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The role of major rift faults in the evolution of deformation bands in the Rio do Peixe Basin, Brazil

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Many studies have investigated on the evolution and properties of deformation bands, but their occurrence and relationships with basin-boundary faults remain elusive when the latter form by brittle reactivation of structural inheritance in crystalline basements. The main objective of our study was to systematically record the location, kinematics, geometry, and density of deformation bands in the early Cretaceous Rio do Peixe basin, NE Brazil, and analyze their relationship with major syn-rift fault zones. Reactivation in early Cretaceous times of continental-scale ductile shear zones led to the development of rift basins in NE Brazil. These shear zones form a network of NE- and E–W-trending structures hundreds of kilometers long and 3-10 km wide. They were active in the Brasiliano orogeny at 540-740 Ma. Brittle reactivation of these structures occurred in Neocomian times (∼140-120 Ma) prior the breakup between the South American and African plates in the late Cretaceous. The Rio do Peixe basin formed at the intersection between the NE-SW-striking Portalegre shear zone and the E-W-striking Patos shear zone. The brittle fault systems developed by the shear zone reactivation are the Portalegre Fault and the Malta Fault, respectively. In this research we used field structural investigations and drone imagery with centimetric resolution. Our results indicate that deformation bands occur in poorly sorted, medium to coarse grain size sandstones and localize in ∼3-4 km wide belts in the hanging wall of the two main syn-rifts fault systems. Deformation bands formed when sandstones were not completely lithified. They strike NE along the Portalegre Fault and E-W along the Malta Fault and have slip lineations with rake values ranging from 40 to 90. The kinematics recorded in deformation bands is consistent with that characterizing major rift fault systems, i.e. major extension with a strike-slip component. Since deformations bands are typical sub-seismic features, our findings can have implications for the prediction of deformation band occurrence in sedimentary basins and their geometric and kinematic relations with major basin-boundary fault systems.