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Oblique orogenic deformation: comparing the cool Caledonian orogen and the hot Araçuai-Ribeira belt

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Abstract:
Continental margins are rarely straight, resulting in oblique sections of transpression or transtension. Two orogens that contain such oblique elements, the Pan-African Araçuai-Ribeira belt and the Caledonian orogen, are here discussed and compared. While the Scandinavian Caledonides are a relatively cool orogen owing to rapid subduction and quick subsequent exhumation, the Brazilian example is much hotter (>750 °C), with widespread partial melting (>30% melt volume). This makes for an interesting comparison both with respect to orogen-perpendicular and oblique convergence and divergence.
In general, the northern section of the Araçuai-Ribeira belt in Brazil (the N-S oriented Araçuaí part) experienced more or less margin-perpendicular contraction, while the NE-SW oriented southern (Ribeira) section was strongly influenced by dextral transpression. The transpressive Ribeira section has a ~150 km wide network of transcurrent shear zones. A possible analog to this zone is the Møre-Trøndelag shear zone in the Caledonides, which also defines a marked regional change in the trend of the orogen. This shear zone is located in the hottest (>650 °C) part of the Scandinavian Caledonides, but has a width of only ~50 km. While several factors may have an influence on this difference in width between the laterally sheared Ribeira belt and the Møre-Trøndelag shear zone, we suspect that the cooler and therefore more rigid nature of the Caledonides may have imposed an important rheologic control on the way that strain is distributed in the middle crust. This goes for the contractional phase, but also for the postcollisional transtensional phase during which multiple crustal-scale shear zones formed or reactivated in the Caledonides. Caledonian extension/transtension structures involve extensive reactivation of Caledonian thrusts, but also formation of new extensional shear zones and faults. Hence the fact that post-collisional transtension/extension structures are better defined and more localized in the Caledonides than in the Araçuai-Ribeira belt may relate to the temperature difference between the two orogens.

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