MINERALOGY OF 12 LARGE "CHONDRITIC" INTERPLANETARY DUST PARTICLES; Michael Zolensky and David Lindstrom, Planetary Science Branch, NASA Johnson Space Center, Houston, TX 77058.

INTRODUCTION: We report here mineralogical analyses of 12 so-called "chondritic" interplanetary dust particles (IDPs) which were all large enough to permit the measurement of trace elements by instrumental neutron activation analysis (INAA) [1&2]. In practice, this meant particles with minimum diameters of approximately 20 um. This is an important distinction, since it is possible that there are recognizable mineralogical differences between IDPs measuring a few vs. tens of microns.

PROCEDURES: All IDPs were initially irradiated and analyzed by INAA [1&2]. We have already determined that this procedure does not appreciably alter the mineralogical composition of particles (e.g. saponite and serpentine survive). All particles were then embedded in EMBED 812 low-viscosity epoxy, and microtomed into 100nm sections. Microtoming was halted approximately half-way through each particle. We thank Ruth Barrett for cutting many of these sections. The remainder of each embedded particle was microprobed for major element composition. When sufficiently large, individual mineral grains were also probed. Microtomed sections were then examined using a STEM equipped with an EDX analysis system.

MINERALOGY: The table gives the major minerals noted in this study. In addition to those minerals given, most particles contained recognizable glass. Two particles (L2005 Q6 and K8) contain nm-sized magnetite grains decorating their peripheries, probably due to atmospheric heating. However, no particles showed evidence of significant atmospheric ablation.

PHYLLOSILICATES: Nine of the twelve chondritic particles described here contain saponite (a smectite), in amounts varying greatly from one particle to another. L2005 K10 contains a small proportion of saponite, but it ranges, in other particles, up to at least 50%. The observed molar Fe/(Mg+Fe) ratio of this smectite varies from 0.1 to 0.3, in good agreement with unequilibrated chondrites and other chondritic IDPs [3].

Serpentine was found in small amounts in only L2005 15, which contains mainly saponite. This is only the second report of both phyllosilicates from a single chondritic IDP, although such a combination is frequently observed in CI1 chondrites [4&5].

SULFIDES: Pyrrhotite and pentlandite are common phases in all chondritic IDPs examined. They dominate L2005 K10. Typically, sulfide grains in IDPs consist of either pyrrhotite or mixtures of pyrrhotite and pentlandite, but occasional free pentlandite grains are also found. Sulfide grains are generally anhedral, range up to 8um in diameter, and are surrounded by phyllosilicate fibers and poorly crystalline flakes.

ANHYDROUS SILICATES: Olivines and pyroxenes were seen in half of the characterized particles, and may be present in minor amounts in the remainder (all hydrous) as well. Where it was possible to perform analyses, olivines in these hydrous IDPs were found to range in composition from Fo76 to Fo100. Enstatites range from En89 to En95. Augite was found in three particles. Plagioclase crystals (up to 0.8um in diameter) were found in the unusual particle L2005 K10. This may be the first report of plagioclase in a chondritic IDP.

CLASSIFICATION: We have resisted discussing separately the silicate mineralogy of the hydrous and anhydrous chondritic particles because several have mineralogies which may defy application of the current IDP classification scheme. Particle L2005 L2 contains saponite, but consists predominantly (~70%) of glass. The saponite in L2005 L2 is very poorly crystalline, and sulfides may be the most abundant crystalline phase anyway. Particle L2007 15 contains both saponite and serpentine, although the former greatly predominates. Particle L2005 K8 contains enstatite, but consists mainly of glass with an olivine composition (Fo76). Particle L2005 K10 contains abundant olivine and pyroxene, but also plagioclase and minor saponite (there is at least no serpentine). If classification is to be made on the basis of the dominant crystalline silicate phase then these particles break down thus: **Saponite**-L2005 P17, L2005 K2, L2005 K7, L2005 Q6, L2005 Q2, L2005 K9, L2007 15 and L2005 L2; **Serpentine**- none; **Pyroxene**- L2005 C31 and L2005 K8; **Olivine**: L2005 C32 and L2005 K10.

DISCUSSION: Compared with a previous estimate by Bradley [6], where saponite-class IDPs accounted for 40% of all samples, we find that they account here for 66%. Our sample set is only half as large as Bradley's, but if the differences are not due to statistics they may indicate that saponite IDPs predominate at larger sizes; our particles were selected on the basis of "chondritic" composition and large size.

Finally, we note that although successful comparisons have been made between saponite IDPs and altered CV3, CO3 and type 3 unequilibrated ordinary chondrites [3], we have recently become aware of additional similar extraterrestrial material. Carbonaceous clasts contained within certain meteorites (the Bholghati howardite, LEW 85300 polymict eucrite and Kaidun carbonaceous breccia for example) have similar (and locally identical) mineralogies to saponite chondritic IDPs [5; M. Zolensky, unpublished data]. These clasts obviously originated on parent bodies with wide-ranging orbits, to permit them to interact with the parent bodies of howardites, eucrites and chondrites, and might make logical sources for saponite chondritic IDPs.

REFERENCES: [1] Lindstrom et al. (1990) LPSC XXI, 700-701; [2] Lindstrom et al. (1991) LPSC XXII, this volume; [3] Thomas et al. (1990) Meteoritics **25** (Meteoritical Soc. Abstract 1990), in press; [4] Zolensky and McSween (1988) in Meteorites and the Early Solar System, 114-143; [5] Zolensky et al. (1991) LPSC XXII, this volume; [6] Bradley (1988) GCA **52**, 889-900.

TABLE 1 COMPARISON OF THE MINERALOGY OF 12 LARGE CHONDRITIC IDPS

PARTICLE	ANHYDROUS SILICATES (MAX. SIZE)	HYDROUS (MAX-SIZE)	SULFIDES	OXIDES	MISC
L2005 P17		SAPONITE: CYLINDRICAL (40NM) FLAKES (70NM) FIBERS	PYRRHOTITE (RARE) (200NM)		
L2005 K2		SAPONITE: FLAKES (60NM) FIBERS	PYRRHOTITE (ABUNDANT) (240NM)		
L2005 K7		SAPONITE: FLAKES (70NM) FIBERS	PYRRHOTITE AND PENTLANDITE (600NM)	MAGNETITE (400NM)	
L2005 Q6		SAPONITE: FLAKES (50NM) FIBERS	PYRRHOTITE (400NM)	MAGNETITE (HEATING)	
L2005 Q2	ABUNDANT GLASS	SAPONITE: FLAKES (80NM)	PYRRHOTITE (2,500NM)		
L2005 K9		SAPONITE: FLAKES (120NM) FIBERS	PYRRHOTITE AND PENTLANDITE (400NM)		
L2007 15	ENSTATITE AUGITE	SAPONITE: FLAKES (150NM) FIBERS SERPENTINE (RARE)	PYRRHOTITE AND PENTLANDITE (8,000NM)	MAGNETITE	
L2005 L2	FORSTERITE Fo100 (650NM) ENSTATITE	SAPONITE: POORLY-XLINE	PYRRHOTITE AND PENTLANDITE (80NM)	CHROMITE (150NM)	
L2005 K10	OLIVINE Fo76 (300NM) ENSTATITE En89 (1,200NM) AUGITE En68Wo23 (250NM) PLAGIOCLASE An<94 (800NM)	SAPONITE: RARE FIBERS	PYRRHOTITE AND PENTLANDITE (250NM)		BRUCITE?
L2005 C32	FORSTERITE Fo91 (150NM) ENSTATITE-AUGITE (1,200NM)		PYRRHOTITE (100NM)		
L2005 K8	ENSTATITE En80-92 (200NM) ABUNDANT GLASS		PYRRHOTITE AND PENTLANDITE (100NM)	MAGNETITE (HEATING)	
L2005 C31	ENSTATITE En95Wo3 (1,000NM) ABUNDANT GLASS		PYRRHOTITE (250NM)		