



Petrogenetic grids for sapphirine-bearing granulites

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Phase relations involving sapphirine, garnet, spinel, orthopyroxene, olivine, cordierite, alumina silicates, corundum, and quartz have been calculated in the system $\text{FeO-MgO-Al}_2\text{O}_3\text{-SiO}_2$ based on internally consistent thermodynamic properties of both the end-member minerals and the solid solutions (Gerya et al., 2004; Podlesskii et al., 2008). The derived P-T diagrams imply stable invariant points and stability fields of key assemblages that differ from those proposed by other authors (Kelsey et al., 2004; Harley 2008). The sapphirine + quartz assemblage, which is widely recognized as indicative of ultrahigh-temperature metamorphism, can be stable down to 835°C and ~6 kbar. The sapphirine + kyanite assemblage has been found stable at temperatures below 860°C and 11.3 kbar, whereas the sapphirine + forsterite assemblage may be stable below 800°C only under specific conditions of a very low activity of water. The existing constraints on the thermodynamic properties of sapphirine are considered insufficient to make decisive conclusions about metamorphic conditions. Granulites containing the sapphirine + quartz assemblage have been investigated with the microprobe to apply both the conventional thermobarometry and thermometry based on Ti contents of quartz (TitaniQ, Wark & Watson, 2006). The results demonstrate that, in some cases, this assemblage might have formed at relatively low temperatures during retrograde stages of metamorphism.

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References

- Gerya, T.V., Perchuk, L.L., & Podlesskii, K.K. In: Zharikov, V.A. & Fed'kin, V.V. (eds.) *Experimental Mineralogy: Some Results on the Century's Frontier*. Moscow: Nauka, Vol. 2, 188-206 (2004).
- Harley, S.L. Refining the P-T records of UHT crustal metamorphism. *Journal of Metamorphic Geology*, **26**, 125-154 (2008).
- Kelsey, D.E., White, R.W., Holland, T.J.B., & Powell, R. *Journal of Metamorphic Geology*, **22**, 559-578 (2004).
- Podlesskii, K.K., Aranovich, L.Y., Gerya, T.V., & Kosyakova, N.A. Sapphirine-bearing assemblages in the system $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2$: A continuing ambiguity. *European Journal of Mineralogy*, **20**, 721-734 (2008).
- Wark, D.A. & Watson, E.B. TitaniQ: a titanium-in-quartz geothermometer. *Contributions to Mineralogy and Petrology*, **152**, 743-754 (2006).