



## **A sharp change in mantle thermal regime in Middle Proterozoic: Evidence from heat production in granitic rocks**

Irina Artemieva (1,2), Hans Thybo (2,3), Kiki Jacobsen (1), Nanna Sørensen (1), and Louise S.K. Nielsen (1)  
(1) University of Copenhagen, IGN, Denmark (irina@ign.ku.dk), (2) Eurasia Institute of Earth Sciences, ITU, Turkey, (3) CEED, University of Oslo, Norway

Granitic rocks play special role in the evolution of the Earth and its thermal regime. Their compositional variability provides constraints on global differentiation processes and large scale planetary evolution, while heat production by radioactive decay is among the main heat sources in the Earth. We analyze a new global database GRANITE2017 on the abundances of Th, U, K and heat production in granitic rocks based on all available published data. Statistical analysis of the data shows a huge scatter in all parameters, but the following conclusions can be made.

1) Heat production is very low in Archean-Early Proterozoic granitic rocks and there is a remarkable peak in Middle Proterozoic granites followed by a gradual decrease towards Cenozoic granites. There is also a sharp change in radiogenic concentrations and ratios from the Early Proterozoic to Middle Proterozoic granites. The Proterozoic anomaly may be caused by major plate reorganizations possibly related to the supercontinent cycle when changes in the granite forming processes may be expected, or it may even indicate a change in global thermal regime, mantle dynamics and plate tectonics styles.

2) The Urey ratio has not been constant through the earth's evolution, its secular change was not monotonous, and seem to be correlated with plate motions, which may have been the fastest in Middle Proterozoic and have been decreasing since then.

3) Bulk heat production in granitic rocks of all ages is ca. 2.0 microW/m<sup>3</sup>. The total present-day heat production in the granitic crust is 5.8-6.8 TW and in the continental crust 7.8-8.8 TW.

4) The present-day global average Th/U value is 4.75 with a maximum in Archean-Early Proterozoic granites (5.75) and a minimum in Middle-Late Proterozoic granites (3.78). The Th/U ratio at the time of granite emplacement has a minimum in Archean (2.78). The present-day K/U ratio is close to a global estimate for the continental crust only for the entire dataset, but differs from the global ratio for each geological time.

5) There is no systematic correlation between the tectonically controlled granite-type and bulk heat production, although A-type (anorogenic) granites are the most radioactive, and many of them were emplaced in Middle Proterozoic. There is also no systematic correlation between heat flow and concentrations of radiogenic elements.

### Reference:

Artemieva I.M., Thybo H., Jakobsen K., Sørensen N.K., Nielsen L.S.K., 2017. Heat production in granitic rocks: Global analysis based on a new data compilation GRANITE2017. *Earth Science Reviews*, 172, 1-26, DOI: 10.1016/j.earscirev.2017.07.003