

## Solubility of ferric iron in sillimanite to calibrate $P$ - $T$ - $f_{O_2}$ of ultrahigh-temperature granulites

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Yokoi (1983) reported the content of  $\text{Fe}_2\text{O}_3$  in sillimanite increases with the metamorphic grade from the low-pressure regionally metamorphosed pelites collected at the Hiraoka-Kadonani area of the Ryoke metamorphic belt in central Japan. In this meeting I would like to report the high-pressure experimental results on the  $\text{Fe}^{3+}$  solubility in sillimanite.

I used the piston-cylinder device at temperature of  $1050^\circ\text{C}$  and pressures of 5, 7, 11 and 15 kbar. The starting materials are: (1) powdered mixture of hematite and sillimanite ( $\text{Fe}_2\text{O}_3$  0.5 wt%) collected from Rundvagshetta in the Lutzow-Holm Complex, East Antarctica (mixing ratio is 1:100); and: (2) powdered meta-iron stone composed of ilmenite, garnet, sillimanite ( $\text{Fe}_2\text{O}_3$  0.5 wt%) and quartz from Mt. Riiser-Larsen in the ultrahigh-temperature terraine of Napier Complex, East Antarctica. These were reacted in the Pt (Sil+Hem) and AuPd (meta-iron stone) capsules for about 1000 hours.

Experimental results are:

- (1) The  $\text{Fe}_2\text{O}_3$  content of sillimanite in the Sil+Hem assembly, reacted in Pt capsule, increases from 0.7 wt% at 5 kbar to 2 wt% at 15 kbar. The sintered sample at 1 atm and  $1300^\circ\text{C}$  in the air shows 1.5 wt%  $\text{Fe}_2\text{O}_3$  in sillimanite.
- (2) Sillimanite of the meta-iron stone shows no significant change in the  $\text{Fe}_2\text{O}_3$  content which is almost constant (1.0 wt%). The sample, sintered at 15 kbar and  $1500^\circ\text{C}$  in a graphite capsule, shows the  $\text{Fe}_2\text{O}_3$  content as 1.5 wt%.

These experimental results indicate that the  $\text{Fe}_2\text{O}_3$  of sillimanite increases with temperature, pressure and oxygen fugacity. This is consistent with the petrographic and geochemical study of the  $\text{Al}_2\text{SiO}_5$  minerals observed the correlation between  $\text{Fe}_2\text{O}_3$  content and the coexisting minerals in the metamorphic rocks of New Mexico by Grambling and Williams (1985).

### References

- Yokoi 1983 J Japan Assoc Min Petr Econ Geol **78** 246-254  
Grambling Williams 1985 J Petrol **26** 324-354