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Asymmetry and polarity of the South Atlantic conjugated margins related to the presence of cratons: a numerical study

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Tectonic asymmetry of conjugated passive margins, where one margin is much narrower than the conjugate one, is commonly observed at many passive margins world-wide. Conjugate margin asymmetry has been suggested to be a consequence of lateral changes in rheology, composition, temperature gradient or geometries of the crust and lithosphere. Here we use the South Atlantic margins (from Camamu/Gabon to North Santos/South Kwanza) as a natural laboratory to understand conjugate margin asymmetry. Along this margin sector the polarity of the asymmetry changes. To the North, the Brazilian margin developed in the strong Sao Francisco craton, and this constitutes the narrow side of the conjugate pair. To the South, the Brazilian margin developed in the Ribeira fold belt, and the margin is wide. The opposite is true for the African side. We have thus numerically analysed how the relative distance between the initial location of extension and the craton influences the symmetry/asymmetry and polarity of the conjugate margin system. Our numerical model is 2D visco-elasto-plastic and has a free surface, strain weakening and shear heating. The initial set-up includes a cratonic domain, a mobile belt and a transition area between both. We have run tests with different rheologies, thickness of the lithosphere, and weak seeds at different distances from the craton. Results show asymmetric conjugated margins, where the narrower margin is generally the closest to the craton. Our models also allow us to study how the polarity is controlled by the distance between the initial weakness and the craton, and help to understand how the presence of cratonic domains affects the final architecture of the conjugated margins.