

# Lithosphere deformation due to tearing at STEPs an analogue model approach

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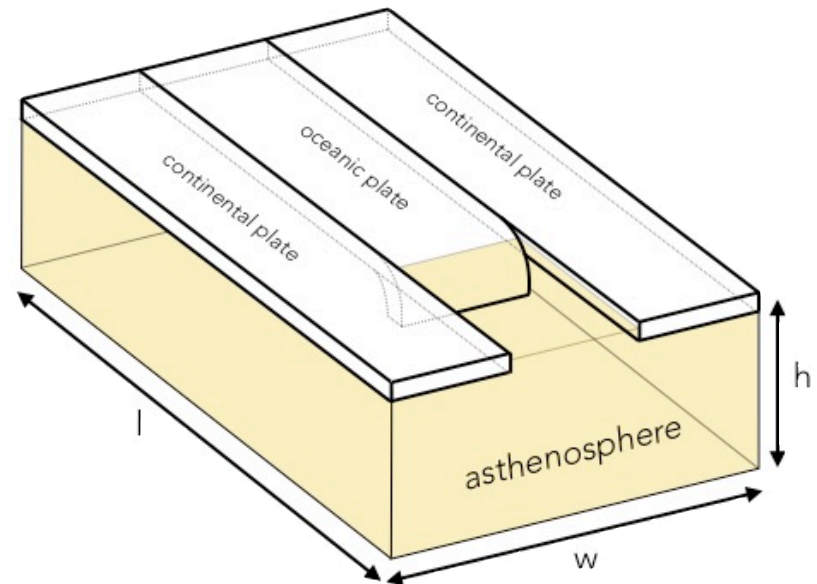
## Physical model of STEP evolution

### questions

- *how does the surface deform close to STEPs?*
- *where does tearing occur?*

Lithosphere: Newtonian (low stress) / power-law rheology (high stress)

Asthenosphere: Newtonian rheology



- no overriding plate (or: very weak overriding plate)
- pre-existing tear for first part of slab
- no other weak zones

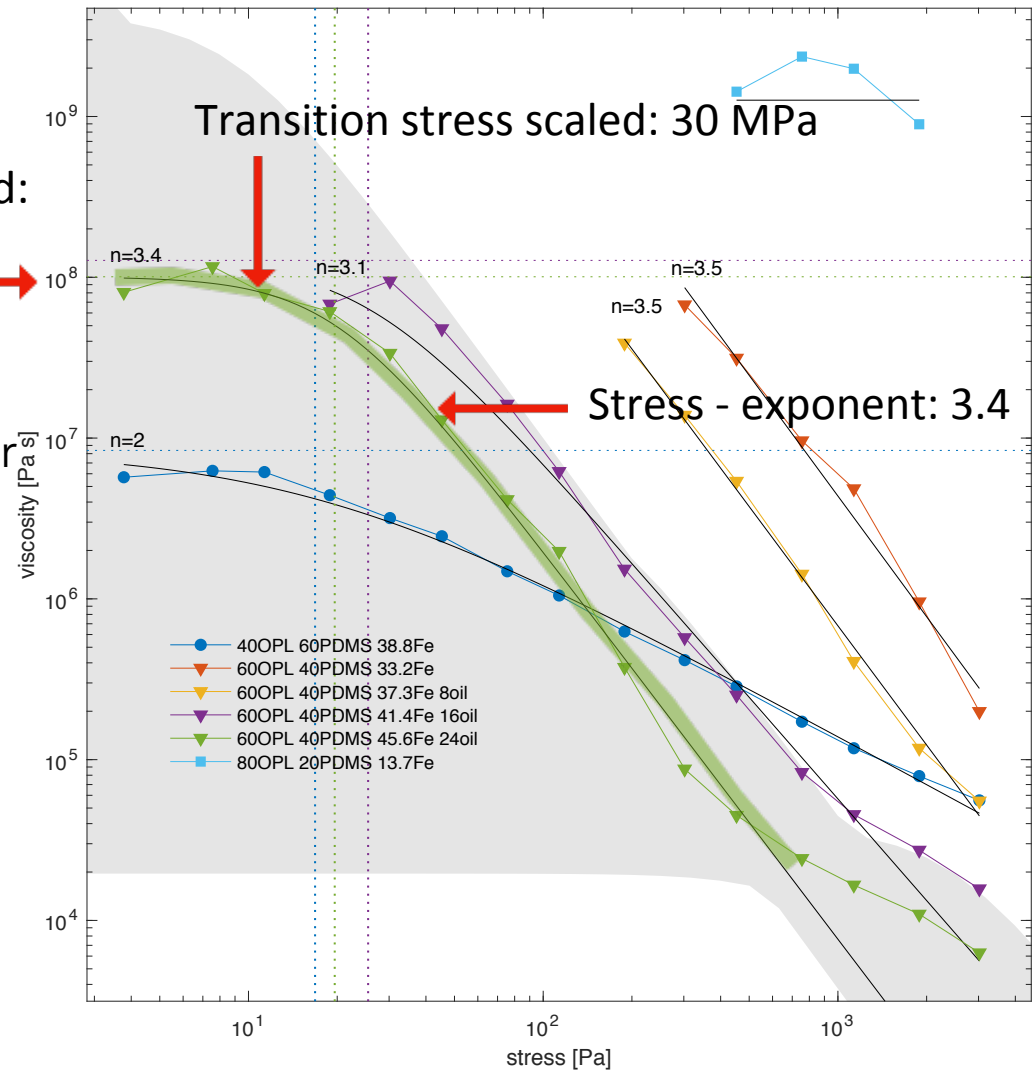


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## Model lithosphere rheology

Zero stress viscosity scaled:  
 $6 \cdot 10^{25} \text{ Pa s}$

- mix of plasticine-silicone polymer
- transition to power-law rheology with increasing stress
- stress weakening required for localization of deformation

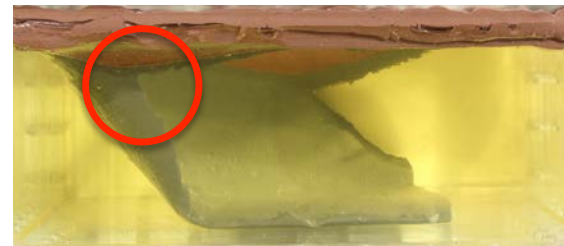
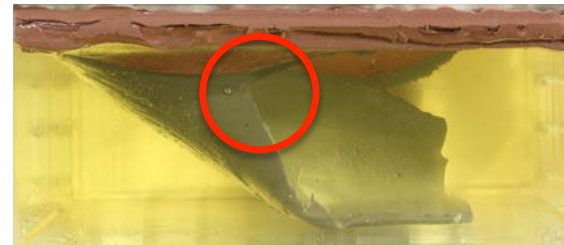
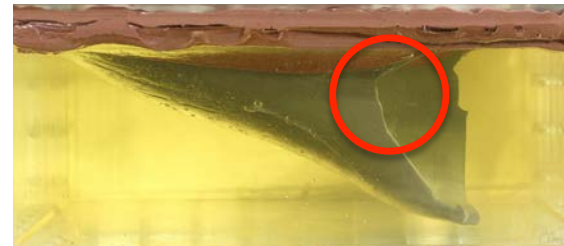
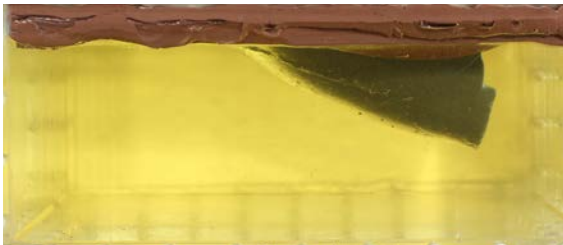


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## Model evolution

- Rollback ahead of tearing
- Tearing commences as thinning

*successive side views*

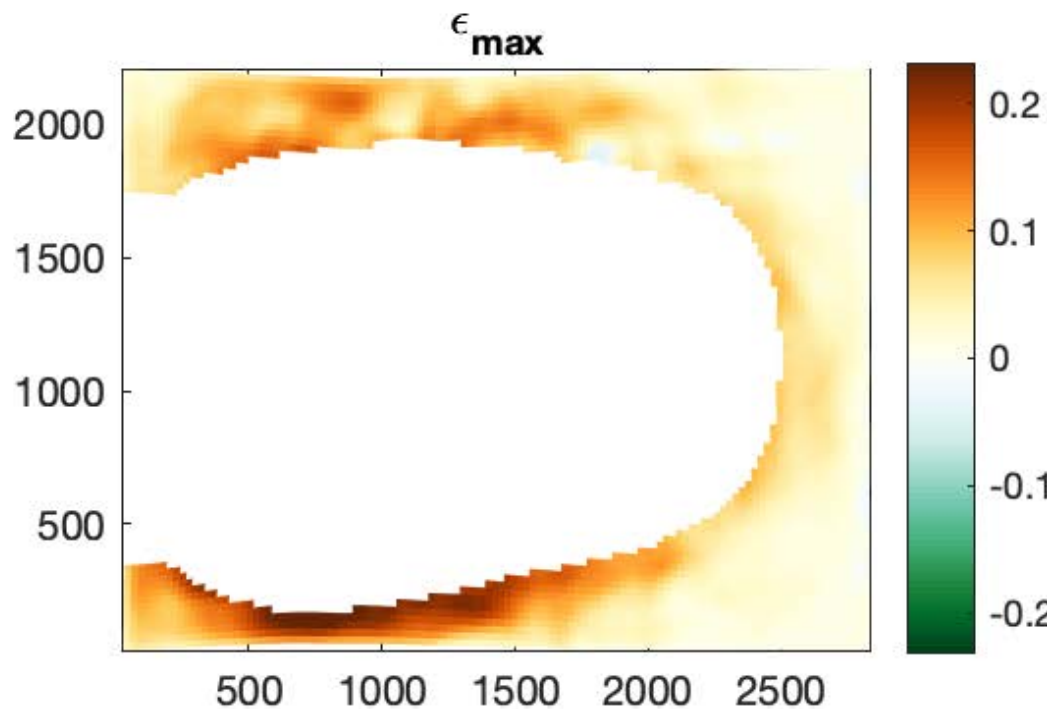


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## Model evolution

Resistance to tearing results in:

- theater shaped subduction zone
- surface extension



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## Outlook

Model applicable to natural  
subduction zones?

Late tearing may explain seemingly  
absent STEP such as in eastern  
Hellenic subduction zone.

