Within plate and subduction-related settings in the Archaean

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There is much discussion of the timing of the onset of plate tectonics, yet there is increasing evidence that magma types similar to those from recent within plate and subduction related settings were generated in different areas at broadly similar times in the early Archaean. It may therefore be helpful to consider when plate tectonics became the dominant mechanism associated with the generation of continental crust, rather than just when it started. To do this we discuss the geochemical and mechanical characteristics of the lithosphere in the search to discern differences between Early Archaean and younger tectonic environments. Seismic tomography allows increasingly detailed mapping of the lithosphere, and it provides some evidence that the degree of anisotropy is different in different Archaean terrains.

Structural styles also appear to vary from basin and swell, or vertical tectonics, as in the Australia Pilbara and southern Africa, to those with more strongly developed regional fabrics and greater seismic anisotropy, as in North America. These terrains tend to be characterized by inferred within-plate and subduction-related magmatism respectively, and we consider possible links between the degree of crustal and mantle anisotropy and the nature of the magmatic record. At least in some areas, terrains with stronger regional fabrics may be younger than those in which such fabrics are less well developed. A model is developed for the generation and stabilization of continental lithosphere in the Archaean. It seeks to reconcile evidence for hot shallow melting with melt fractions up to 40% to generate residual peridotites now preserved as mantle xenoliths, and the lower degrees of melting required to generate the mafic sources of TTGs (fractionated Lu/Hf and Sm/Nd, and perhaps not Rb/Sr).