Granulites & granulites 2009

13–15 JULY, HRUBÁ SKÁLA CHATEAU, CZECH REPUBLIC

GRANULITES, PARTIAL MELTING AND RHEOLOGY OF OROGENIC LOWER CRUST

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thermodynamic calculations for understanding mass transport in high-P environments. Thus, we present coupled thermodynamic models for hydrous aluminosilicate melt and aqueous fluid at pressures higher than 1 GPa. During model calibration it has become clear that several important P–T–composition regions are poorly constrained by existing experimental data.

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Huang, W. L. & Wyllie, P. J., 1973. Melting relations of muscovite-granite to 35 kbar as a model for fusion of metamorphosed subducted oceanic sediments. *Contributions to Mineralogy and Petrology*, **42**, 1-14.

Granulite facies calc-silicate rocks from Goianira, Anápolis-Itauçu Complex, Brazil: modelling wollastonite + scapolite stability in the NCASC and NCASHC systems

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Ultrahigh temperature metamorphism is known from multiple localities in the Anápolis-Itauçu Complex, Central Brazil, with mineral assemblages such as saphirine + quartz, aluminous-orthopyroxene + sillimanite + quartz and spinel + quartz + ternary feldspar. These granulites, which were formed during the Neoproterozoic, are associated in the field with common felsic and mafic granulites, calc-silicate rocks, layered gabbros and granites. Peak temperatures were probably close to 1000 °C at ~9 kbar, although most granulites do not have a diagnostic mineral assemblage of ultrahigh temperature conditions.

In calc-silicate rocks from the Goianira region, wollastonite and scapolite are common and represent a potential ultrahigh temperature mineral assemblage. For this reason, we have modelled the stability of assemblages with wollastonite + scapolite in the NCASC and NCASHC chemical systems.

In an active quarry in Goianira, the main lithology is an impure calcite marble with diopside, wollastonite, scapolite, orthoclase and plagioclase, and rare quartz, grossular and titanite; the lithology is heterogeneous and modal proportions vary significantly from sample to sample. Wollastonite is separated from calcite by a corona of quartz. Scapolite predominantly has a composition of $EqAn_{66}$, although rare grains have higher Ca contents of $EqAn_{70-80}$. Garnet is rare and almost pure grossular; it forms coronae separating wollastonite from scapolite, always associated with plagioclase, calcite and quartz inclusions.

Modelling in the NCASC and NCASHC chemical systems was undertaken using THERMOCALC. In a system with no free-CO_2, wollastonite and end-member meionite are stable at T higher than 864 °C, independent of P. The mineral assemblage is only diagnostic of ultrahigh temperature conditions if P is >9 kbar and scapolite composition is end-member meionite ($EqAn_{100}$).

The formation of garnet is investigated using two artificial bulk compositions, one with quartz in excess and the other with grossular in excess. In T *vs.* X_{CO2} space, grossular-rich garnet is only stable with a H_2O-rich fluid and it is incompatible with a CO_2-rich fluid if wollastonite and scapolite are present. Based on these results, we infer that fluid-absent granulite facies metamorphic conditions are necessary for the formation of grossular-rich garnet, wollastonite, and meionite-rich scapolite in the presence of calcite.

This work is supported by FAPESP (grants 04/09682-8 and 06/60381-4 to RM).