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Global map of lithosphere thermal thickness on a 1 deg x 1 deg grid - digitally available

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This presentation reports a 1 deg $\times$1 deg global thermal model for the continental lithosphere (TC1). The model is digitally available from the author's web-site: www.lithosphere.info.

Geotherms for continental terranes of different ages (early Archean to present) are constrained by reliable data on borehole heat flow measurements (Artemieva and Mooney, 2001), checked with the original publications for data quality, and corrected for paleo-temperature effects where needed. These data are supplemented by cratonic geotherms based on xenolith data.

Since heat flow measurements cover not more than half of the continents, the remaining areas (ca. 60% of the continents) are filled by the statistical numbers derived from the thermal model constrained by borehole data. Continental geotherms are statistically analyzed as a function of age and are used to estimate lithospheric temperatures in continental regions with no or low quality heat flow data. This analysis requires knowledge of lithosphere age globally.

A compilation of tectono-thermal ages of lithospheric terranes on a 1 deg $\times$ 1 deg grid forms the basis for the statistical analysis. It shows that, statistically, lithospheric thermal thickness z (in km) depends on tectono-thermal age t (in Ma) as: z=0.04t+93.6. This relationship formed the basis for a global thermal model of the continental lithosphere (TC1). Statistical analysis of continental geotherms also reveals that this relationship holds for the Archean cratons in general, but not in detail. Particularly, thick (more than 250 km) lithosphere is restricted solely to young Archean terranes (3.0–2.6 Ga), while in old Archean cratons (3.6–3.0 Ga) lithospheric roots do not extend deeper than 200–220 km.

The TC1 model is presented by a set of maps, which show significant thermal heterogeneity within continental upper mantle. The strongest lateral temperature variations (as large as 800 deg C) are typical of the shallow mantle (depth less than 100 km). A map of the depth to a 600 deg C isotherm in continental upper mantle is presented as a proxy to the elastic thickness of the cratonic lithosphere, in which flexural rigidity is dominated by olivine rheology of the mantle. The TC1 model of the lithosphere thickness is used to calculate the growth and preservation rates of the lithosphere since the Archean.