Geophysical Research Abstracts
Vol. 18, EGU2016-5849, 2016
EGU General Assembly 2016

Geophysical and geochemical nature of relaminated arc-derived lower crust underneath oceanic domain in southern Mongolia

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The Central Asian Orogenic Belt (CAOB) in southern Mongolia consists of E-W trending Neoproterozoic cratons and Silurian-Devonian oceanic tectonic zones. Previous study revealed that the Early Paleozoic accretionary wedge and the oceanic tectonic zone are underlain by a layer giving a homogeneous gravity signal. Forward gravity modelling suggests that this layer is not formed of high-density material typical of lower oceanic crust but is composed of low- to intermediate-density rocks resembling continental crust. The nature of this lower crust is constrained by the whole-rock geochemistry and zircon Hf isotopic signature of abundant Late Carboniferous high-K calc-alkaline and Early Permian A-type granitoids intruding the two Early Paleozoic domains. It is possible to explain the genesis of these granitoids by anatexis of juvenile, metaigneous (tonalitic-gabbroic) rocks of Late Cambrian age, the source of which is presumed to lie in the “Khantaishir” arc (520–495Ma) further north. In order to test this hypothesis, the likely modal composition and density of Khantaishir arc-like protoliths are thermodynamically modelled at granulite- and higher amphibolite-facies conditions. It is shown that the current average density of the lower crust inferred by gravity modelling (2730 $\pm$20kg/m3) matches best metamorphosed leucotonalite to diorite. Based on these results, it is now proposed that Mongolian CAOB has an architecture in which the accretionary wedge and oceanic upper crust is underlain by allochthonous lower crust that originated in a Cambrian arc. A tectonic model explaining relamination of allochthonous felsic to intermediate lower crust beneath mafic upper crust is proposed.