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# Melting experiments of orthopyroxene felsic gneiss and garnet-sillimanite felsic gneiss under UHT metamorphic condition

# Kei Sato[1]; Tomoharu Miyamoto[2]; Yasutaka Yoshimura[3]; Toshihiro Suzuki[4]; Eiichi Takahashi[5]; Toshisuke Kawasaki[6]

[1] Earth Planetary Sci., Tokyo Inst. of Tech.; [2] Earth and Planetary Sci., Kyushu Univ.; [3] Natural Environmental Science, Kochi University; [4] IFREE / JAMSTEC; [5] Earth and Planetary Sci., Tokyo Inst. of Tech.; [6] Earth Sci., Ehime Univ.

Ultrahigh-temperature (UHT) metamorphism has been known as a crustal evolutional process that thermal peak attained 900-1100 degree-C (Harley, 1998) or over 1120 degree-C (Harley and Motoyoshi, 2000). Possibility of partial melting under UHT metamorphic condition was suggested by previous field evidences and petrographical studies (e.g. Sheraton et al., 1987; Hokada et al., 1999; Osanai et al., 1999; Yoshimura et al., 2000; Miyamoto et al., 2004; Grew et al., 2004). Hokada and Arima (2001) conducted melting experiments that used a mineral mixture of Qtz + antiperthite + minor amounts of Opx as a starting material and were set as 10 kbar and T = 1000-1150 degree-C. As a result, Hokada and Arima reported that melt coexisting with mineral phases was found in only one run product obtained at 1150 degree-C. For constraints on P-T condition of partial melting that were accompanied by the UHT metamorphism, we carried out high-pressure and high-temperature experiments using natural felsic gneisses. Mineral abbreviations are after Kretz (1983), except for Afs (= alkali feldspar).

In our experiments, two felsic gneisses having different bulk composition and mineral assemblage were used as starting materials. These samples were collected from Howard Hills in Napier Complex, East Antarctica. One of them is Opx felsic gneiss (sample no. TM981229-03Ef; Miyamoto et al., 2004; Grt-Sil-free) to be CaO = 2.65, Na2O = 2.89 and K2O = 1.48 (wt %) in whole rock. Another one is Grt-Sil felsic gneiss (sample no. YY9812290702; Yoshimura et al., 2000; Opx-free) to be CaO = 0.48, Na2O = 0.40 and K2O = 1.58 (wt %) in whole rock. Melting experiments were conducted using the Opx felsic gneiss at P = 4-16 kbar and T = 1050-1150 degree-C. Another experiments that used the Grt-Sil felsic gneiss were carried out at P = 12-16 kbar and T = 1100-1150 degree-C at 25 degree-C intervals. Before these experiments, all starting materials within sample container were dried at 110 degree-C in an oven. An internally-heated gas pressure apparatus (at TITech) and piston-cylinder apparatuses (at TITech and Ehime Univ.) were used in these experiments.

Experimental results are given in Figs. 1 and 2. In the Opx felsic gneiss system (Fig. 1), felsic melt coexisting with mineral phases was generated at 9-14 kbar and 1150 degree-C, and such assemblage was also observed at 4 kbar and over 1050 degree-C. In the Grt-Sil felsic gneiss system (Fig. 2), molten phase was found in run products obtained at 12-14 kbar and 1150 degree-C. In both these felsic gneiss systems, any molten phases were not generated at 16 kbar and 1150 degree-C. For a comparison with our experimental data, Hokada and Arima's (2001) experimental results are also shown in Fig. 1. Although two gneisses having different bulk and mineral assemblage were used in our experiments, the P-T condition to cause partial melting of these rocks was independent of such factors (Figs. 1 and 2). If temperature condition attains the solidus with T increasing, firstly alkali feldspar will disappear from constituent minerals in these gneiss systems. In our presentation, we'll discuss about the possibility of partial melting of UHT metamorphic rocks on the basis of these data.

References: Grew et al. (2004) The 24th Symp. Antarct. Geosci. Program and Abstracts, NIPR, Tokyo, 27-28; Harley (1998) In What drives metamorphism and metamorphic reaction? (P.J. Treloar and P.J. O'Brien. Eds.). Geol. Soc. London Spec. Publ., 138, 81-107; Harley and Motoyoshi (2000) Contrib. Mineral. Petrol., 293-307; Hokada et al. (1999) Polar Geosci., 49-70; Hokada and Arima (2001) Polar Geosci., 39-52; Kretz (1983) Am. Mineral., 277-279. Miyamoto et al. (2004) Polar Geosci., 88-111; Osanai et al. (1999) Polar Geosci., 1-28; Sheraton et al. (1987) Bur. Miner. Resource Bull., 223, 51 p.; Yoshimura et al. (2000) Polar Geosci., 60-85.

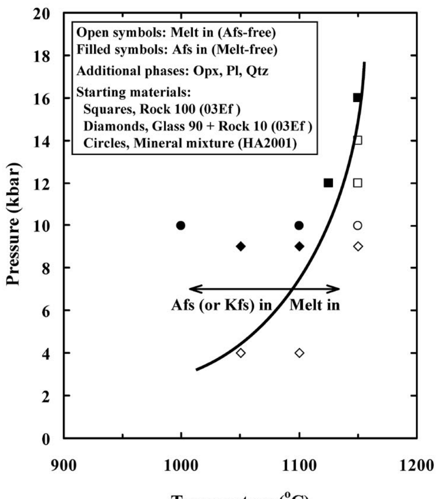


Fig. 1.

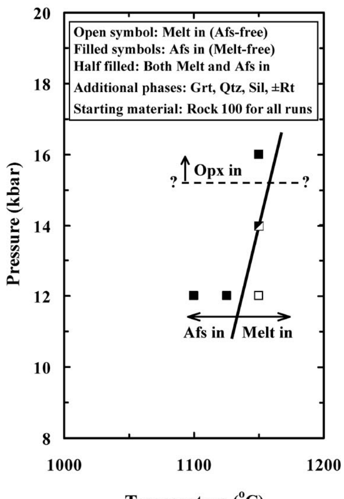


Fig. 2.