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Ductile deformation, boudinage and low angle normal faults. An overview of the structural variability at present-day rifted margins

Camille Clerc (1), Laurent Jolivet (1), Jean-Claude Ringenbach (2), and Jean-François Ballard (2)

(1) Institut des Sciences de la Terre d'Orléans, UMR 7327, Orléans, France (camille.clerc.geol@gmail.com), (2) Total SA, CSTJF, Avenue Larribau, 64000 Pau, France

High quality industrial seismic profiles acquired along most of the world's passive margins present stunningly increased resolution that leads to unravel an unexpected variety of structures. An important benefit of the increased resolution of recent seismic profiles is that they provide an unprecedented access to the processes occurring in the middle and lower continental crust. We present a series of so far unreleased profiles that allow the identification of various rift-related geological processes such as crustal boudinage, ductile shear and low angle detachment faulting.

The lower crust in passive margins appears much more intensely deformed than usually represented. At the foot of both magma-rich and magma-poor margins, we observe clear indications of ductile deformation of the deep continental crust along large-scale shallow dipping shear zones. These shear zones generally show a top-to-the-continent sense of shear consistent with the activity of overlying continentward dipping normal faults observed in the upper crust. This pattern is responsible for a migration of the deformation and associated sedimentation and/or volcanic activity toward the ocean. In some cases, low angle shear zones define an anastomosed pattern that delineates boudin-like structures. The interboudins areas seem to localize the maximum of deformation. The lower crust is intensely boudinaged and the geometry of those boudins seems to control the position and dip of upper crustal normal faults. We present some of the most striking examples (Uruguay, West Africa, Barents sea...) and discuss their implications for the time-temperature-subsidence history of the margins.