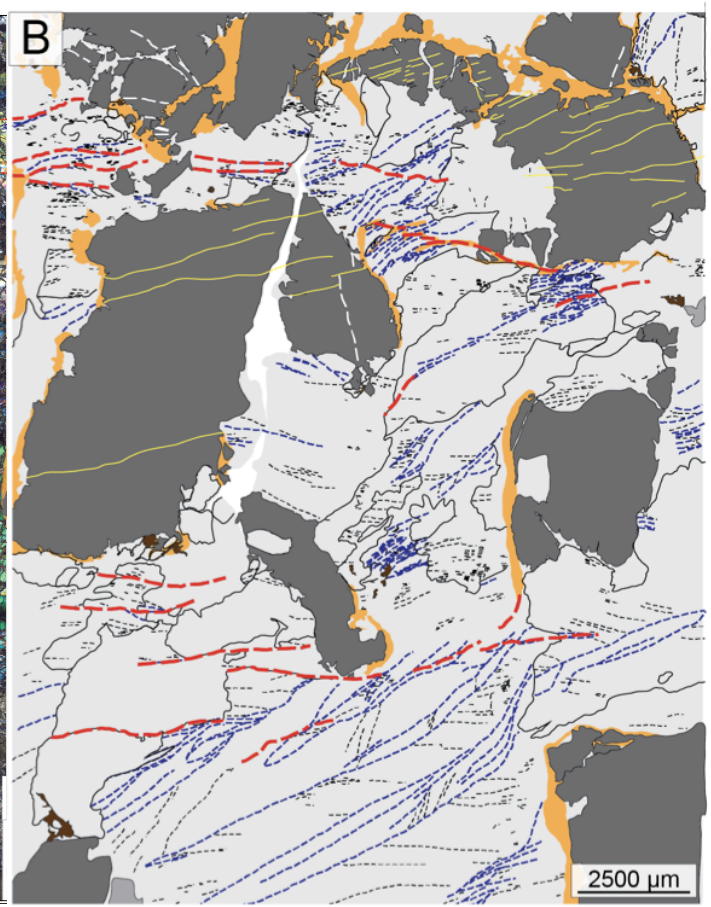
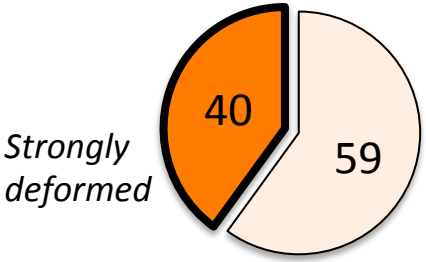
Heterogeneous high stress deformation







*These **grain size reduction (GSR) zones** are preferentially located **along orthopyroxene grains** or around **kinked olivines**. Both represent **stronger grains** that produce stress concentrations.*

Minerals
- Olivine
- Clinopyroxene
- Orthopyroxene
- Spinel

Microstructures
- Fractures in OPX
- Microfractures
- Kinks in olivine
- Subgrain walls
- GSR zones

[Bickert et al., to be submitted]

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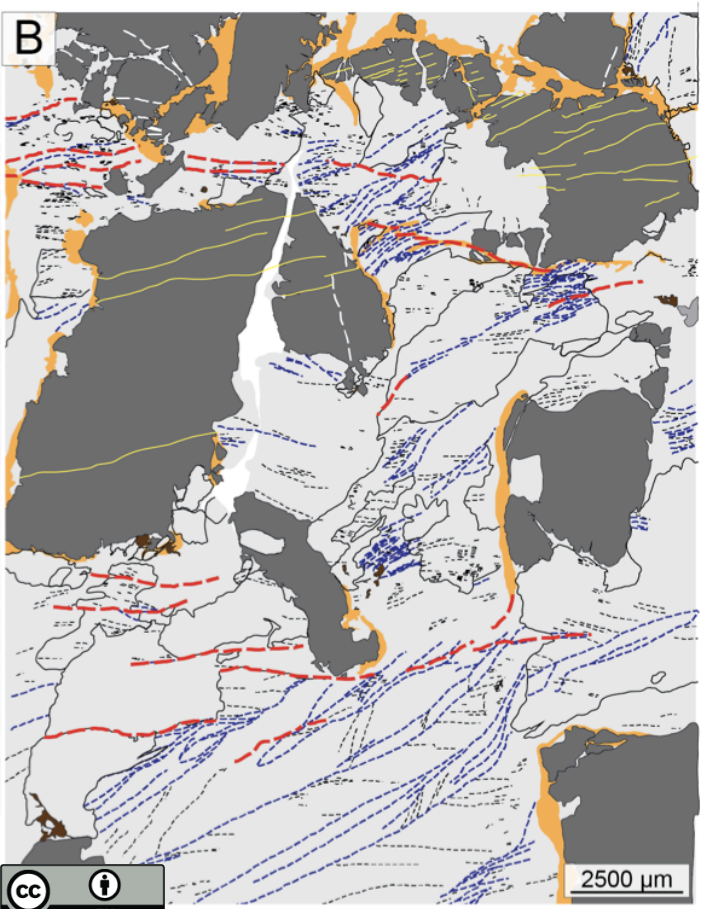
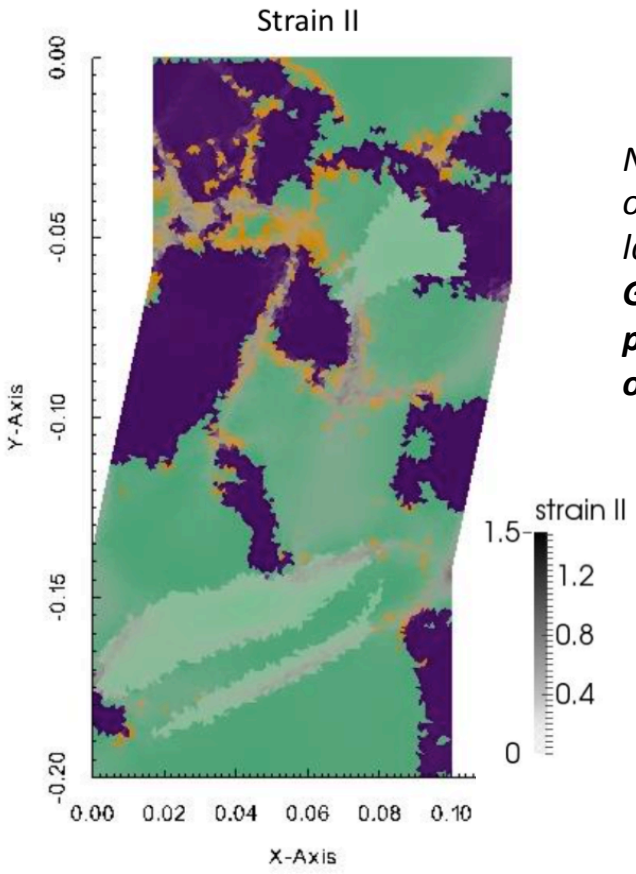
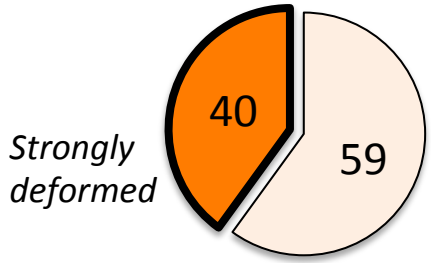
Rock-scale thermomechanical models







Numerical models using orthopyroxene and olivine flow laws reproduce the observations: ***GSR zones in olivine*** *also* ***initiate preferentially*** *next to* ***brittle orthopyroxene****.*

Rheologies
- Strong olivine
- Weak olivine
- Pyroxenes
- Recrystallized olivine

Minerals
- Olivine
- Clinopyroxene
- Orthopyroxene
- Spinel

Microstructures
- Fractures in OPX
- Microfractures
- Kinks in olivine
- Subgrain walls
- GSR zones

[Jammes, Bickert et al., in prep.]

Questions ? Comments ?
Feel free to contact the authors:

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