The systematics of continental rifts

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Résumé

Intra-continental rifts are classically described as either passive or active systems, depending upon their driving forces. Passive rifts are driven by plate divergence with extensional forces transmitted through the lithosphere. Active rifts are, instead, mostly driven by a mantle plume underneath. Active rifts are also magmatic while passive rifts are often amagmatic. The expected evolution of an intra-continental rift system is toward full-up and oceanisation but some rifts abort and never reach that stage. Based on the examples of the East African Rift (EAR) and the European Cenozoic Rift System (ECRIS), we have proposed an alternative way of describing rift systems, opposing two endmembers, a-type and b-type rifts, based on the angle between the strike of the rift and the direction of asthenospheric flow underneath. B-type rifts are those striking perpendicular to mantle flow, the most classical view of rift systems, while a-type rifts strike parallel to mantle flow. The EAR and the ECRIS are typical a-type rifts developed above fingers of hot mantle oriented parallel to the absolute motion of plates. Typical a-type rifts are also active ones, extensional forces being mostly due to the gravitational potential energy above the hot anomaly in the mantle, they are also often magmatic but not always and pure a-type endmembers do not evolve into oceans. Typical b-type rifts are also the passive kind, and they evolve into oceans. We review a number of other rift systems and present them in a diagram showing their passive/active character *vs* the angle between their strike and the direction of mantle flow. We discuss the dynamics of intermediate rifts between a- and b-types with a focus on the South Atlantic and the origin of volcanic and non-volcanic passive margins. We also speculate upon the role played by the two main types of rifts in plate fragmentation.

Mots-Clés: rift, passive margin, active rift, passive rift, a, type rift, b, type rift, mantle convection, plate fragmentation

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