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Orogenic Growth and Collapse:Seismic Perspectives from the Western Trans-Hudson Orogen, Canada

Seismic exploration of modern orogenic belts has significantly improved our understanding of their geodynamic evolution and structural architecture. However many questions regarding processes within the deeper parts of these orogens remained unresolved. The deeply exhumed internides of Precambrian orogens may bring to light features observed remotely within modern orogens. There are two competing aspects of the late-stage exhumation processes: 1) Important crustal sections will be removed and the enclosed geological information will be lost and 2) The exhumation process brings to the near surface structural units from the deep parts of orogenic wedges, therefore making them more accessible for geological and geophysical investigations. The 1.8 Ma old Trans-Hudson Orogen (THO) situated in central North America is a deeply exhumed, complex collisional belt. It is one of the best-studied Paleoproterozoic orogens, with extensive associated geological and geophysical datasets. The post-Paleoproterozoic tectonic overprint is not significant on a regional scale, thus most of the observed structural elements reflect its Paleoproterozoic growth and subsequent collapse. Seismic sections from the western margin of the THO (LITHOPROBE, COCORP, EXTECH-IV) are of reliable quality and image the orogen on different scales. The gross reflectivity pattern can be compared with surface geology. There is significant evidence for both crustal thickening (ductile regime nappe stacking) as well as thinning (orogen parallel ductile extension). The exact temporal and spatial relationships remain however only partially constrained by existing age data and the complex 3D geometry of the orogen.