The Lithoprobe Abitibi-Grenville Transect: Two Billion Years of Crust Formation and Recycling in the Precambrian Shield of Canada

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We summarise the results of Lithoprobe studies in the Neoarchean southeastern Superior Province and the Mesoproterozoic Grenville Province, in the southeastern Precambrian Shield of Canada, through two composite cross-sections based on seismic reflection data, which define dramatically different styles of crust formation and tectonic accretion in the Neoarchean and Mesoproterozoic. In the Neoarchean, the structures at the surface are steep, with discontinuous and flatter structures at depth, much of the crust appears to be juvenile, and the predominant process of crustal growth is inferred to have been subduction-accretion of primitive crust in a prograding arc system. In the Mesoproterozoic, surface structures are shallow and the seismic character of the crust is continuous over the entire cross-section. Archean parautochthonous rocks and reworked Archean crust comprise a very significant proportion of the preserved crust in the Mesoproterozoic, and provided the backstop to the Grenvillian orogeny, resulting in the exhumation of crustal rocks formed at high pressures. Preservation of Neoarchean crust, including a thickened lithosphere, in the Superior Province, in contrast to its general destruction in younger orogens, may well relate to a unique thermal regime at this time on Earth.