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# Passive margin asymmetry and its polarity in the presence of a craton

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When continental lithosphere is extended to break-up it forms two conjugate passive margins. In many instances these margins are asymmetric: while one is wide and extensively faulted, the conjugate thins more abruptly and exhibits little faulting. Recent observational studies have suggested that this asymmetry results from the formation of an oceanward-younging sequential normal fault array on the future wide margin. Numerical models have shown that fault sequentiality arises as a result of asymmetric uplift of the hot mantle towards the hanging wall of the active fault, which weakens this area and promotes the formation of a new oceanward fault. In numerical models the polarity of the asymmetry is random. It results from spontaneous preferential localization of strain in a given fault, a process reinforced by strain weakening effects. Slight changes in the experiments initial grid result in an opposite polarity of the asymmetry. However, along a long stretch of the South Atlantic margins, from the Camamu-Gabon to the North Santos-South Kwanza conjugates, the polarity is not random and is very well correlated with the distance of the rift to nearby cratons. Here, we use numerical experiments to show that the presence of a thick cratonic root inhibits asthenospheric flow from underneath the craton towards the adjacent fold belt, while flow from underneath the fold belt towards the craton is favoured. This enhances and promotes sequential faulting towards the craton and results in a wide faulted margin located in the fold belt and a narrow conjugate margin in the craton side, thereby determining the polarity of the asymmetry, as observed in nature.