FORMATION, REWORKING AND RECYCLING OF PRECAMBRIAN SHIELDS

SYLVESTER, P.J., Department of Earth Sciences, Memorial University of Newfoundland, St. John's, NF, A1B 3X5 Canada

The last decade has seen a remarkable evolution of ideas about the origin of Precambrian shields. Two aspects stand out in particular. The first is the notion that large catastrophic mantle melting events formed continental crust episodically in the Precambrian. This provides an explanation for the concentration of ages of Precambrian rocks in discrete clusters, mostly at 2.7, 1.9 and 1.2 Ga. During these crust formation episodes, the style of mantle convection is thought to have changed abruptly from layered to whole mantle, induced by overheating of the lower mantle and/or foundering of subducted slabs through the 660-km seismic discontinuity. Hot lower mantle rocks rose into the upper mantle, perhaps as plumes, where they melted to form thick oceanic plateaus, preserved today as tholeiite-komatiite successions in greenstone belts. Subduction and partial melting of basalt on the plateaus produced the dominant tonalite-trondhjemite-granodiorite (TTG) suite of shields. The second is the idea that lithospheric plate collisions led to extensive reworking and recycling of the Precambrian continental crust of shields just prior to final stabilisation. The collisions led to delamination of the mantle lithosphere and lower crust, upwelling of hot asthenosphere, and partial melting of TTGs to produce abundant potassium-rich granites. Recycling of lower crustal mafic rocks changed the bulk composition of shields from basaltic to tonalitic. The volume of crust recycled during the Precambrian may have been substantial. Compositions of Archean and Proterozoic basalts indicate that their mantle sources were just as depleted from crust formation as is the modern mantle.