New Data on Lunar Magmatic Processes

Abstract: New data based on a detailed analysis of pyroxene zoning strongly suggests that convection is an important process in lunar magmas. Elardo et al. carefully document irregular oscillatory zoning that is best explained by movement of pyroxene crystals in a convecting magma. Lunar samples that contain such data are rare, but this study should inspire more extensive efforts to further document magmatic processes

This paper by Elardo et al. provides the first convincing evidence for magmatic convection. The Authors document a kind of zoning in pyroxene from a lunar basalt that suggests that magmatic convection is active within the magma chamber in which the phenocrysts crystallized prior to the eruption of this basalt upon the lunar surface. These kinds of features are rare in lunar basalts. The authors do an excellent job of analyzing and interpreting the zoning features in the meteorite. They are correct to state that the oscillatory zoning they observe is not the product of local kinetic processes that control crystallization at the growing interface of pyroxenes. The irregular nature of the zoning bands clearly suggests a more magma wide process such as convection allowing the crystals to grow in varying environments that produce the compositional variations.

We know very little about magmatic processes on the moon because rocks that contain complex magmatic features are rare. Current models for lunar magmatism suggest that there is magma ocean with a feldspathic layer near the lunar surface and concentrations of pyroxene and olivine at depth. To date little evidence has come to light for such processes as convection although intuition would lead us to believe that they must exist. Evidence for such processes have been noticeably absent in lunar rocks with a magmatic origin. This is partly true because these features are rare in basaltic rocks. In addition rocks formed at depth that might also contain such features are rare in the Apollo collection of lunar samples. The addition of lunar meteorites to the mix of samples to study has been a welcome addition. This is a valuable contribution that will further our understanding of magmatic processes in the lunar crust and hopefully encourage more extensive examination of all lunar rocks with a magmatic origin. Only with such detailed studies will we to fully understand magmatic processes on the moon.