HARDNESS AND SHAPE IRREGURARITY OF METALLIC PARTICLES IN ANTARCTIC ORDINARY CHONDRITES.

Fujii,N. (1), Y.Horii (1) and H.Takeda (2)

(1) Dept. of Earth Sciences, Fac. of Sci. Kobe Univ., Kobe 657, Japan.
(2) Mineralogical Institute, Univ. of Tokyo, Bunkyo, Tokyo 113, Japan.

Shock effects recorded in meteorites are generally heterogeneous due mainly to the heterogeneous mechanical properties such as pores and matrices at the grain boundaries even in micro- to milli-meter scale. Most of shock effects in chondrites have been described by mineralogical and/or petrochemical approaches [1,5]. An attempt to characterize quantitative shock effects in metallic minerals is made for shock-melted LL-chondrites (Y-790345, Y-790519 and Y-790964) and H-chondrite (Y-82163) by using the Micro Vickers Hardness with as small pit as possible, together with the shape analysis of metallic grains [3].

Fig. 1 summarizes all the hardness values obtained, in which each pit is 3 to 10 microns and at least three points are measured for each grain. Names of chondrites with a symbol # are shock-melted and others are ordinary chondrites (hereafter referred as 'unshocked'). Fig. 2 shows hardness values of *Fe-Ni* grains as a function of *Ni* content. Hardness values of kamacites varies considerably and no correlation with *Ni* content is observed. In contrast, hardness of taenites obviously increases with *Ni* content except a few grains, which are always covered by *FeS* indicating high temperature experienced. Fig. 3 is a sketch of pores and metallic grains in shock-melted LL-chondrite (Y-790964), which shows preferential melting of plagioclase rich components [4] possibly due to planetesimal-scale collision [6]. Fig. 4 shows distribution of hardness values based on about 45 measurements in a taenite grain indicated by a circle with a short arrow in Fig. 3 and closed diamond with a vertical bar in Figs. 2 and 5. By using a divider method [2], fractal dimension of each metallic grain perimeter is calculated. In Fig. 5, hardness values *vs* fractal dimensions are shown for kamacites in H-chondrites (left) and taenites in LL-chondrites (right), respectively.

Although the number of measurements and chondrites studied is limmited, several features may be pointed out: (1) Values of the Vickers Hardness of kamacites in shock-melted chondrites are rather uniform with respect to variations of fractal dimension in contrast to those of unshocked chondrites. Due to shock-induced high temperatures, deformations of kamacites would be annealed and constrained by circumferential silicate grain boundaries. (2) Taenites in shock-melted LL-chondrites show decrease of hardness values with fractal dimension increases, although *Ni* content would effect the values of hardness as seen in Fig. 2. Further investigations of hardness and morphology as well as chemical and mineralogical studies will become more quantitative clues of shock effects in meteorites.

References:

[1] Dodd, R.T. (1981) *Cambridge University Press, Cambridge*, 432p.
[2] Fujii, N. and T. Nakano (1988) *Jouhou Chishitsu*, **13**, 119-139, (in Japanese).
[3] Horii, Y., N. Fujii and H. Takeda (1989) *Proc. NIPR Symp.*, **3**, (submitted).
[4] Miyamoto, M., H. Takeda, and T. Ishii (1984) *J. Geophys. Res.*, **89**, 11581-11588.
[5] Sears, D.W. et al. (1984) *Geochim. Cosmochim. Acta*, **48**, 343-360.
[6] Takeda, H. (1989) *Earth Plant. Sci. Lett.*, **93**, 181-194.

HARDNESS AND SHAPE IRREGURARITY
Fujii,N., Y.Horii, and H.Takeda

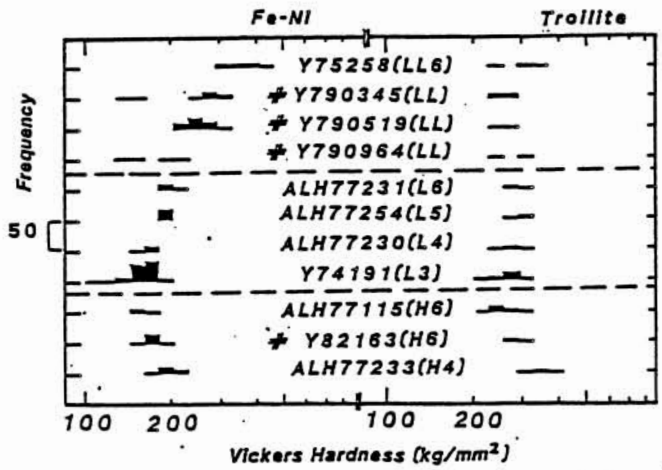

Fig. 1. Hardness of Metallic grains in chondrites.

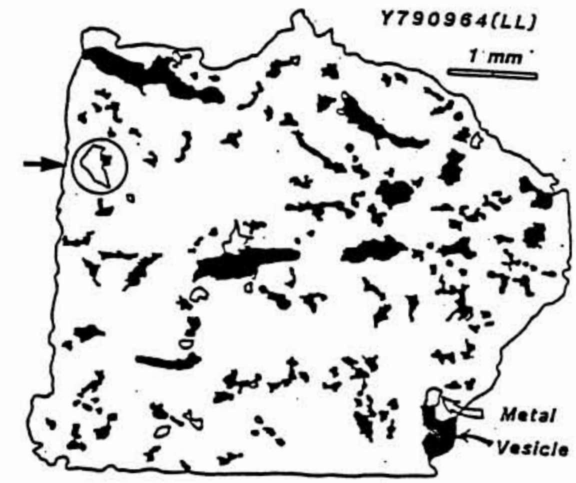

Fig. 3. A sketch of polished surface of shock-melted LL chondrite (Y-790964). Open and closed areas indicate metallic grains and vesicles, respectively.

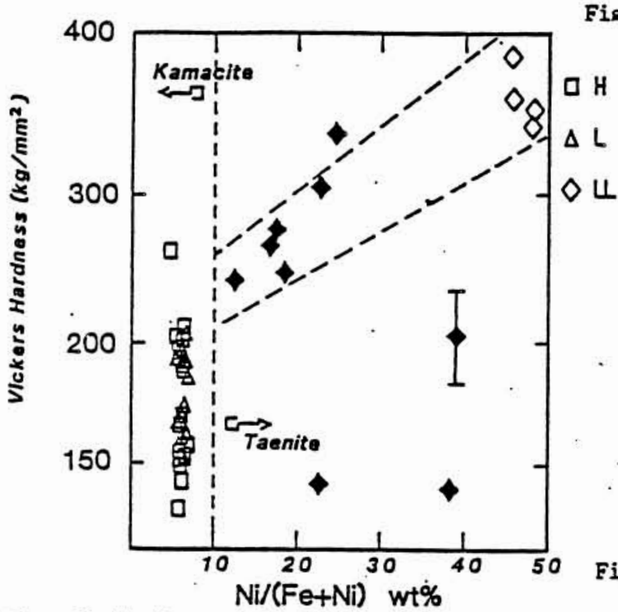

Fig. 2. Hardness values vs Ni contents.

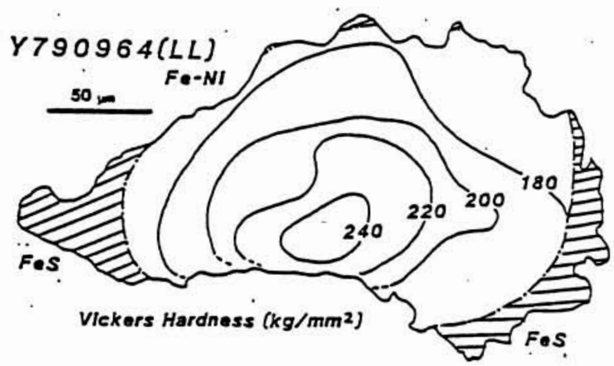

Fig. 4. Distribution of hardness values based on about 45 measurements in a taenite grain in Y-790964.

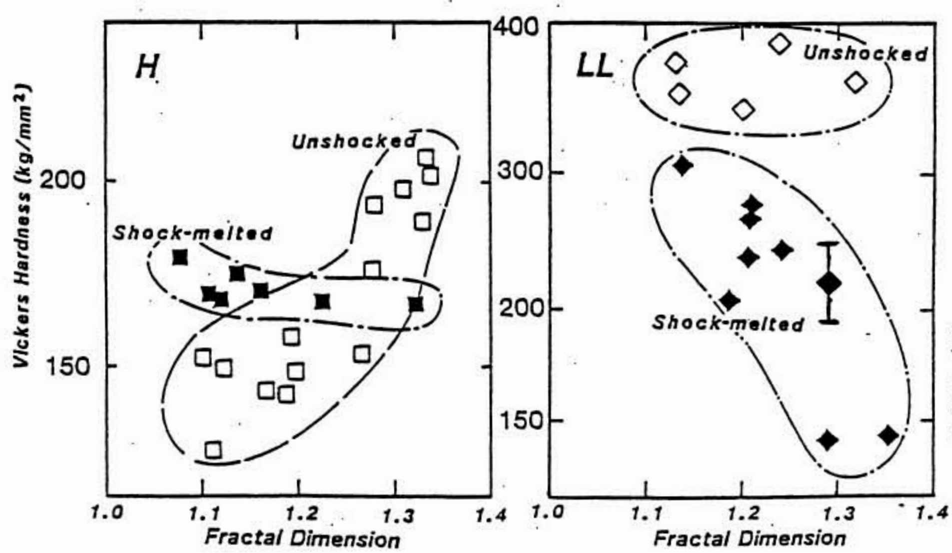

Fig. 5. Vickers Hardness vs fractal dimention for kamacites (left) and taenites (right).