



A Global compilation of Heat Production in Granitic Rocks

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Abstract

Knowledge of the heat production in the crust is important for understanding the energy balance in Earth. It is assumed that the crust produces a substantial part of the heat in Earth, but its proportion in comparison to the mantle and the contribution from core solidification is not well known. Knowledge of the crustal heat production is required for assessing the mantle heat flow at the crust-mantle interface. Granites probably are the main heat producing rock types in the crust, and therefore their heat production is of crucial importance for understanding Earth heat balance.

As part of a B.Sc. thesis study we have compiled a new database based on published values of heat production in various types of granites. The database has about 500 entries for concentrations of U, Th, and K and the total heat generation in different continental regions. The database also includes information on crustal age and the emplacement age of granites, where available.

Some of the main conclusions that may be drawn from analyses of this new database are:

- Distribution of heat production values is narrow in Archean-early Proterozoic granites but very broad in middle-late Proterozoic granites.
- We observe no correlation between granite type and heat production.
- Some correlation may be inferred between age and heat production – heat production is relatively low in Archean-early Proterozoic granites.
- Proterozoic granites are dominated by A-type which have high heat production; the I-type Archean granitic rocks seem to have the highest Th/U ratio.
- The Th/U ratio is supposed to be 3.7-4.0 based on relative time constants. This is in general correct with a global average value of 3.7. However, it is ca. 3.8 for Phanerozoic and Archean-early Proterozoic granites and 3.3 for middle-late Proterozoic granites. We speculate if this variation may be caused by major plate reorganization or perhaps by change in global plate tectonic style?