Geophysical Research Abstracts
Vol. 20, EGU2018-3603, 2018
EGU General Assembly 2018

The trajectory of the P–T path controls the onset of melting in metasedimentary rocks.

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Partial melting is a key orogenic process in controlling the rheology of evolving thickened crust. Consequently, understanding the location of the solidus in pressure–temperature (P–T) space is critical. Investigations of the onset of anatexis in rocks are limited as, using conventional modelling or experimental approaches, it is impossible to adequately accommodate changes in subsolidus bulk rock water content that occur as a function of pressure and temperature. This study uses Rcrust, a new software tool that allows calculation of phase equilibria in systems with a continually changing bulk composition to investigate the P–T path dependence of partial melting of an average metapelite composition. Three different fluid states are considered: fluid-saturated with an abundant H_2O-rich fluid; fluid-restricted which has a restricted quantity of water (0.1 vol.%) filling pore spaces; and fluid-absent, which has no fluid phase but is fully-hydrated. The behaviour of the system under all three fluid states was investigated along a variety of linear prograde P–T paths that culminate in granulite and eclogite facies P–T conditions. Three fundamental aspects were revealed: (1) the bulk water content at the solidus of an average metapelite varies substantially as a function of pressure; (2) the fluid-absent solidus and the wet solidus are identical for all but steep P–T paths; (3) rocks following steep P–T paths ($dP/dT > 1$ kbar/20 °C) will melt at significantly higher temperature than that of the wet solidus. Thus rapid tectonic burial of significant volumes of rock will delay orogenic collapse due to anatexis of the deep crust.