Crustal evolution in North America recorded in heat production.

J.-C. Mareschal[2], C. Jaupart[1], and H.K.C. Perry[2]

[1] Institut de Physique du Globe de Paris, 4 Pl. Jussieu, F75252, Paris, France ; cj@ccr.jussieu.fr.
[2] GEOTOP-UQAM-McGill, University of Quebec, Montreal, QC, H3C3P8, Canada; jcm@olympus.geotop.uqam.ca; claire@olympus.geotop.uqam.ca.

The Superior Province

We use measurements of heat flow and U, Th, K concentrations to determine the amount of heat generated in various belts of the Superior Province of the Canadian Shield, the largest Archean craton on Earth. From these data, we estimated the average crustal heat production and compositional differences between upper and lower crustal assemblages. The bulk average heat production of the Superior Province crust is 0.64 μWm^{-3}, with very little differences between belts of slightly different ages, illustrating the remarkable uniformity of crust-building mechanisms during the final assembly of the Superior Province.

Crustal evolution in North America

In the wider context of the North American continent, the bulk crustal heat production decreases from 1.0 μWm^{-3} in the oldest Slave Province to a minimum of 0.55 μWm^{-3} in the Paleo-Proterozoic Trans-Hudson Orogen. It increases in younger provinces, culminating with a high value of 1.05 μWm^{-3} in the Phanerozoic Appalachian Province. During the Proterozoic, juvenile crust has much lower heat production than sediments derived from Archean cratons. In all provinces, U and Th enrichment is systematically associated with sedimentary accumulations.

We have observed very similar trends in the heat flow and heat production data available in other cratons (South-Africa, Australia).

Crustal differentiation

We define a crustal differentiation index as the ratio between the average values of heat production at the surface and in the bulk crust. The differentiation index is correlated with the bulk average heat production, which suggests that crustal differentiation processes are largely driven by internal radiogenic heat.