

## CRYSTALLIZATION HISTORY OF POIKILITIC SAMPLE 62235.

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Poikilitic basalt sample 62235, A KREEP basalt, was studied with a view toward determining the origin of the poikilitic rocks returned by the Apollo 16 mission. The results of this study support the conclusions of Simonds *et al.* [1] that the poikilitic rocks are crystallized melts containing varying, but minor, proportions of xenoliths and xenocrysts. In 62235, shocked and partially or totally annealed plagioclase grains and aggregates are interpreted as xenocrysts. Some plagioclase-olivine aggregates showing varying degrees of assimilation by the melt are also thought to be inclusions. The rest of the mineral assemblage results from the crystallization sequence which would be expected from a melt.

The first phases to form are Fe-Ni globules, the anorthite cores ( $An_{98-96}$ ) of the larger (.3-.1 mm) plagioclase grains, and one grain of pink chromian pleonaste. They are each surrounded by a reaction rim of later crystallizing phases (bronzite on some Fe-Ni globules, plagioclase on spinel, bytownite ( $An_{89}$ ) on anorthite.) Each of the early phases might also be interpreted as part of the xenocryst assemblage but the euhedral shape of the core anorthite, the symmetrical outward zoning of Fe, Mg and Al in the spinel, and the evidence that Fe-Ni-P globules separate as immiscible liquids from KREEP melts [2] permit the interpretation that these minerals formed from the 62235 melt. The presence of chromian pleonaste at or near the liquidus in a rock of this composition would require initial crystallization at high pressure.

Olivine ( $Fe_{80-75}$ ) occurs as aggregates and single grains subsequently rimmed by bronzite and rarely as small inclusions at the margins of the anorthite cores of the large plagioclase grains. The bytownite ( $An_{86}$ ) forms equant grains .2-.05 mm in diameter as well as rims around the anorthite. Both olivine and bytownite grains contain round and elongate inclusions of devitrified melt a few microns in size. In olivine, the melt inclusions reacted to produce a pyroxene similar in composition to that which rims the olivine, and a potassium-rich residuum (at least 7.1%  $K_2O$ ), probably a mixture of feldspar and glass. The inclusions in plagioclase now consists of a Ti phase (ilmenite?), a P phase, olivine, K-feldspar, and glass. This glass is high in  $SiO_2$  and low in  $Al_2O_3$  (less than 6%). The

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compositions of the inclusions in both plagioclase and olivine suggest that they are the remainders of entrapped samples of the KREEP rich melt from which the other phases were growing. The abrupt change in plagioclase composition and the formation of olivine and new plagioclase grains which crystallized rapidly enough to entrap melt inclusions are interpreted as resulting from a decrease in pressure (magma rise) and a consequent release of the volatiles which formed the numerous vugs in the rock. Similar zoning and melt inclusions in plagioclase due to the pressure drop on eruption occur in terrestrial rocks although the compositional change in the latter is more extreme due to differences in magma composition and volatile content.

Continued crystallization involved reaction between the olivine and the melt to form bronzite ( $\text{En}_{81}\text{Fs}_{16}\text{Wo}_3$ ,  $\text{Al}_2\text{O}_3 > 2.5\%$ ). an increase in the calcium content of the plagioclase rimming both the earlier generations of plagioclase grains, and the formation of new plagioclase nuclei (all  $\text{An}_{93}$ ). When the bronzite reached the composition  $\text{En}_{78}\text{Fs}_{18}\text{Wo}_3$ , with  $\text{Al}_2\text{O}_3$  between 1.84 and 1.64%, the rate of pyroxene growth slowed relative to the rate of plagioclase nucleation, and the pyroxene began to enclose the small plagioclase crystals. Beyond this stage all pyroxene is highly poikilitic. At  $\text{En}_{72}\text{Fs}_{23}\text{Wo}_5$  the bronzite is joined by augite ( $\text{En}_{49}\text{Fs}_{15}\text{Wo}_{36}$ ) as discrete grains in the groundmass and as .01 mm wide lamellae paralleling (100) of the bronzite. Subsequently some of the bronzite continued along a path of increasing Fe-Mg ratio with no change in Ca whereas other grains are rimmed by pigeonite. The ophitic augite and pigeonite in the groundmass are identical in composition to the outer margins of the coarser grains. The groundmass consists predominantly of tiny plagioclase laths associated with the ophitic pyroxene grains, subophitic ilmenite laths, tiny patches of a high K phase, probably K-feldspar, and a P mineral. During the final stage of crystallization, near equilibrium conditions must have obtained as shown by the oriented pyroxene overgrowths, the very limited zoning of the pyroxenes, and the similarity of compositions between the rims of coarse grains and the fine groundmass.

Microscopic examination of sections of poikilitic rock samples 60315 and 65010, which are described in the Fourth Lunar Science Conference Proceedings, reveals many of the same features as 62235. All poikilitic rocks are thus interpreted as possibly crystallizing from a magma erupted from the lunar interior. This interpretation rests on the discontinuous

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plagioclase zoning pattern seen in many of the poikilitic rocks described to date as well as in the more obvious igneous-textured rocks 14310 and 68415 [3], and on the occurrence of melt inclusions in the more sodic plagioclase and in the olivine. The latter are thought to be a second generation of minerals crystallized from the melt rather than grains formed during an initial, rapid quench.

#### References

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