COMET-LIKE GRAND-PARENT BODIES FOR SHOCK ORIGIN OF ORDINARY CHONDRITES; M.Kitamura[1], and A.Tsuchiyama[2], (1) Dept. Geol. Mineral., Kyoto Univ., Kyoto 607, Japan, (2) Coll. General Education, Osaka Univ., Toyonaka 560, Japan.

Shock origin of ordinary chondrites has been suggested by the fact that relict minerals in chondrules have specific microtextures produced by shock events, such as high dislocation densities [1,2]. In fact, textures and chemical compositions similar to chondrules and fine grained aggregates were reproduced by shock melting experiments of porous materials [3]. Matrix in chondrites is also explained as clastic fragments and vapor condensates by the shock event. Thus, it is considered that most constituents of chondrites (chondrules, matrix, and mineral fragments) were formed by a shock event of solid precursor materials forming a grand-parent body, and a parent body of chondrite was reconstructed by following accretion. In the present paper, an ice-dust (comet-like) body is proposed as a possible model for the grand-parent bodies of chondrites.

Following conditions which are related to the shock origin were considered here.
(1) The shock experiments show that starting materials should be more porous than chondrites to produce abundant shock melts. Thus, a grand-parent body should be more "porous" than chondrites. However, porosity of a parent body reconstructed by the following accretion, should decrease in general. This discrepancy can be solved if the grand-parent body consists of a mixture of highly volatile solids (e.g., ice) and refractory solids (silicates, metals, sulfides, and others), because the highly volatile solids vaporize easily and can act as "pores" during the shock deformation.
(2) When a solid rock was shocked and brecciated, the brecciated fragments should have a wide variation in size. On the other hand, the constituents of chondrites, such as chondrules, do not show such a wide variation. This suggests that shock waves in the grand-parent body propagated rather homogeneously throughout the body, like in the case of "vapor explosion". Then, the grand-parent body should consist of a mixture of the "ice" and "dust".
(3) The Mg/Fe ratios of silicates in chondrules and matrix of ordinary chondrites indicate that they were formed under more oxidized conditions than that expected from the solar abundance. This oxidized conditions can be explained by vapor produced by the shock event from "ice" mainly composed of H_2O in the grand-parent body.
(4) Chondrites generally have no melt pockets by shock events, indicating no significant shock events after the formation of chondrites. However, probability of collision of small planets to the body should not change significantly before and after the formation of chondrites. Therefore, the shock event of the chondrite formation must occur only once under specific conditions which are characteristic not of the parent body but of the grand-parent body. These conditions are considered to be (i) the grand-parent body contains "ice", and (ii) a large amount of

vapor produced by the shock event from the "ice" escaped during the accretion of solids.
(5) The relative abundances of rare gases in most chondrites are similar to those in the terrestrial atmosphere (e.g., [4]). This planetary type abundances are expected in the "ice", and more rare gases are included in "ice" than "dust". Accordingly, if such relative abundances were not changed largely by the shock event, the ice-dust mixtures can also explain the abundances of rare gases in chondrites.

As discussed above, a comet-like grand-parent body composed of highly volatile solids (ice) and refractory solids (silicates, metal, sulfides, and others) explains characteristics of ordinary chondrites well. A simple calculation shows that when two comet-like bodies collided head-on each other with 10^4m/sec, most of the H_2O ice can vaporize, and some of silicates and metal melt or vaporize. This calculation supports the above discussions.

The following processes were possible for the chondrite formation. A comet-like body was formed by accretion of dusts and ice in the primordial nebula. Probably, fractionation of refractory elements in the dusts had taken place by condensateion or vaporization prior to this process. This comet-like grand-parent body was exploded with instantaneous vaporization of "ice" by collision. Melting and vaporization of some silicates, metal, and sulfides took place by heating due to adiabatic compaction of the gas from the "ice". Chondrules were formed from these melted materials. Because it is reasonable to assume heterogeneous distribution of temperature chondrules with various textures and fine grained aggregates were formed from partially and completely melted states. A part of matrix was formed by condensation for the vaporized materials. Clastic fragments were also formed due to the heterogeneous distribution of temperature. Finally a chondrite parental body was formed by accretion of these materials. Deficiency of volatile elements in chondrites (e.g., [4]) is also explained by loss of these elements as gas molecules. Autometamorphism model of ordinary chondrites [5] are also explained easily by the present model.

References: [1] Watanabe, S. *et al.* (1984) *Mem. Natl. Inst. Polar Res., Spec. Issue*, **35**, 200-209. [2] Kitamura, M. and Watanabe, S. (1989) 14th Symposium on Antarctic Meteorites (abstract) 73-74. [3] Kitamura, M. *et al.* (1989) 14th Symposium on Antarctic Meteorites (abstract) 75-77. [4] Wasson, J. T. (1985) "Meteorites", W.H.Freeman and Co., N.Y. pp.267. [5] Watanabe, S. *et al.* (1987) *Eath Planet. Sci. Lett.*, **86**, 205-213.