Compression, reaction activation and phase transitions: How to form a basin

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The geodynamic significance of rock densities extracted from calculated equilibrium phase diagrams is currently under investigation. In an extensional setting, mantle rocks are the most natural candidate to cause significant density contrasts due to their high temperature. Continental crustal rocks in convergent settings, however, may be in a state of metastability with sluggish reaction kinetics due to low temperature and the lack of fluids as has been reported in field and detailed petrological studies. We attempt to quantify the thermal and mechanical closure of specific reactions which have large effects on the density along relevant *P*-*T* paths.

Our study area is the East Barents Sea basin, one of the world's deepest basins with up to 20 km of sediments. The formation mechanisms of such intracratonic basins are still poorly understood and extensional models prove to be insufficient to describe the fast and deep subsidence. We propose a compressional setting in combination with phase transitions which may explain the rapid subsidence of the East Barents Sea basin at Permo-Triassic times as well as the small present day gravity anomalies. This model requires the activation of some reactions with large effects on the density and we discuss several mechanisms of 'opening' or 'triggering' those reactions. Shear heating is considered as a source of heat, tectonic and reaction overpressures as a mechanism for increasing pressure leading to the rise of differential stresses and a downward fluid flow. The pressure increase causes a densification of crustal rocks, while the temperature increase eliminates thermal closure. Differential stresses and fluid weakening may then open mechanically closed reactions.

Cromian picroilmenites as a potential geothermometers: An experimental study

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We performed experimental study in the system Mg-Fe-Ti-Cr-Al-Si-O in order to constrain oxide-silicate relations with particular attention to picroilmenite. Experiments were performed at temperature of 1000-1400 °C and pressure of 2.5, 3.5, and 5 GPa using different bulk compositions with variable Mg/Fe, Cr/Al ratios, and silica activity under relatively reducing conditions by employing graphite containers sealed into Pt-capsule. Experiments were run in solid-media piston cylinders and multi-anvil apparatus for durations of 30-120 hours.

Stability of ilmenite in equilibrium with silicates (olivine, opx) and oxides (spinel, rutile) have been experimentally determined. Compositional variations of ilmenite and spinel correlate with temperature: depletion in trivalent cations is observed with increasing temperature for spinel whereas the compositions of ilmenite exhibit enrichment in trivalent cations with increasing temperature. Currently, we investigate the quantitative effect of Cr^{3+} on the ilmenite solid solution by thermodynamic analysis of the experimental results.

The partitioning of Fe^{2+} and Mg between silicates and oxides in these systems is characterized by slightly negative temperature effect. The present study provides additional data on Fe-Mg exchange in the presence of trivalent cations, in particular Cr^{3+}, which considerably complicates existing olivine-ilmenite, opx-ilmenite and two-oxide thermometers.