THE SHAPES OF OPAQUE GRAINS OF PRIMITIVE ACHONDRITES AND THE DIFFERENTIATION OF PRIMITIVE ACHONDRITES; K. Yugami, H. Takeda, and M. Miyamoto, Mineralogical Institute, Graduate School of Science, University of Tokyo, Hongo, Tokyo 113, Japan.

The opaque minerals (mainly FeNi metal and troilite) of acapulcoites and lodranites have interesting complex shapes. We studied the tendency of these grain shape changes of metals in five samples, Acapulco, Allan Hills (ALH) 77081, ALH78230, Elephant Moraine (EET) 84302 and Yamato (Y) 791491 by measuring the area and outline length of the opaque grains. We found that the complexities of opaque grain shapes have some relevance to modal abundances of minerals and a formation which assumes migration of melt through grain boundaries for the metal growth of the samples. Large opaque grains with very complex shapes in EET84302 suggest that the heterogeneous distributions of materials are resulted from movements of melts through grain boundary. If we advance this process one step further, iron meteorite with silicate inclusions may be formed by joining the metal grains within the same parent body of acapulcoites and lodranites.

Introduction. Primitive achondrites include sub-groups: acapulcoites, lodranites, winonaites and silicate inclusions of iron meteorites. The oxygen isotopic compositions indicate that acapulcoites and lodranites (AL) are from the same parent body, and that winonaites and silicate inclusions of IAB iron meteorites (WI) are not from the parent body of AL [1]. No iron meteorite was found in the AL group, but it is possible that iron meteorites can be formed within the AL body. The AL group includes meteorites of various modal abundances of minerals and textures. Their opaque minerals are FeNi metal and troilite and accessory chromite. They often coexist within one opaque grain. The opaque grains have complicated shapes. The complexity of opaque mineral shapes varies from meteorites to meteorites. We measured the area and outline length of the opaque grains of five meteorites in the AL group to represent the complexity of the shape of an opaque grain by a numerical value.

Samples and Method. We studied five meteorites in the AL group, Acapulco, ALH77081, ALH78230, EET84302 and Y791491. Acapulco, ALH77081 and ALH78230 are acapulcoites. Y791491 is a lodranite. EET84302 has acapulcoite-like modal abundances of silicate minerals and lodranite-like large grain size. We took photomicrographs of polished thin sections of these meteorites with transmitted light and measured the area (S) and the outline length (L) of five grains per one meteorite. S/L^2 is used to indicate the complexity of the grain shape. The smaller S/L^2, the more complex the grain is. If the grain boundary is a circle, $4\pi \times S/L^2=1$.

Results and Discussion. The measured data (Table 1) are compared with the amounts of plagioclase and metal including opaque minerals (FeNi+FeS+schreibersite) (volume percentage) [2-4]. ALH77081 is the smallest in the opaque grain size and in the total amount of opaque minerals, and the largest in S/L^2. EET84302 is the largest in the opaque grain size and in the total amount of opaque minerals, and the smallest in S/L^2. These data plotted in Fig. 1 shows a

OPAQUE GRAIN SHAPES OF PRIMITIVE ACHONDRITES: Yugami K. et al.

tendency that the samples with larger S/L^2 are plotted at farther points in the plagioclase-metal plane. The opaque grains of EET84302 have extremely complex shapes. They often almost surround silicate grains. It is well known that EET84302 has heterogeneous distribution of minerals [2]. One area is a lodranite-like area with major orthopyroxene and chromite, and other areas are rich in metal and plagioclase [2]. If the segregation of metal grains proceeds one step further, the metal grains will be connected, resulting in an iron meteorite with silicate inclusions. The migration of metal melt through the boundaries of silicate grains can make the shapes of metal grains complex. The complexities of shapes of opaque grains keep the records of differentiation of these primitive achondrites.

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References: [1] Clayton R. N. et al. (1992) *Lunar Planet. Sci.* **23**, 231-232. [2] Takeda H. et al. (1994) *Meteoritics* **29**, 830-842. [3] Yugami K. et al. (1995) *Proc. 27th ISAS lunar and planetary symp.*, in press. [4] Palme H. et al. (1981) *Geochim. Cosmochim Acta* **45**, 727-752.

Table 1.

	ALH77081	Y791491	Acapulco	ALH78230	EET84302
$4\pi \times S/L^2$	0.77	0.706	0.64	0.59	0.312
Metal (vol%)*	10.2	29.5	26.3	10.1	29.7
Plagioclase (vol%)*	16.8	0.25	8.8	12.9	12.6
Average S (mm^2)**	0.045	0.19	0.14	0.10	0.68

Metal = FeNi+FeS+schreibersite.

* Data from [2-4]. ** Average area of 5 opaque grains.

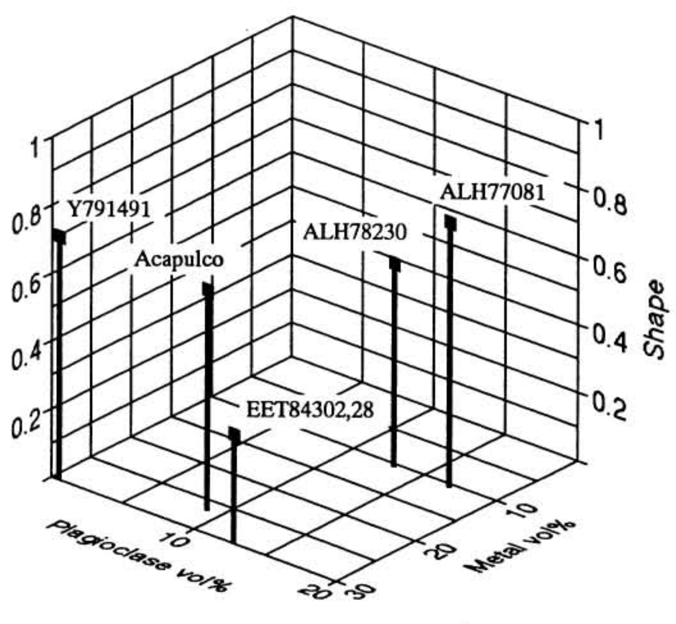

Fig. 1. $4\pi \times S/L^2$ and metal and plagioclase vol% of 5 primitive achondrites (data in Table 1) plotted in one figure. Shape = $4\pi \times S/L^2$.