

ORANGE GLASSES: REACTION OF MOLTEN LIQUIDS WITH APOLLO 17 SOIL BRECCIA (70019) AND GABBRO (79155), H. K. Mao, A. E. L. Goresy and P. M. Bell, Geophysical Laboratory, Washington, D. C. 20008

Orange glasses similar to the Apollo 17 orange soil (74220) have been discovered as a quenched, frothy coating on the surfaces of soil breccia (70019) and gabbro (79155). The crystal field spectra of these coatings are nearly identical with those measured on the orange soil suggesting that the color is caused by the interaction of the absorption of Fe(II), Ti(III), and Ti(IV). The orange glass coatings exhibit flow banding and are fraught with bubbles and vesicles giving evidence of a gas phase. Compositional variation within the bands has apparently been caused by reaction with the soil and rock to which it adheres. Fine-grain soil covers the outer surface of the glass and obscures its color.

Chemical reaction of the molten liquids with the soil and gabbro can be seen in the remarkable quench texture. Three previously unreported reactions have occurred: 1. Reaction between silicate liquid and armalcolite to form ulvospinel and ilmenite separately; 2. Reaction between silicate liquid and rutile to form zones of armalcolite and ilmenite; 3. Armalcolite appears to have formed by a breakdown of ilmenite accompanied by the production of metallic iron and the release of oxygen. There is a suggestion that implanted solar wind gases played a role in the volatile phase.

This study of orange glasses suggests that a special or unique process for the formation of glass spheres in the Apollo 17 soils is not required. Preliminary data imply that the liquids from which the orange glasses formed were abundant at the Apollo 17 site. There is textural evidence of shock-impact in 70019 and 79155 but this is not necessarily related to the origin of the liquids.

The study of the orange glass coating may provide data with far-reaching implications on the chemical history of the lunar regolith: A. Evidence of the process of formation of a liquid unrepresentative of any known lunar rock type; B. Quenched reactions of molten liquid with components of the regolith; C. Origin and nature of volatiles; D. Characterization of impact and melt processes in the development of the lunar regolith.