Geophysical Research Abstracts
Vol. 12, EGU2010-8050, 2010
EGU General Assembly 2010

The composite TTG series: evidence for a non-unique tectonic setting for Archaean crustal growth.

Jean-François Moyen
(jean.francois.moyen@univ-st-etienne.fr)

The geodynamic context of formation of the Archaean TTG (tonalite-trondhjemite-granodiorite) series, the dominant component of the Archaean continental crust, is a matter of debate. The two end-member models for TTG formation are melting of the basaltic slab in a “hot subduction”; and intra-plate melting of basaltic rocks at the base of thick crust (oceanic plateau?). Both models do however predict strikingly different geothermal gradients, as in the modern Earth a typical subduction gradient is less than 10 °C/km compared to > 25-30 °C/km in the case of plateau melting.

Using a large database of published TTG compositions, and filtering it to remove rocks that do not match the definition of TTG, it is possible to show that the TTG series is actually composite and made of a range of geochemically identifiable components that can be referred to as low-, medium- and high-pressure groups. The geochemistry of the low-pressure group (low Al, Na, Sr, relatively high Y and Nb) is consistent with derivation from a plagioclase and garnet- amphibolite; the medium-pressure group was formed in equilibrium with a garnet-rich, plagioclase-poor amphibolite, whereas the high pressure group derived from a rutile bearing eclogite.

As the temperature of melting of metamafic rocks is largely independent from pressure, this corresponds to melting along a range of contrasting geothermal gradients. The low pressure group requires gradients of 10-12 °C/km, whereas the gradient required for the low pressure group can be as high as 25—30 °C/km. Regardless of the preferred tectonic model for the Archaean, such a range of gradients requires an equally large range of tectonic sites for the formation of the Archaean continental crust.