The age of the lower crust of the central part of Nuna

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We have compiled available data on texture, REE contents, Hf isotope composition and U-Pb age of zircons from lower crustal xenoliths from Precambrian areas which were part of the Nuna supercontinent, to address the question of the age of the lower crust. The time when the lower crust reached its current state, a layer of high-pressure granulite-facies rocks, is dated by zircon equilibrated with garnet from the observed metamorphic association. Older and younger metamorphic zircons allow reconstruction of the geological history. Zircons that have magmatic textures can provide the age of protolith crystallization, which did not necessarily occur within the lower crust.

Magmatic zircons from the Slave, Wyoming, Superior cratons, the Siberian (the Anabar province) and Karelian cratons (the boundary with the Svecofennian belt), as well as the Archean Belomorian mobile belt in NW Russia, have Archean ages. No convincing evidence of the addition of younger material has been found yet, although this is possible. Metamorphic zircons show a wide spread of ages from 2.6 to 1.1 Ga. The oldest come from the Slave craton. Its crust has remained largely unchanged since that time. Most zircons from the other localities show the predominance of ages within 1.9-1.8 Ga. Several metamorphic episodes can be inferred from different zircon generations, and they generally correlate with major orogenic events that led to formation of the Nuna supercontinent. The major features of lower crustal zircons in comparison to upper crustal ones are the shift to younger age values and prolonged existence under high-temperature conditions.

Zircons with younger ages (1.7-1.1 Ga) can be ascribed to multiple extensional events within cratonic areas. They are not abundant; however, those from the Superior craton demonstrate the strong influence of extension: migmatisation at 1.4 Ga and metamorphism at 1.1 Ga. Zircons formed in the presence of garnet with older ages (≥2.20 to 1.95 Ga) are evidence for thick crust that existed before Paleoproterozoic orogenic events. We believe that the lower crust as a lithospheric unit was formed in Paleoproterozoic (with incorporation of older fragments) but, in cratonic areas, its material is Archean in age.