Origin of Chemical and Mineralogical Variations of Apollo 12 Crystalline Rocks

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Nine crystalline rocks (18, 20, 21, 22, 38, 40, 52, 64 and 65) of the Apollo 12 samples have been analyzed with the wet chemical method. The compositions of these rocks, except for 22, fall on the straight lines originating from $Fo_{75}Fa_{25}$ olivine composition in the major oxide variation diagrams, suggesting that these rocks are products of magmatic differentiation caused mainly by crystallization and settling of olivine in a magma body or a lava lake. Rocks 18, 20 and 40 are olivine cumulate type, while others are not. This magma body was probably broken by meteorite impact and various parts of the body were thrown out on the lunar surface. Remelting of the rocks by impact may have taken place. The texture of the rocks and the compositional variations of olivine, pyroxenes and spinels determined by microprobe indicate that the fractional crystallization of magma took place during the relatively rapid crystallization on or near the lunar surface. The melting experiments have been made at 1 atm and 10^{-13} atm Po_2 and also at high total pressures on a crystalline rock (65) and a synthetic mixture of the composition of the original magma which has been estimated on the basis of the oxide variation diagram. The phases crystallized near the liquidus temperatures in the 1 atm experiments are similar in composition to the core of the phenocrystic minerals. It is suggested that the original magma may have been formed by partial melting of a plagioclase-bearing peridotite within the moon's interior at depths shallower than 250km.

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