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Compressional Reactivation, Atlantic Margin of Brazil: Structural Styles and Consequences for Hydrocarbon Exploration*

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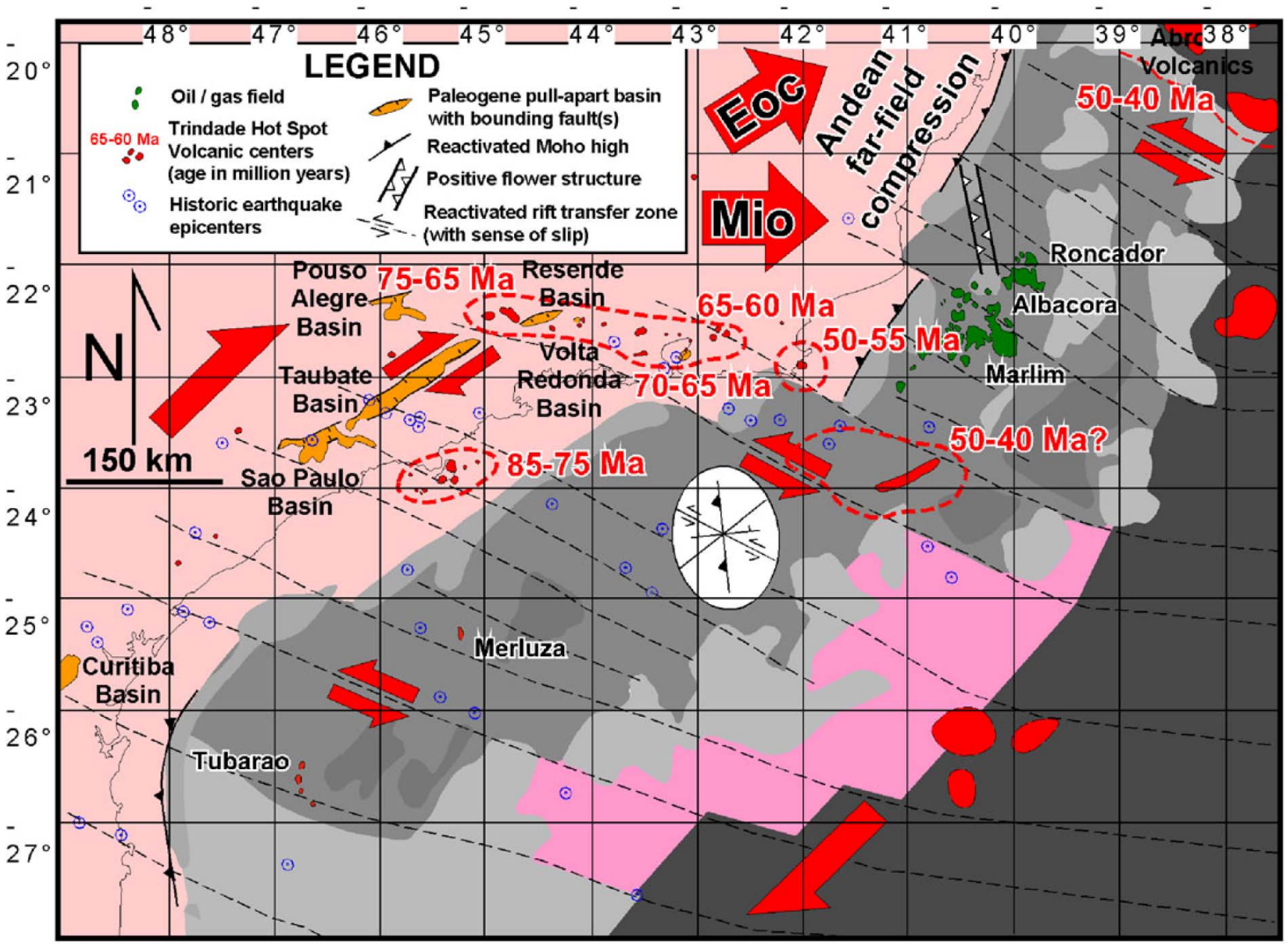
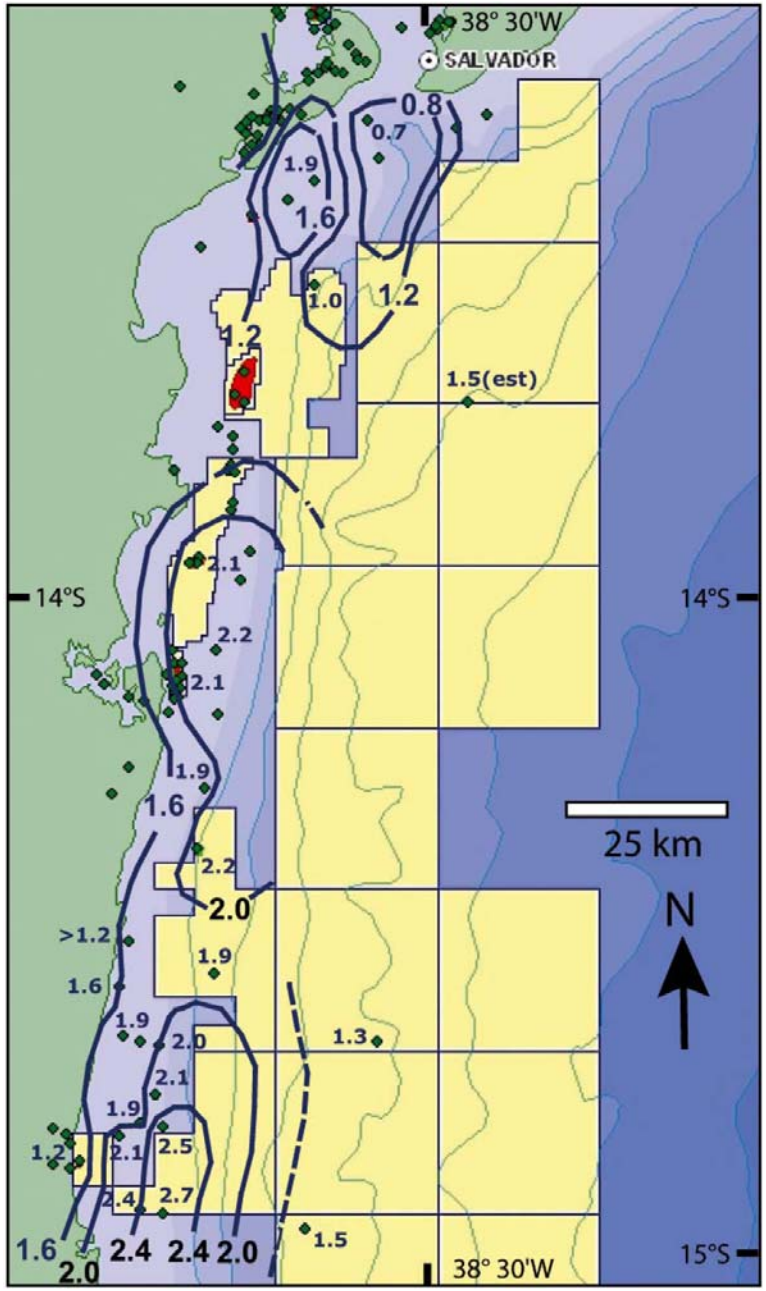
Abstract

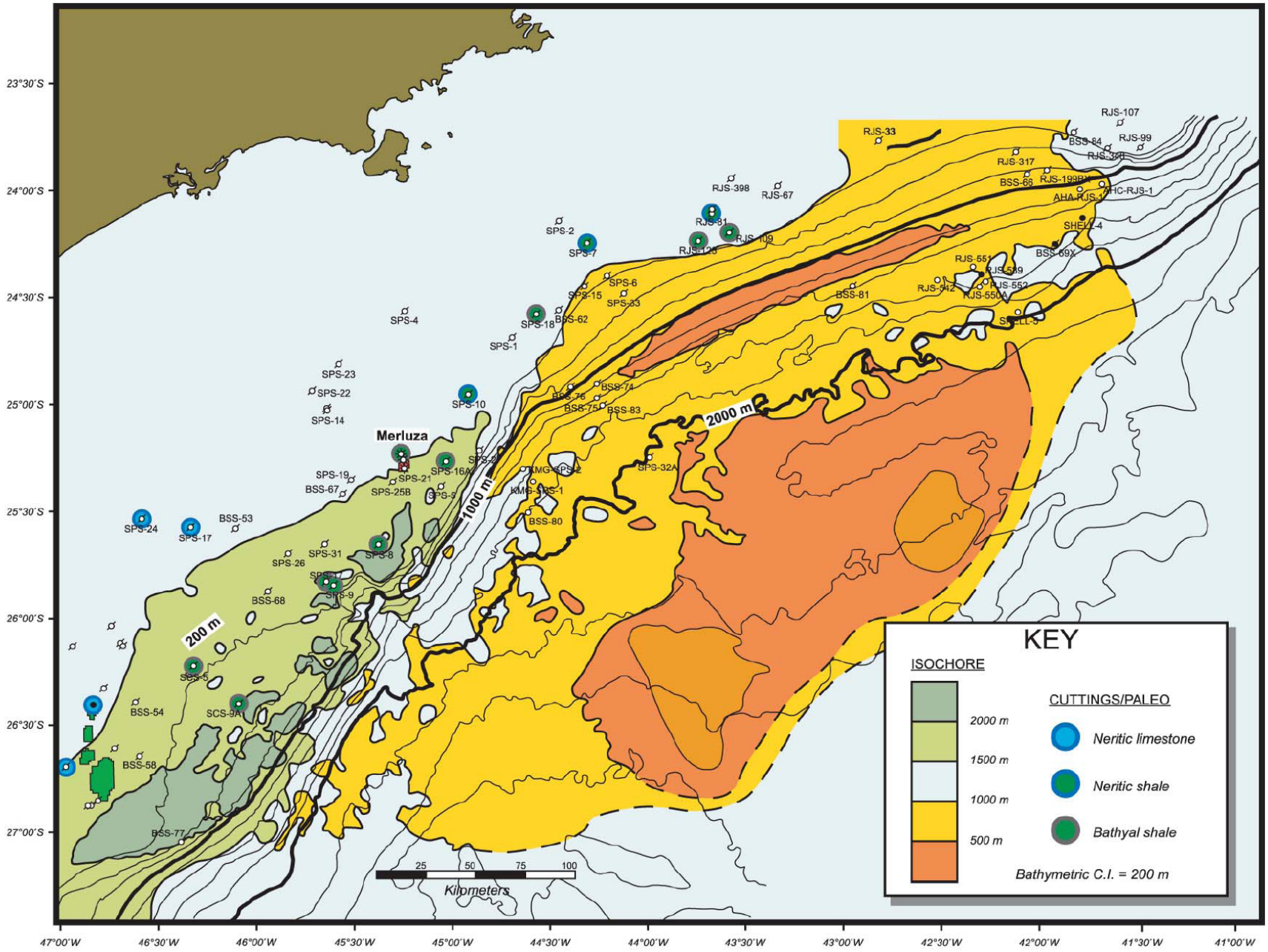
The Atlantic margin of Brazil formed by Neocomian rifting. Although in principle the margin is passive, in practice it is seismically active. Immediately next to it is a wide belt of mountains, several kilometres high. We review evidence that these mountains have resulted from several phases of post-rift uplift and exhumation. Evidence for rapid erosion, in the Late Cretaceous, Eocene and Neogene, comes from patterns of offshore clastic sedimentation. These reflect the changing positions of major rivers, in response to topographic barriers and river capture. Evidence for compressive stress comes from the onshore Taubaté Basin and the edge of the continental shelf. In the Taubaté Basin, normal faults were active in the Palaeogene, and strike-slip faults were active in the Neogene. In the Santos Basin, Mesozoic strata end at a hinge, which was active in the Campanian and middle Eocene. Near Cabo Frio, regional growth folds were active in the Late Cretaceous. In the Campos Basin, reverse and strike-slip faults form the edge of a triangular block of basement. Tectonic uplift of this block in the Neogene led to reworking of Eocene turbidites into shelf-fed aprons, which now form reservoirs for the Albacora and Marlim oil fields. In the Espirito Santo Basin, the shelf edge is a major reverse fault, which formed by reactivation of a Neocomian master fault, bounding a half-graben. The same configuration holds for the shelf edges of the Camamu and Sergipe basins. There the shelves have undergone several kilometres of exhumation since the Late Cretaceous. In the Camamu Basin, uplift of the margin and continental interior triggered giant slides. Sharp unconformities constrain the main period of sliding (Campanian to middle Eocene). Horizontal compression also modified the shapes of some offshore basins. Thus the Santos Basin resembles a foreland basin. There is a Late Cretaceous to Eocene depocentre, next to the Serra do Mar, and a distant bulge, which has trapped giant sub-salt accumulations of hydrocarbons. In SE and NE Brazil, apatite fission track analysis (AFTA) points to three post-rift episodes, in the Late Cretaceous, Eocene and Miocene. These have important consequences for burial, maturation and preservation of hydrocarbons. Because the post-rift episodes are synchronous with phases of orogenesis in the Andes, a likely cause is plate-wide horizontal compression.



Neotectonic structural framework, Santos and Campos basins (Cobbold, Meisling, and Mount, 2001).



Camamu Basin: Subsea depth to top of oil window (Cobbold et al., in press).



Neogene thickness, Santos Basin (Modica and Brush, 2004).

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