Geophysical Research Abstracts
Vol. 21, EGU2019-17818, 2019
EGU General Assembly 2019

Back-arc rifting/spreading reversals in finite width slabs

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Back-arc rifting and/or spreading are observed in subductions settings, where extensional stresses have cause rupture of the overriding lithosphere. Subsequent reversals from extensional to compressional stresses inhibit spreading and trigger obduction or thrusting of oceanic lithosphere (or even continental hyperextended margins). The Mediterranean exhibits two very different areas: obduction is observed as ophiolites in the continuously retreating wide Aegean subduction system as a result of a (temporal) collision with a microcontinent. On a larger scale, we observe continental margin thrusting in the Alboran where a narrow slab seems to have been locked after collision with a small buoyant block. To understand the nature of these differences, we study the impact of the slab width as well as the size of buoyant indentors on the thickness of an extending overriding plate.

In simple 3D numerical models, we model a slab retreating between two STEP faults and a thinned overriding plate. Buoyant continental material is placed across the whole width of the subducting plate. In the parameter study, we systematically vary the width of the subducting plate as well as the length of the continental indentors (i.e. different sizes of inventors). Our results suggest narrow slabs are more likely to experience a rift/spreading-reversal than wide slabs. For identical buoyant features on the subducting slab, subduction of the narrow slab is ceased (with significant compressional stresses), while it only temporally decelerates subduction velocities of wide slabs. Our models further suggest that the location of the spreading center is closer to the trench for narrow slabs than for wide ones. These results may help explain, how the narrow slab in the Alboran seems to be locked, while the broader Aegean slab is still retreating, although several microcontinents have been subducted.