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Terrane accretion: Insights from numerical modelling

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The oceanic crust is not homogenous, but contains significantly thicker crust than norm, i.e. extinct arcs, spreading ridges, detached continental fragments, volcanic piles or oceanic swells. These (crustal) fragments may collide with continental crust and form accretionary complexes, contributing to its growth. We analyse this process using a thermo-mechanical computer model (i2vis) of an ocean-continent subduction zone. In this model the oceanic plate can bend spontaneously under the control of visco-plastic rheologies. It moreover incorporates effects such as mineralogical phase changes, fluid release and consumption, partial melting and melt extraction.
Based on our 2-D experiments we suggest that the lithospheric buoyancy of the downgoing slab and the rheological strength of crustal material may result in a variety of accretionary processes. In addition to terrane subduction, we are able to identify three distinct modes of terrane accretion: frontal accretion, basal accretion and underplating plateaus. We show that crustal fragments may dock onto continental crust and cease subduction, be scrapped off the downgoing plate, or subduct to greater depth prior to slab break off and subsequent exhumation. Direct consequences of these processes include slab break off, subduction zone transference, structural reworking, formation of high-pressure terranes, partial melting and crustal growth.