高変成メタペライトの相関係：高酸素分圧下のKFMASH系における実験的に決定した岩石成因論的 グリッド

Phase relations in high-grade metapelites:experimentally constrained petrogenetic grid in KFMASH system at high oxygen fugacity

 # カウシク　ダス [1]，ソンナス　ダスグプタ [2]，三浦　裕行 [1]，寺田　省一 [1]
Kaushik Das [1], Somnath Dasgupta [2], Hiroyuki Miura [1], Shoichi Terada [1]

[1] 北大・理・地球惑星，[2] ジャダプール大・理・地質
[1] Earth and Planetary Sci., Hokkaido Univ, [2] Geological Sci., Jadavpur Univ

グラニュライト相の高酸素分圧下における変成反応を明らかにするため合成実験を行い、KFMASH系の高酸素分圧、低H2O条件下での反応関係を明らかにした。平均組成がSiO2に富み、Mg組成の異なる3種類ペライト組成の出発物質を合成し、黒雲母の脱水溶融反応を実験的
に再現できるようにした。7-12kB、800-1100℃の条件下でピストンシリンダーを用いて実験を行った。得られた結果は低酸素分圧の時とは異なっており、7.5-8.5kB、850-1000℃で大隅石+スピネルの共存領域が確認された。この領域は高温側のサフィリン+opxの領域、高圧側のopx+珪線石の領域および低圧側の大隅石+菫青石の領域とは明瞭に区別される。

Introduction and aim:

In the different parts of the presently exposed granulite terrains of the world, mineral parageneses show a high oxygen fugacity environment at the time of the mineral equilibrium. From the theoretical consideration, it is known that with increasing oxygen fugacity the topology of the P-T grid changes. So far experimental works have been concentrated on grid that is stable at low fO2. But it has not been possible to use these experimental data to explain the reactions that are equilibrated at the high fO2. There are some works that explains this alternate grid by incorporating the effect of minor elements like Zn in spinel. So this present work has been aimed to have direct experimental evidence through the biotite dehydration melting reactions.

Experiments:

The reaction relations for the phases osumilite, spinel, cordierite, sapphirine, orthopyroxene, sillimanite, garnet, biotite, K-feldspar, quartz and water-undersaturated melt have been constrained experimentally in the system KFMASH under low water activity but at high oxygen fugacity. Three bulks of quartz-saturated pelitic compositions with XMg of 0.55, 0.72 and 0.81 have been studied. The pressure-temperature range that has been aimed in this present study extends from 7kb to 12kb and from 800C to 1100C. The experimental runs are buffered by hematite and magnetite mixture with a double capsule technique. The runs where buffer assemblage shows stability, provide the assemblage data and phase compositions. A petrogenetic grid with implication towards the process of granulite formation in the "oxidized" lower crust via. fluid absent biotite melting reactions is derived on the basis of these data.

Results:

It is observed from the present data that the pair osumilite and spinel is stable in a temperature range from 850C to 1000C but in a narrow pressure interval of 7.5 to 8.5 kbar. This pair comes through a high variance reaction from cordierite at the lower pressure and breaks down to orthopyroxene and sillimanite at pressure more than 8.5 kbar. The lower pressure assemblage of osumilite and cordierite are bounded by the reaction from biotite and sillimanite at the low temperature side and that at the high temperature side by the reaction that produces sapphirine and orthopyroxene. Osumilite has not been found to be stable beyond 9 kbar at the investigated range of temperature. At the temperature higher than 1000C, the sapphirine-orthopyroxene pair is changed to spinel-sapphirine pair. And at the high pressure - high temperature portion garnet-sapphirine pair has become stable. Therefore our data clearly separates stability field of osumilite from the higher temperature assemblage of sapphirine and orthopyroxene. And in contrast to the low fO2 grid it clearly indicates a stability field of osumilite-spinel pair which is in agreement with the natural data.

This present work has been aimed to have direct experimental evidence for the biotite dehydration melting reactions at high fO2 to understand metamorphic reactions of granulite facies. The reaction relations in the system KFMASH under low water activity but high fO2 were evaluated. Three bulks of quartz-saturated pelitic compositions have been studied using piston cylinder at 7kb-12kb and from 800-1100C. From the present data, a P-T grid has been prepared which in contrast to the low fO2 grid, clearly shows a stability field of osumilite-spinel pair in the

temperature range from 850-1000C at pressure interval of 7.5-8.5 kb. Moreover, this field is distinct from the high T field of sapphirine-opx; that from the high P field of opx-sillimanite and that from osumilite-cordierite at low P.