A COMPOSITIONAL AND MORPHOLOGICAL STUDY OF APOLLO ASTEROID 4953 (1990MU);  M. S. Kelley and M. J. Gaffey, Dept. of Earth & Env. Sci., Rensselaer Polytechnic Institute, Troy, NY 12180-3590

High resolution spectral data have been obtained for 4953 (1990MU) using the 52-channel double CVF (0.8-2.5μm) system at the Infrared Telescope Facility on Mauna Kea. These were collected during the favorable apparition of this asteroid in June, 1994. The spectra of 4953 (1990MU) exhibit strong 1 and 2μm pyroxene absorption features. They also exhibit a strong feldspar or olivine absorption feature at about 1.4μm. Analysis of these data suggests surface compositional heterogeneity on this asteroid. There is a possible compositional gradient over which olivine content may vary significantly. Two types of surface material are apparently seen on this object. The first, and better characterized, is consistent with basaltic rock containing pyroxene and feldspar with negligible olivine. The second material appears to be a feldspar-pyroxene-olivine mixture in which olivine is a significant component. Two plausible explanations for this are: 1) a large basaltic intrusion into a more primitive (chondritic) country rock, or 2) a contact between crustal and mantle materials.

Lightcurve segments have been extracted from the data which were collected on two consecutive nights. Lightcurve portions obtained contain a segment descending from near maximum to near minimum and a second minimum and its rising limb. Based on these segments, the most likely rotation period of this asteroid appears to be about 6.5 hours.

The strongest band I features (1 and 1.4μm) occur at the deeper of the two lightcurve minima. Composition in this region is consistent with a feldspar-pyroxene-olivine mixture similar to that of H-, L-, or LL-chondrites. The positions of these features are shifted toward longer wavelengths and the band I area is about twice as strong as that of the features occurring near the lightcurve maximum. Close to the lightcurve maximum, the composition appears to be consistent with a feldspar-pyroxene (basaltic) mixture with negligible olivine content.

4953 (1990MU) can be interpreted as a fragment of a basaltic crustal unit from a parent body that was at least partially differentiated. This asteroid may include a second compositional unit of H-, L-, or LL-chondrite composition. Therefore, it may exhibit a compositionally heterogeneous surface. Two possible morphological explanations are: 1) the presence of a large basaltic intrusion into a more primitive starting material, or 2) a boundary between crustal and mantle units. Visible region data obtained within a few days of the near-IR data is being reduced and should enhance the interpretation of this object and will be used to check for the surface heterogeneity.

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