LIQUID-SOLID EQUILIBRIA IN LUNAR ROCKS FROM APOLLO 15, 16 AND 17, AND PHASE RELATIONS IN PARTS OF THE SYSTEM $CaMgSi_2O_6$-$CaFeSi_2O_6$-Fe_2SiO_4-$CaAl_2Si_2O_8$, A. Muan, T. Löfall and Che-Bao Ma, Geosciences Dept., The Pennsylvania State University, University Park, Pa. 16802.

Liquid-solid relations under equilibrium conditions have been determined for lunar rocks #15535,37; 15597,4; 15475,28; 60335,42; 62295,50; 68415,93; 71055,48; 74220,109; 75075,69, in contact with metallic iron. The experimental methods used were similar to those described previously.[1,2] Olivine, pyroxene and plagioclase, together with small amounts of opaque phases (spinel or ilmenite), are the main crystalline phases present. Plagioclase is the primary crystalline phase in rocks #60335,42 and #68415,83, followed by spinel and olivine, in that order, whereas olivine or spinel is the primary crystalline phase in the remainder of the rocks. In all rocks olivine, pyroxene and anorthite (with or without opaque phase(s)) coexist with liquid in the temperature range of approximately 1080-1150°C.

The system $CaMgSi_2O_6$-$CaFeSi_2O_6$-Fe_2SiO_4-$CaAl_2Si_2O_8$ encompasses the crystalline phases olivine, pyroxene, anorthite, spinel in equilibrium with a liquid phase at temperatures similar to those involved in liquid-solid equilibria in lunar rocks. This combination of components therefore serves as a model for evaluating parameters of importance for an understanding of the petrogenesis of rocks from the mare regions of the moon.

Phase relations in the liquidus-solidus temperature region were determined in contact with metallic iron. The bounding system $CaAl_2Si_2O_8$-Fe_2SiO_4 shows phase relations similar to those previously reported for the system $CaAl_2Si_2O_8$-Mg_2SiO_4[3], except that much lower liquidus (and solidus) temperatures prevail in the Fe-containing system of the present investigation (1212°C for the coexistence of anorthite, spinel and liquid, 1123°C for the coexistence of olivine, spinel and liquid). In the bounding system $CaMgSi_2O_6$-Fe_2SiO_4 pyroxene and olivine coexist in equilibrium with liquid at 1335°C, and there is a flat temperature maximum at 1345°C on the olivine liquidus curve. In the system $CaMgSi_2O_6$-Fe_2SiO_4-$CaAl_2Si_2O_8$ pyroxene, olivine, anorthite and liquid coexist at as low a temperature as 1198°C, and olivine, spinel, anorthite and liquid at 1132°C. In order to follow paths of crystallization in more detail as the liquid composition moves out of the plane described above, $CaFeSi_2O_6$ has been added as a component. Phase relations in the system $CaMgSi_2O_6$-$CaFeSi_2O_6$-Fe_2SiO_4-$CaAl_2Si_2O_8$ have been represented in a projection onto the composition triangle CaO-MgO-FeO in order to illustrate in a simple way the partitioning of Ca^{2+}, Mg^{2+} and Fe^{2+} among coexisting olivine, pyroxene and liquid under equilibrium conditions in the temperature range concerned (1182-1318°C).

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