The growth of Turkish – Iranian Plateau and comparative models for understanding the deformation on the overriding plate during plateau formation

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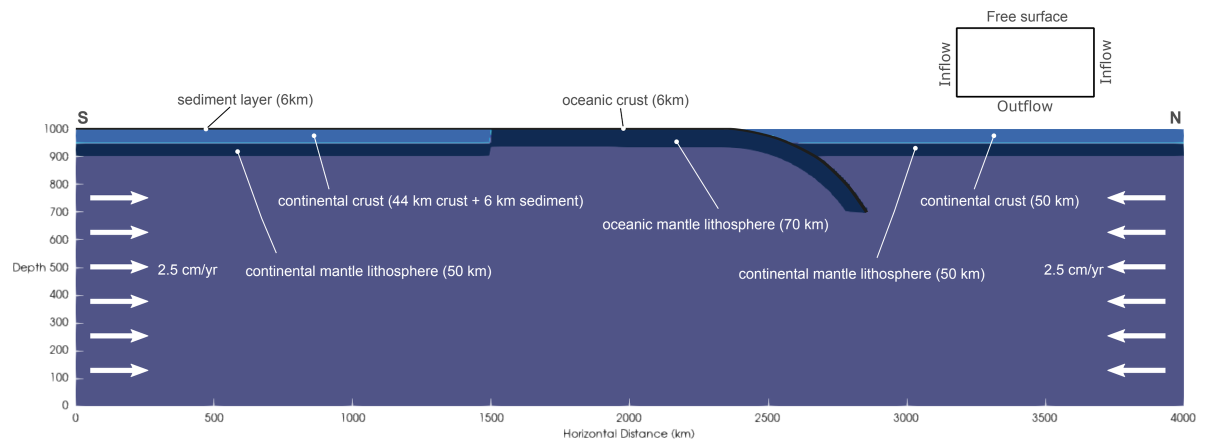
INTRODUCTION

The Arabia-Eurasia collision, which started during Late Eocene (~35 Ma) or afterward across the Bitlis-Zagros suture, resulted in the formation of the Turkish – Iranian Plateau. Even though the average elevation throughout the plateau is around 2 km, the lithospheric structures between East Anatolian and the Iranian parts may be different. For instance, seismological studies suggest that East Anatolia is underlain by anomalously low-speed anomalies/hot asthenosphere whereas the Iranian part is associated with a rather thick (>200 km in some places) and strong lithosphere. Therefore, the area may be regarded as two distinct regions, namely, the East Anatolian Plateau and the Iranian Plateau. The growth of the plateau is mostly attributed to slab break-off combined with crustal shortening. Other processes often associated with the collision are lithospheric delamination and tectonic escape of microplates. These hypotheses suggested for the growth of the plateau are yet to fully explain the dualistic nature of the lithosphere in a region where elevations are roughly similar.

In this work, by using 2D numerical experiments we aim to investigate the physical, geometric, and rheological parameters affecting the deformation of the plate during pre-, syn-, and post-collision. Our results show an extension (up to ~70 km) on the terrane that is dragged behind the subducting plate, while the overriding plate undergoes shortening during the collision in experiments with diffusion creep dominated rheology. The collision results in ~100 km of underthrusting in 50 Myrs which is in the range for the measured amounts of underthrusting across the plateau. We also determine 3 different modes of slab break-off based on the dislocation creep participation in the models where both diffusion creep and dislocation creep are active.

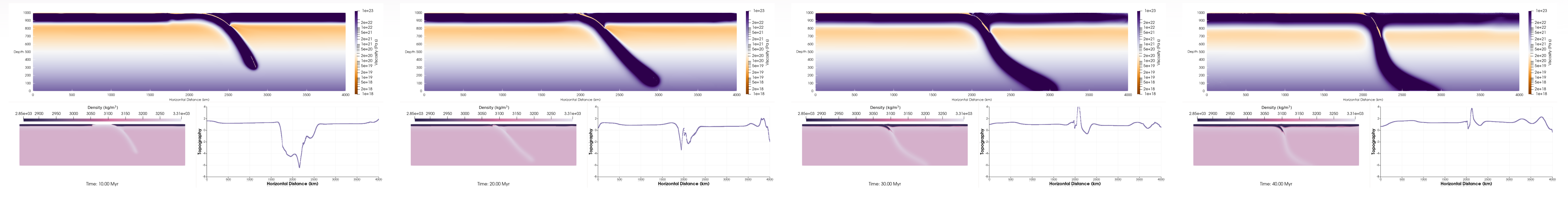
MODEL SETUP



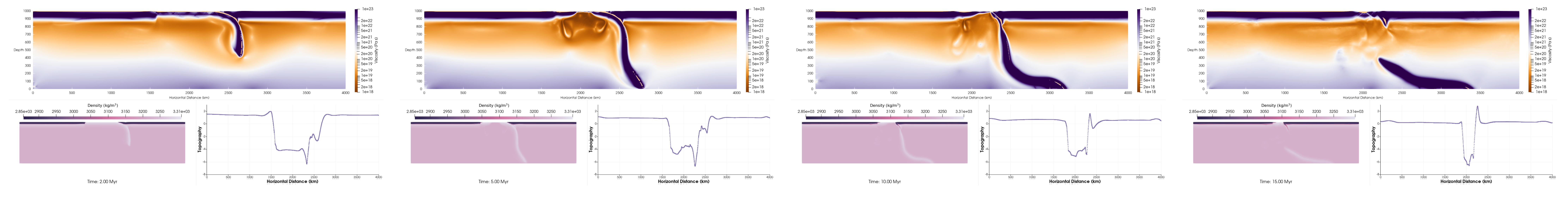
RESULTS AND FUTURE WORK

- Participation ratio of dislocation vs diffusion creep controls the mode of subduction,
- Dislocation creep is essential to achieve slab break-off,
- Too much contribution from dislocation creep results in very early break-off,
- Future models will include region appropriate rheology and layer thicknesses.

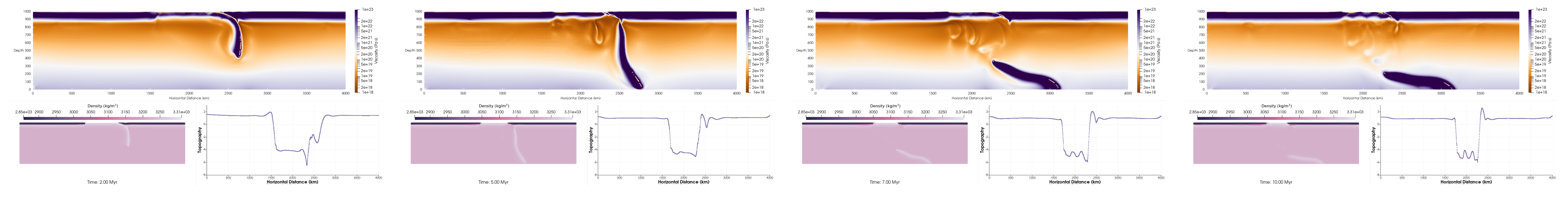
DIFFUSION CREEP DOMINANT SUBDUCTION



DISLOCATION CREEP MODE 1



DISLOCATION CREEP MODE 2



DISLOCATION CREEP MODE 3