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Mid-crustal tectonic lateral extrusion in the Southeastern Churchill province; evidence from structural analysis, airborne geophysics, petrofabrics and geochronology

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The southeastern Churchill Province (SECP) is located in the eastern segment of the Paleoproterozoic Trans-Hudsonian Orogen, in North-America, which is interpreted as a deeply eroded analog to the present-day Himalayan-Tibetan Orogen. The SECP can be divided in three parts, from east to west being the Torngat Orogen (TO), the Core Zone (CZ) and the New Quebec Orogen (NQO). The structural and metamorphic architecture of the CZ, a reworked Archean block, is best explained through a complex history involving two successive collisions resulting from oblique convergence with the North Atlantic Craton and the Superior Craton indentor. Previous metamorphic studies have demonstrated protracted anatectic conditions typical of hot orogens in the CZ and TO. An anomalously hot lithosphere at the time of collision is also supported through the structural style displaying a complex systems of anastomosing steeply dipping shear zones the CZ and the OT. To understand the bulk deformation regime, the regional geometry, kinematics, strain analysis, temperature of deformation and geochronology of the shear zone need to be investigated. In this contribution, we present new results on the major shear zones that divide the lithotectonic domains composing the CZ. Structural analysis shows subvertical foliation and subhorizontal lineation in the George river, Lake Tudor and Moonbase shear zones. The interpretation of the aeromagnetic survey indicates regional scale sense of shear and orientation for the George river and Moonbase shear zones consistent with a conjugate set of crustal-scale ductile shear zones. In the >600 km long orogen-parallel George River shear zone, quartz c-axis fabrics reveal two different types of deformation: coaxial constriction and dextral non-coaxial. The c-axis opening angles indicate temperatures of deformation mostly in the range of 500-700 °C. In the Lake Tudor shear zone, quartz petrofrabrics confirm a dominant dextral sense of shear and higher temperature of deformation between 680 and 760 °C, close to peak metamorphic conditions. The timing of deformation in the Lake Tudor shear zone is constrained between 1828 ± 7 Ma and 1805 ±3.2 Ma through cross-cutting relationships. In the George River shear zone, a synkinematic dyke indicates that the deformation was waning by 1812 ±5 Ma. Our new results suggest a hot orogen style of deformation characterized by horizontal constrictional strain and dextral shearing. Coeval dextral and sinistral shearing along the George river and Moonbase shear zones is interpreted to have caused extrusion of the Mistinibi and Orma domains, which escaped the main high-grade metamorphic event between 1820 to 1775 Ma.