



How slab dynamics and structural inheritance control microcontinent formation at subduction zones

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Microcontinents and continental fragments are pieces of continental lithosphere that are (almost) completely surrounded by oceanic lithosphere and are usually found near continental rifted margins. These include fairly large microcontinents, such as Jan Mayen in the NE Atlantic, and smaller continental knolls, such as found offshore Western Australia. However, in some cases, microcontinents form in the proximity of subduction zones due to extension and, possibly, rotation of the overriding plate. Examples include the Corsica-Sardinia block in the Central Mediterranean and the Queensland and Louisiade plateaus in the Coral Sea, NE of Australia. Their formation requires a local extensional regime within the overall compressional subduction setting. This raises the question how such extension can occur and which parameters control the formation of the microcontinents and continental fragments near subduction zones.

In this study we use numerical experiments to investigate conditions for localisation of extension in the overriding plate of a subduction system. Using the finite element code Citcom we conduct fully dynamic 2D and 3D numerical experiments of oceanic subduction with a continental overriding plate. To simulate the presence of a pre-existing weakness, we introduce a weak zone of variable width and with variable viscosity in the overriding plate. In the 3D experiments we introduce lateral variability in the downgoing plate in the form of an incoming continental block. The collision of this continental block induces trench rotation during subsequent slab retreat, triggering extension in the overriding plate.

Preliminary results show that in 2D experiments the upper plate stretches, but continental breakup is hard to achieve. Furthermore we find that the magnitude of the viscosity contrast between the weak zone and the continental lithosphere is more important for the amount of upper plate stretching than the width of the weak zone. In our 3D simulations we observe high amounts of upper plate stretching and eventually breakup. This increase in extension is most likely due to the achievement of higher stresses in the 3D setup compared to the 2D setup. Our experiments illustrate how extension caused by trench rotation can localise at a pre-existing weakness in the overriding plate and induce continental breakup, thus creating a microcontinent.