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Crustal growth in southern Siberia: a Nd-isotope synthesis

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Nd-isotope analyses from 114 rock samples of the southern part of the Siberian craton were obtained and interpreted to establish crustal formation scenario for the region.

New evidence, particularly from recent studies on Nd model ages supports the recycling of Palaeo- and Eoarchaean crust during Palaeoproterozoic granite intrusion in the southern Siberian craton. In the Sharizhalgai terrane the period 3.4-3.6 Ga represents early crust formation as determined from Nd isotope composition of basement granulite and TTG-orthogneisses. The mafic xenoliths from these basement rocks provide evidence of the existence of juvenile crust in the area perhaps as old as 3.9 Ga. Nd isotopic data indicate that the Birusa and Goloustnaya terranes separated by Sharizhalgai and Urik-Iya terranes are underlain by younger crust (2.8 and 2.6 Ga respectively). Further of the Goloustnaya terrane, early crust is locally present in the Baikal terrane as indicated by Nd ages of 3.0 – 3.2 Ga.

The distribution of different Nd model ages throughout the southern Siberian craton indicates a significant heterogeneity of the crustal protoliths.

The Urik-Iya and Chuya units are relicts of Palaeoproterozoic (2.0-2.3 Ga) juvenile crust within the studied segment of the Siberian craston margin. The Chuya unit is interpreted as a Palaeoproterozoic island-arc reworked during major 1.9 – 2.0 Ga orogenesis. The juvenile nature of the Urik-Iya Palaeoproterozoic crust suggests that at 2.0 Ga the Birusa terrane was not in direct contact with the older Sharizhalgai terrane. High-grade (up to eclogite facies) metamorphosed mafic-ultramafic relicts in the eastern side of the Urik-Iya terrane mark the boundary of these two terranes whose assembly probably occurred around 1.9 Ga during a Palaeoproterozoic accretion-collision event.

The Nd isotope data of Neoarchaean collisional type granites and numerous Palaeoproterozoic post-collisional granite plutons indicates that all of these intrusions inherited their Nd isotope composition from the Palaeo- to Neoarchaean basement from which they were derived and through which they intruded.

This synthesis of new Nd isotope highlights the significance of Nd isotope data for constraining the crustal growth processes responsible for the evolution of the Siberian craton. The data provides evidence that the southern part of the Siberian craton preserves a long history of crustal development extending from the Neoproterozoic as far back as Eoarchaean. The complicated and heterogenous structure of the southern Siberian craton indicates that the craton formed from a series of distinct Archaean crustal fragments with different histories (Fig. 3) that were amalgamated by Palaeoproterozoic accretion between 2.0-1.9 Ga. Following amalgamation, voluminous granites were intruded at 1.85 Ga into the Archaean crustal units and the suture zones separating them. These granites mark the final stage of the stabilization of the southern Siberian craton. The assemblage of Siberia broadly coincides with important orogenic events on nearly every Precambrian continent, suggesting that the evolution of the southern part of the Siberian craton reflects its involvement in the amalgamation of a Palaeoproterozoic supercontinent.