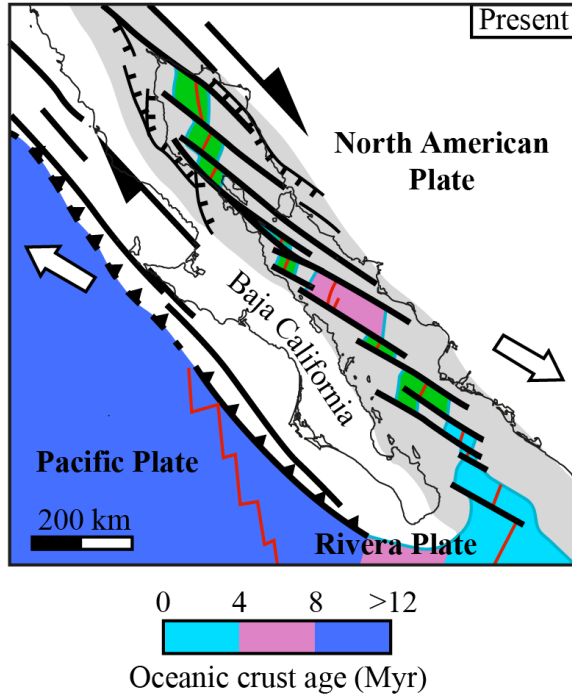


Looking beyond kinematics: 3D thermo-mechanical modelling reveals the dynamics of transform margins

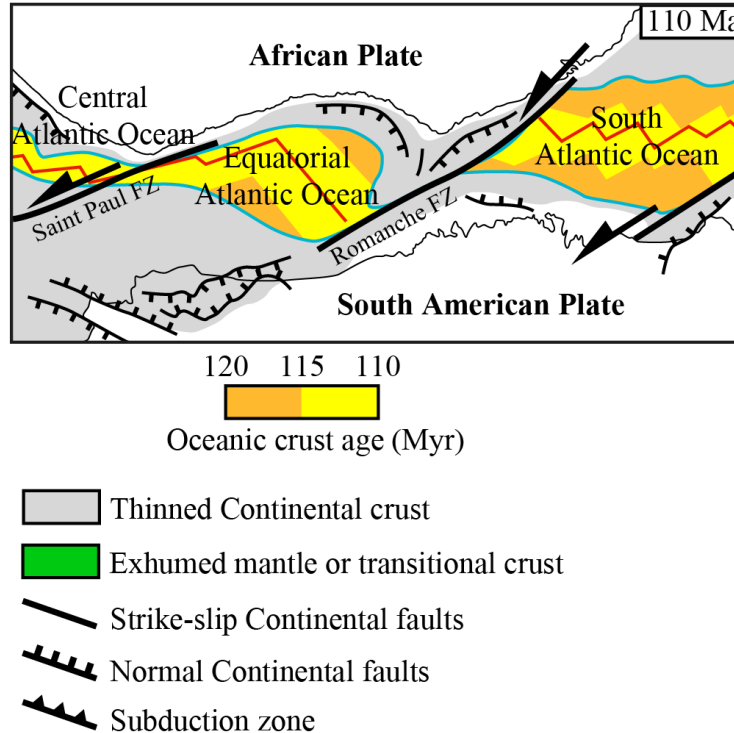
Anthony Jourdon, Charlie Kergaravat, Guillaume Duclaux, and Caroline Huguen

Natural examples

High Obliquity rifting Gulf of California



Moderate Obliquity rifting Equatorial Atlantic

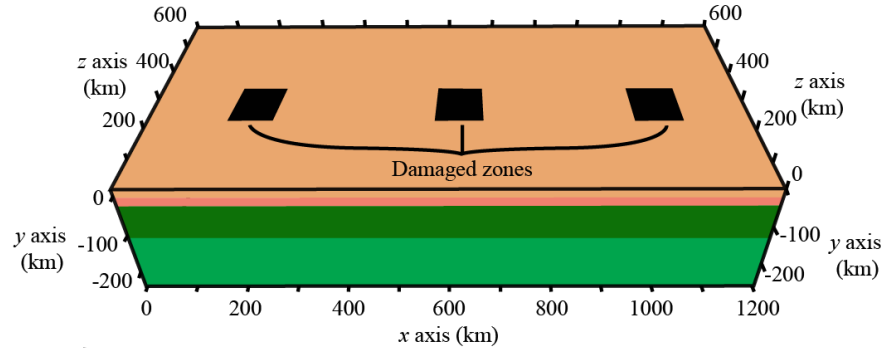


**3D systems
~30% of non
convergent margins**

**→ How an oblique rift
turns into a transform
margin ?**

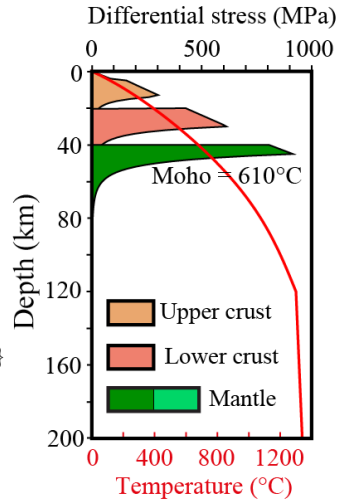
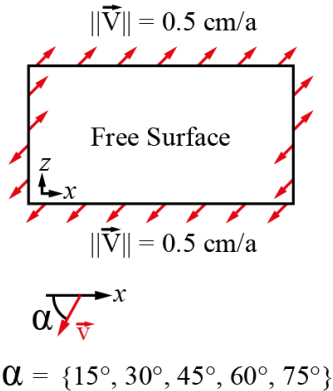
**→ When and how
transform/strike-slip
faults generate ?**

Model setup

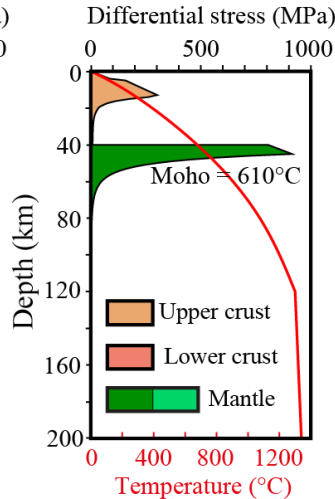


Original approach:
Obliquity through boundary conditions

+3 weak zones to initiate deformation



Strong Lower Crust



Weak Lower Crust

Variables :

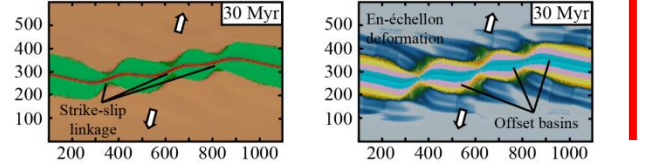
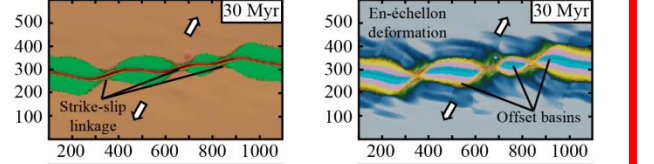
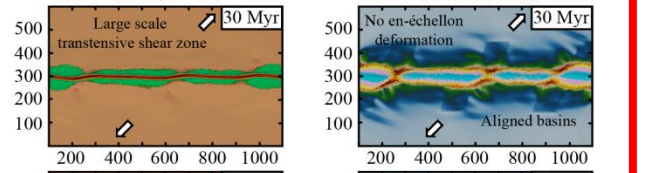
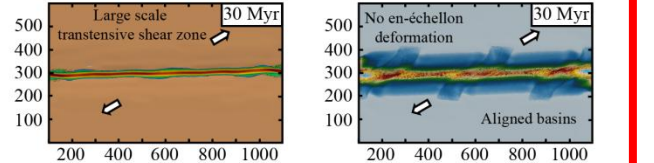
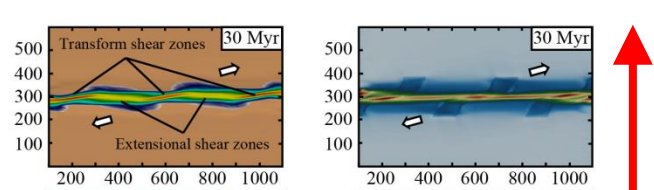
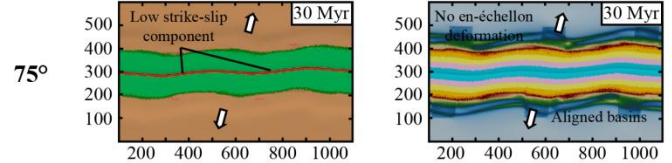
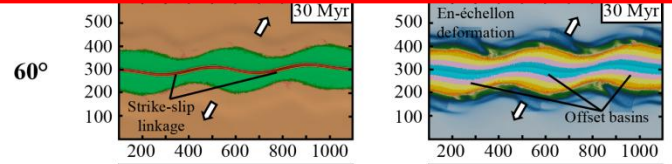
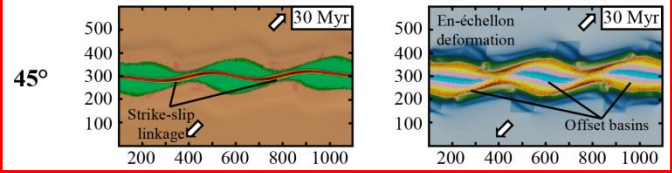
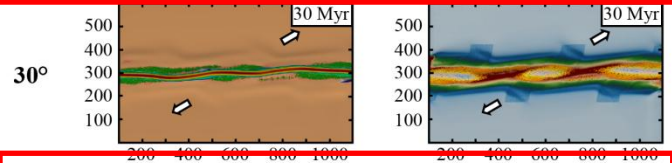
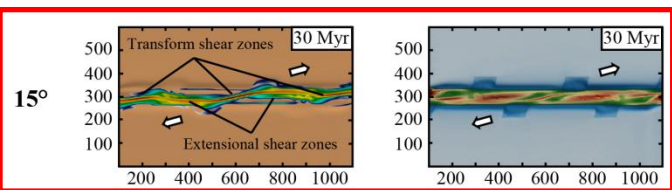
1. Obliquity from 15° (highly oblique) to 75°
2. Crust rheology

High resolution models
1024x128x512 elements
 $\approx 1\text{km}/\text{elements}$

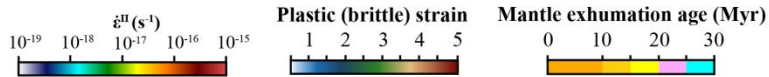
α

Strong Lower Crust

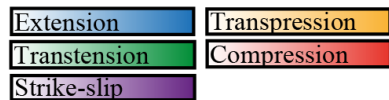
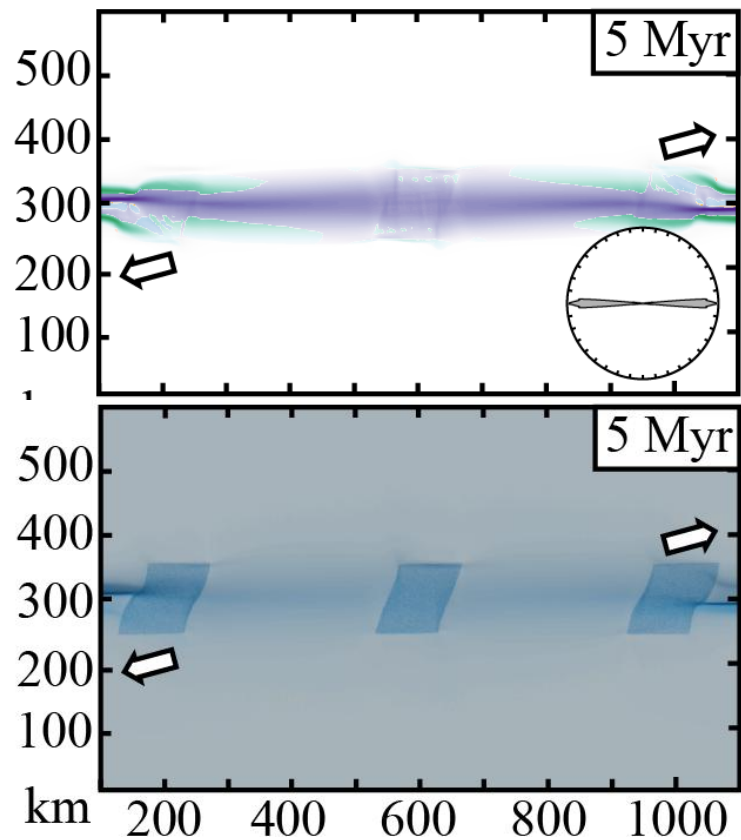
Weak Lower Crust



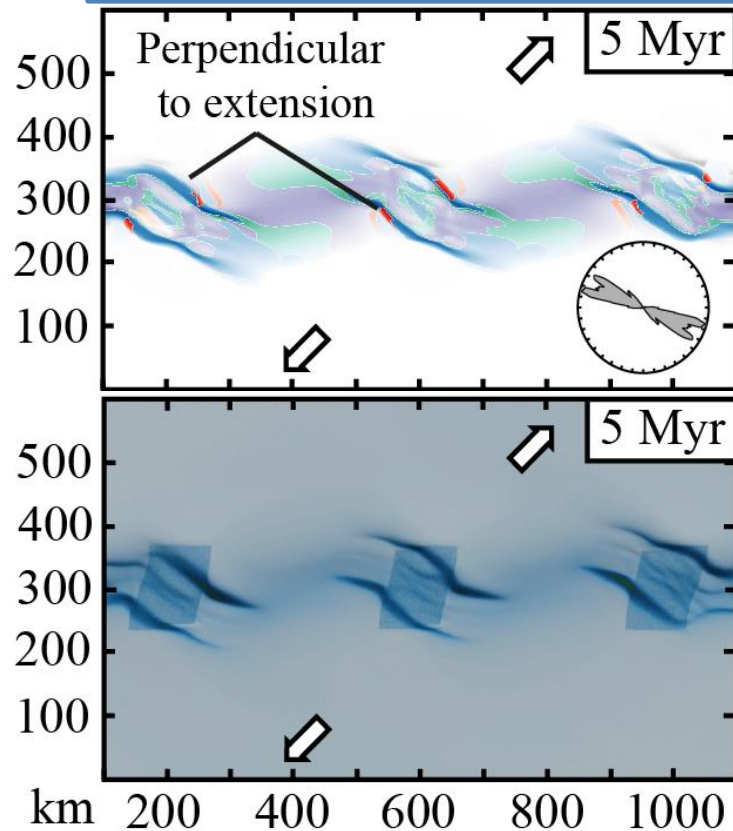
Obliquity



15° → High obliquity



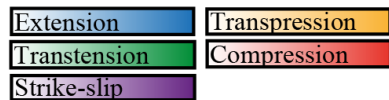
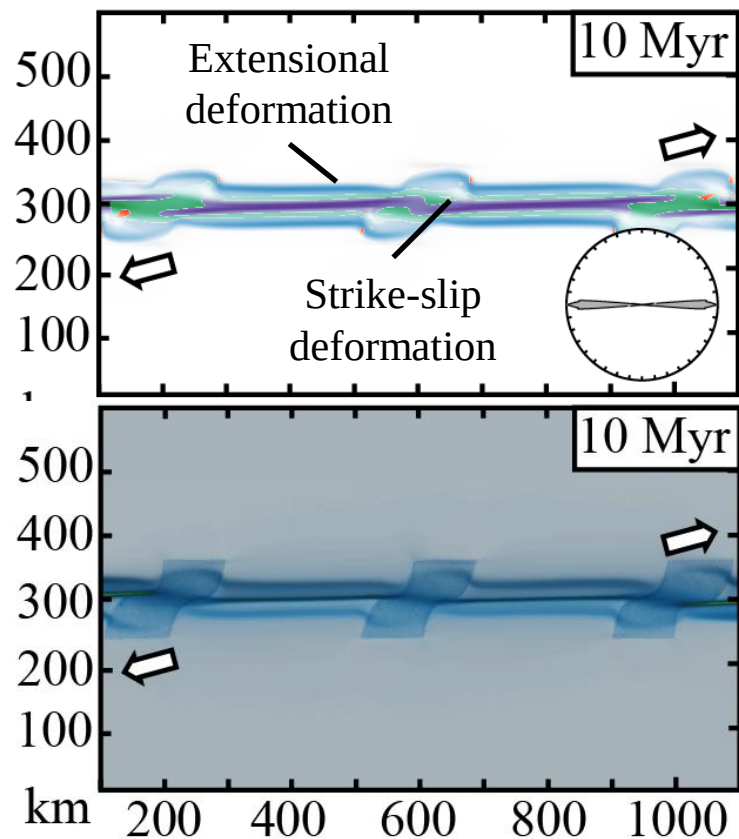
45° → Moderate obliquity



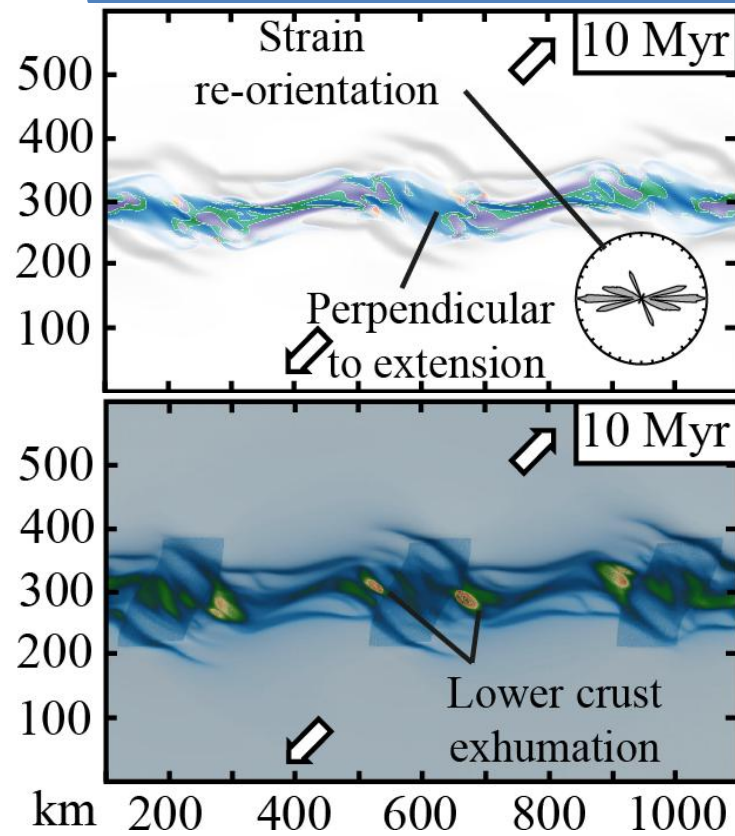
Plastic (brittle) strain



15° → High obliquity



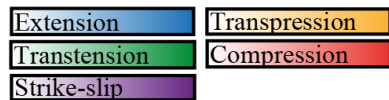
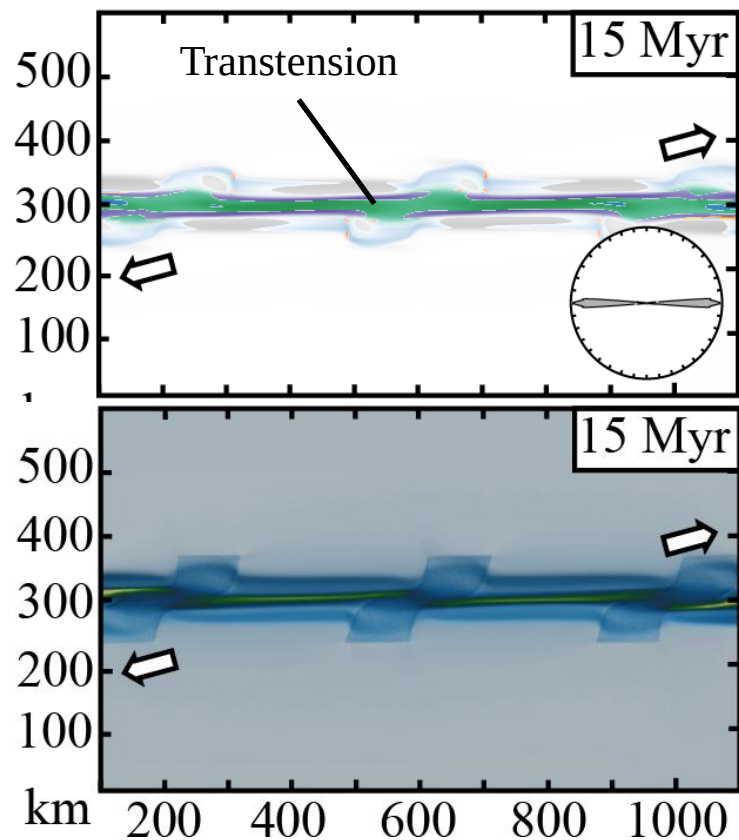
45° → Moderate obliquity



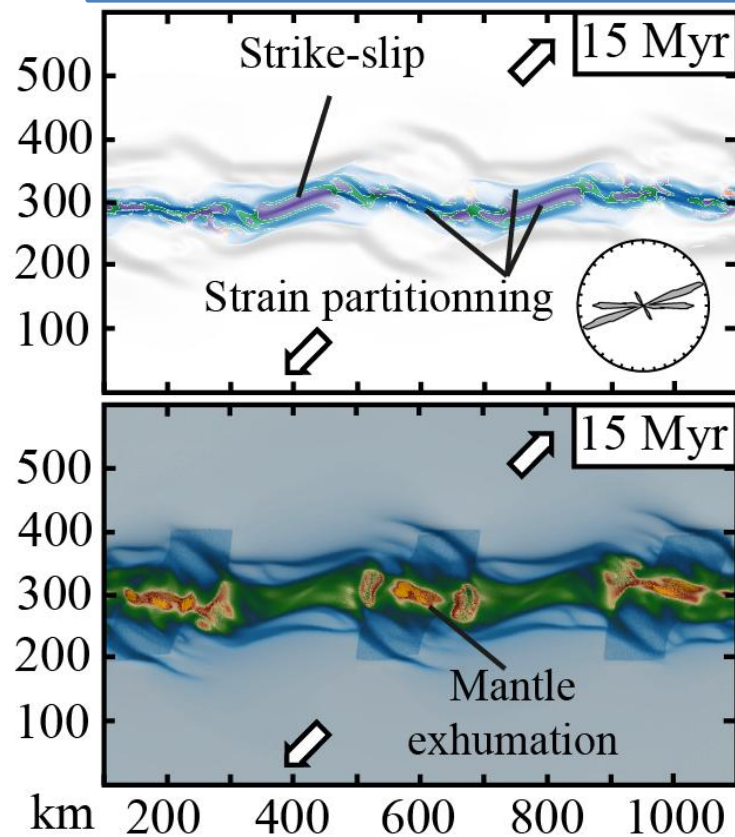
Plastic (brittle) strain



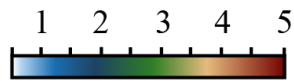
15° → High obliquity



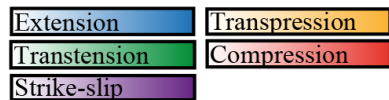
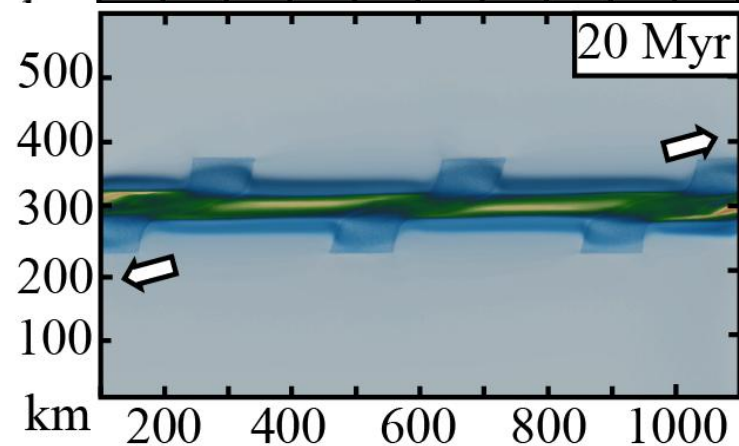
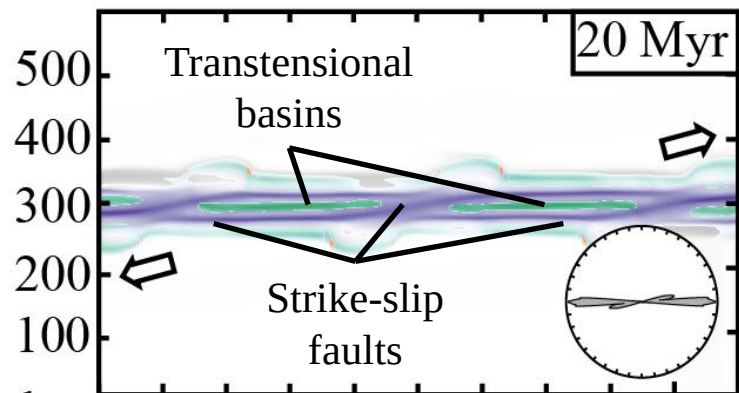
45° → Moderate obliquity



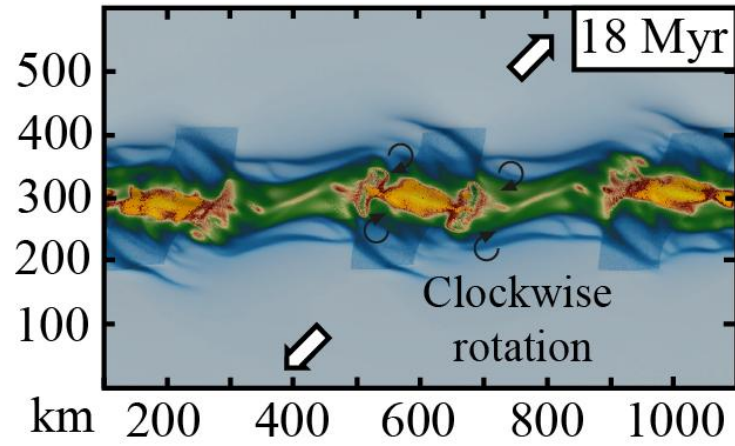
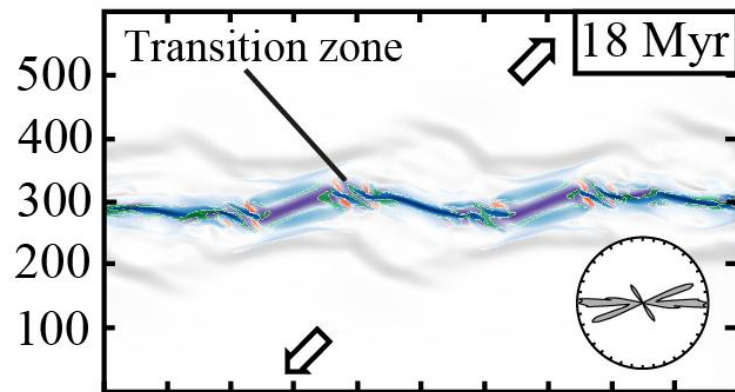
Plastic (brittle) strain



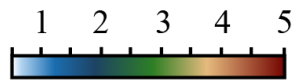
15° → High obliquity



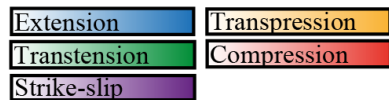
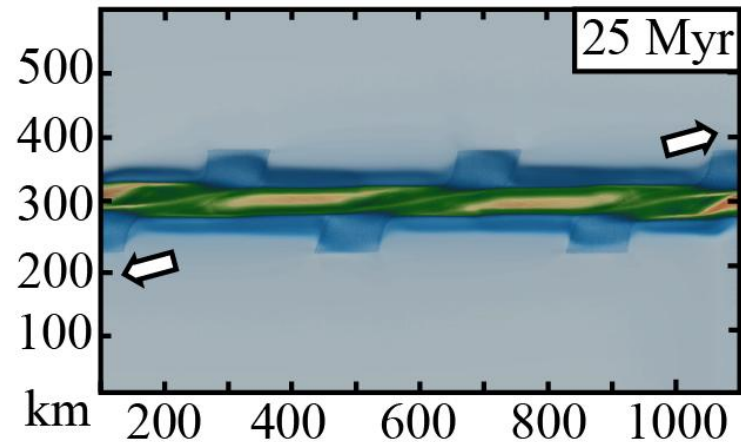
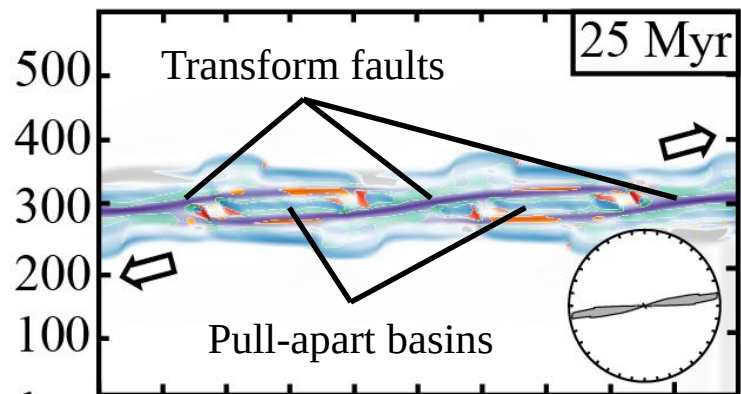
45° → Moderate obliquity



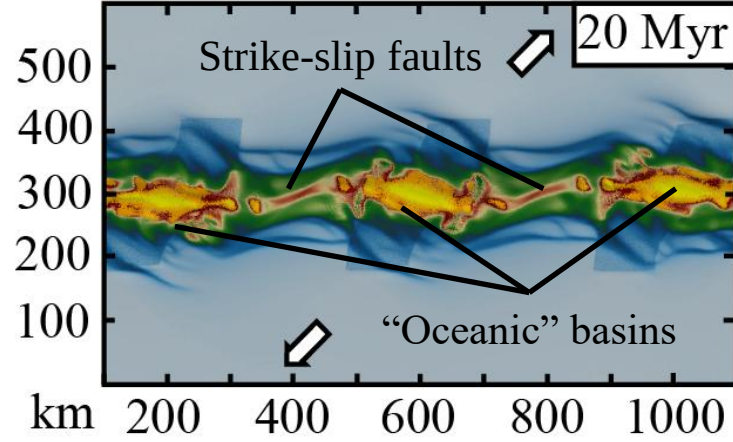
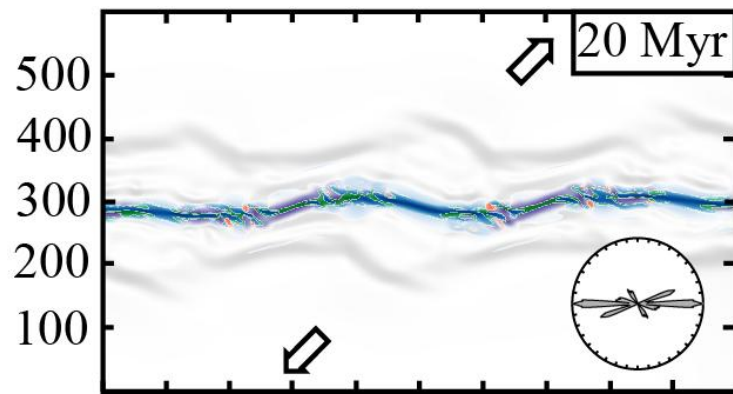
Plastic (brittle) strain



15° → High obliquity



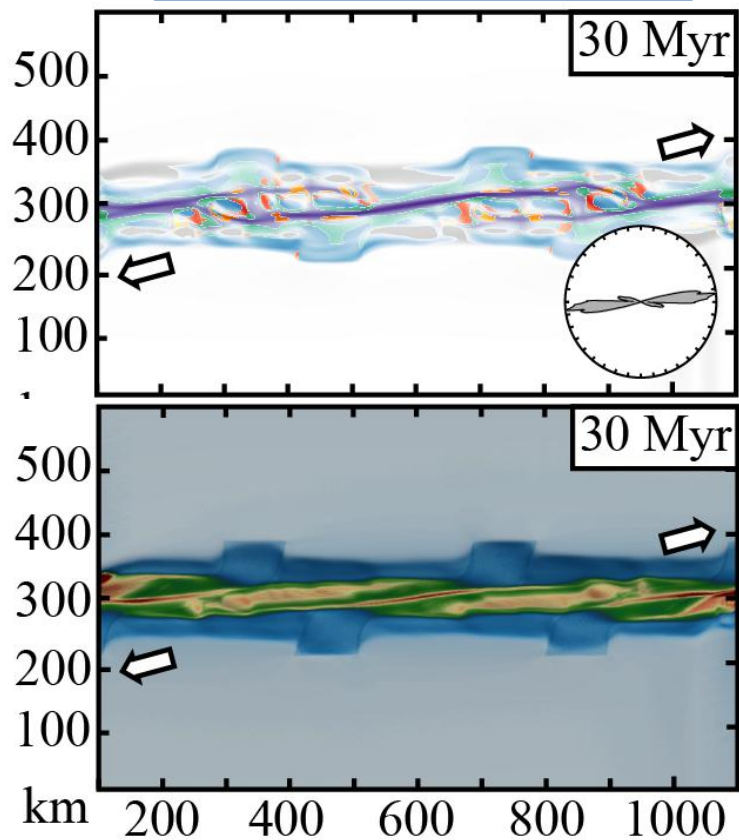
45° → Moderate obliquity



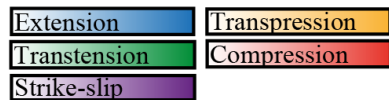
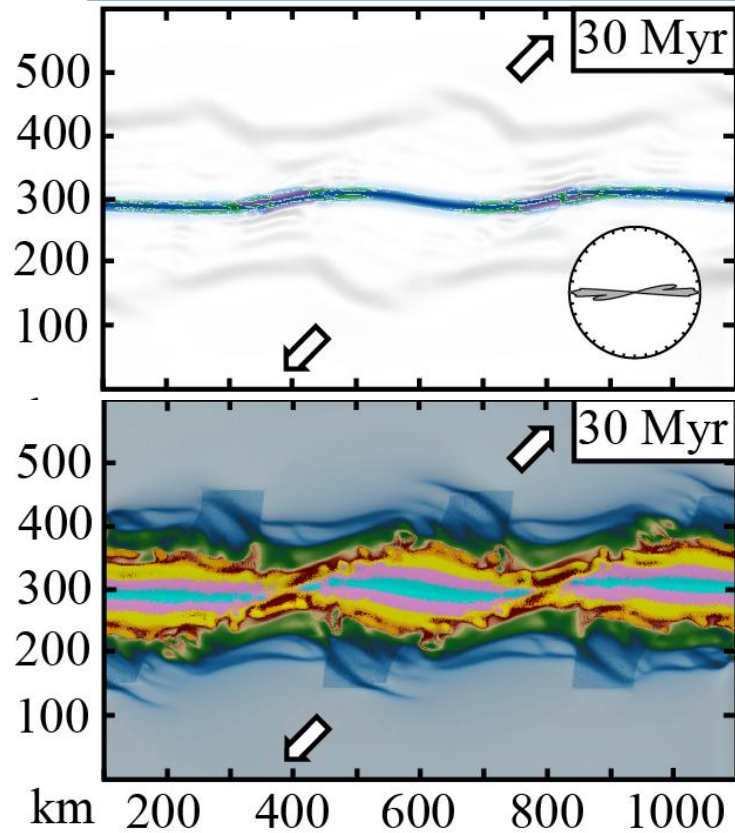
Plastic (brittle) strain



15° → High obliquity



45° → Moderate obliquity



Plastic (brittle) strain



15° → High obliquity



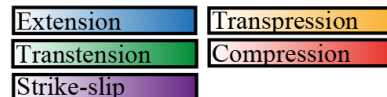
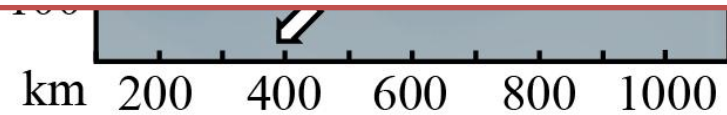
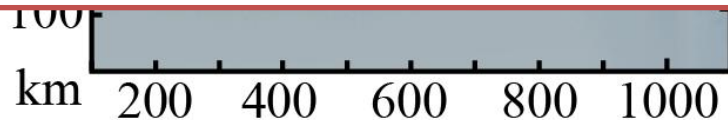
45° → Moderate obliquity



System segmentation by strike-slip structures always occurs after lithospheric thinning

→ Requires to reduce the lithosphere resistance to generate strike-slip structures

- High obliquity ($< 30^\circ$) → Transform faults
- Lower obliquity ($> 30^\circ$) → Strike-slip faults



Plastic (brittle) strain



More details here:

Solid Earth, 12, 1211–1232, 2021

<https://doi.org/10.5194/se-12-1211-2021>

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Looking beyond kinematics: 3D thermo-mechanical modelling reveals the dynamics of transform margins

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Thanks!