LESSONS FROM COMPARING THE COOL SCANDINAVIAN CALEDONIDES AND THE HOT ARAÇUAI-RIBEIRA BELT

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ABSTRACT: The orogenic processes that operate during continental collision depend on a number of variables, and lessons may be learned by comparing different orogenic belts. In this presentation we will compare the Siluro-Devonian Caledonian belt in Scandinavia with the late Proterozoic Araçuai-Ribeira belt of the Brasiliano orogenic system. These belts are similar with respect to length, width and their non-linear strikes, but differ in other ways, including time span and temperature. The Scandian continent-continent collision phase of the Scandinavian Caledonides created a fairly cool orogen with limited amounts of partial melting and syn- to postcollisional intrusive activity. This can be related to the short period of continental subduction and the quick switch to extension-related exhumation. While both orogenic belts developed a series of thrust sheets that were thrust over the foreland, important differences show up in the hinterland. In the Araçuai-Ribeira belt the temperatures where high (>750 °C) for a long time in a wide part of the hinterland, causing extensive mid-crustal migmatitization. This generated a rheological structure of the belt where the middle crust was much weaker than the cool Caledonian crust, which again made them behave differently during the collision and the following exhumation:

1) Very deep subduction of Caledonian basement was possible because the basement was cool and rigid. In most of the Araçuai-Ribeira belt the crust was too hot and weak to reach (U)HP conditions;

2) Strain localization was stronger in the Caledonides, both during continental subduction and extensional collapse. In the Araçuai-Ribeira belt, however, the middle crust was extremely weak, and collapsed gravitationally over a wide area (e.g., the Carlos Chagas anatectic domain), generally with only weak fabric development;

3) The gravity-driven collapse created subhorizontal fabrics in the Araçuai belt, and a ~150 km wide transpressional zone in the oblique Ribeira section with stronger fabrics. A Caledonian analogue to the oblique Ribeira belt is the Møre-Trøndelag Shear Zone, which also defines an oblique part of the orogen, with strong and steep fabrics. However, this oblique shear system has a width of only ~50 km, 1/3 of that of the Ribeira belt, and is limited to, and probably controlled by, the relatively narrow hot part of the Caledonides.

4) The cold Caledonian crust was affected by major post-collisional extensional shear zones and detachments, some of which transect the entire crust, while extensional collapse in the Araçuai-Ribeira belt was controlled by the weak middle crust, where it was much more distributed and difficult to separate into syn- and post-collisional components.

The reason(s) why the Araçuai-Ribeira belt was so hot is unclear, but it had significant effects on the resulting orogenic rheological structure, anatomy and evolution.

KEYWORDS: OROGENY; RHEOLOGY, TECTONICS.