ACAPULCOITE COMPLEXITIES: CLUES FROM TRACE ELEMENT DISTRIBUTIONS. C. Floss[1], [1]Laboratory for Space Sciences and Dept. of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130, U.S.A. (floss@wuphys.wustl.edu)

Introduction: Acapulcoites and lodranites are primitive achondrites from a common parent body that experienced variable degrees of partial melting and melt migration [1,2]. Variations in trace element abundances emphasize the complex processes these meteorites have undergone and indicate that a simple bimodal classification system is inadequate to describe this diverse group of samples [2]. This work reports on the trace element distributions of three new acapulcoites: GRA 98028, NWA 725 and Dhofar 125. These meteorites exhibit features suggesting they may be more primitive than other acapulcoites, including the presence of relict chondrules in GRA 98028 and NWA 725, the absence of large metal-sulfide veins in GRA 98028 and Dhofar 125, and a smaller than typical average grain size in Dhofar 125 [3-5].

Results and Discussion: Individual grains of phosphates, pyroxenes and plagioclase were measured by ion microprobe. GRA 98028 appears to be the least processed of the three samples measured. Trace element (e.g., the REE, Ti, Zr and Y) distributions in the silicates and in merrillite of this meteorite generally fall within fields observed for typical acapulcoites [2], indicating that it has probably not experienced any silicate partial melting.

The trace element abundances of many silicate grains measured in Dhofar 125 also fall within the acapulcoite ranges. However, five apatite grains have high REE abundances with a strongly LREE-enriched pattern and a large negative Eu anomaly. The pattern is similar to that of a single apatite grain measured in the coarse-grained lithology of the anomalous acapulcoite LEW 86220 [6]. This lithology has been interpreted as a basaltic partial melt that migrated from its source region, leaving behind a lodranite residue, and intruded an acapulcoite region of the parent body [1]. REE abundances in the clinopyroxenes and one plagioclase grain also show affinities to their counterparts in LEW 86220. However, the chondritic mineralogy and equigranular texture of Dhofar 125 [4] are significantly different from the coarse gabbroic lithology present in LEW 86220.

NWA 725 shows evidence of more extensive heating that may have included some silicate partial melting. REE abundances in merrillite are lower than those observed in typical acapulcoites, but do not exhibit the LREE-depleted pattern typical of lodranite merrillite grains [2]. Although Ti and Zr abundances in clinopyroxene fall within acapulcoite ranges, LREE and Y abundances in clinopyroxene, as well as in plagioclase, are elevated. This suggests that some redistribution of these elements from phosphates to silicates may have occurred during heating, as has been suggested for ALHA81187 and GRA 5209 [2]. Most notable, however, is the fact that orthopyroxenes from NWA 725 have Ti, Zr and REE abundances that fall within the ranges observed for lodranite orthopyroxenes. In the lodranites, such depletions have been attributed to the formation and removal of silicate partial melts and are consistent with the non-chondritic mineralogies of these meteorites. However, unlike the lodranites, NWA 725 does not appear to be depleted in plagioclase and troilite.

References: [1] McCoy T. J. *et al.* (1997) *Geochim. Cosmochim. Acta 61*, 639-650. [2] Floss C. (2000) *Meteorit. Planet. Sci. 35*, 1073-1085. [3] McCoy T. J. (2000) *Ant. Met. Newsl. 2*, 18. [4] Greshake A. *et al.* (2001) *Lunar Planet. Sci. XXXII*, #1325. [5] Barrat J. -A. (2002) Pers. Comm. [6] Floss C. (2000) *Lunar Planet. Sci. XXXI*, #1277.