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Geodynamic evolution of extended rift terranes

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Back-arc extension occurs along convergent plate boundaries by rifting in the overriding plate that is commonly attributable to slab rollback. Within oceans, rifting of island arcs leads to the formation of small oceanic back-arc basins. Where ocean floor is subducted beneath a continent, extension typically produces arc-crestal rift basins that are 100 to 200 km wide, although in some cases those rifts may also develop into small ocean basins. We concentrate on broad regions of extended continental rifting in the Great Basin, the Aegean Sea and Western Anatolia province, the sub-West Siberian Basin, and the combined Lord Howe Rise and Norfolk Ridges rift systems. These regions are here called Extended Rift Terranes (ERT). An ERT is a broad continental region, greater than 500 to 600 km wide, characterized by basin and range type geomorphology that may include metamorphic core complexes and major detachments. The tectonic conditions that lead to ERT development appear to be relatively rare because less than 1% of over 550 rift basins identified globally lie within ERTs.

The proposed model suggests that ERTs form where low strain rates are produced as a result of high angles of relative motion between subducting and overriding plates in relation to the intervening trench. The ERTs studied here formed as back-arc basins, but typical rollback induced extension was accompanied by lateral motion of the overriding plate relative to the subducting slab. Lateral motion in the Great Basin and in the Aegean Sea / Western Anatolia province are related to the San Andreas and North Anatolian Fault systems. Similar strike-slip motion has been suggested to have been a component of motion as the sub-West Siberian Basin and Lord Howe Rise / Norfolk Ridges rift systems formed. The effect of this motion was to reduce the strain rate in the overriding plates and in that way to generate regions of strain hardening over an extensive area.

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