largely theoretical considerations. There are also some observable characteristics of the main-belt and Earth-approaching asteroid populations (size distribution, Hirayama families, spins and shapes) and of cratering records on the moon and the Earth that are helpful.

Crucial issues include the following: (1) To what degree are meteorites derived from Earth-approachers or from main-belt asteroids? (2) Are they derived primarily from giant collisions, from a hierarchy of collisions, or from cratering impacts? (3) Are asteroids of various sizes primarily rocky or "gravelly," and what effect does such structure have on their response to collision and on their ability to generate meteorites? (4) How is collisional energy and momentum partitioned into the quantity, velocity, and size-distribution of ejected fragments? My perspective on these questions is based on developments of the Greenberg/Chapman scenario (*Icarus*, in press), which emphasizes the role of smaller (cratering) collisions of the larger main-belt asteroids in producing meteorites. While these problems are very interesting and merit further study by several kinds of interdisciplinary approaches, I believe we may have to await spacecraft investigation of main-belt asteroids and Earth-approachers before a firm consensus can be developed on all of these issues.

A SEARCH FOR PRIMORDIAL Pb IN IRON METEORITES

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This report is on our efforts to identify and measure primordial lead (PAT) in iron meteorites. We previously found variable Pb isotopic composition in several iron meteorites after etching the surface of the meteorites to remove terrestrial contamination (Chen and Wasserburg, 1983). A first leach of Canyon Diablo (IA) metal (CD Ext., Fig. 1) has a factor of 10 higher Pb concentration and more radiogenic Pb than the interior (Fig. 2). $^{204}Pb/^{206}Pb$ of the interior metal is ~ 5‰ less than a troilite (CDT) reported by Tatsumoto *et al.* (1973). That is a very good estimate of PAT. A troilite-graphite nodule (Fig. 2) from Canyon Diablo was analyzed by us and gave $^{207}Pb/^{206}Pb$

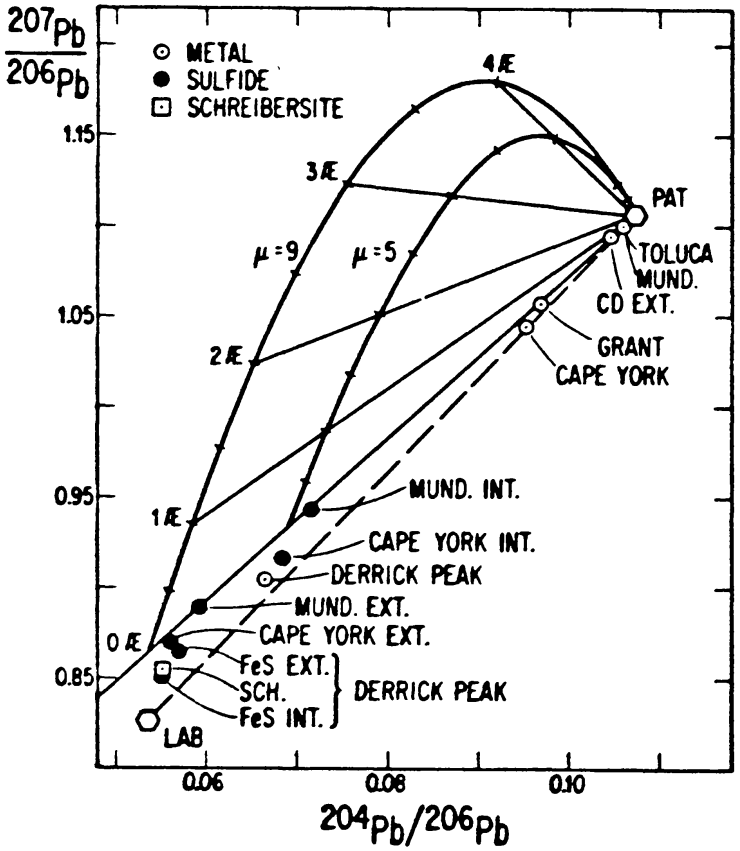

Fig. 1

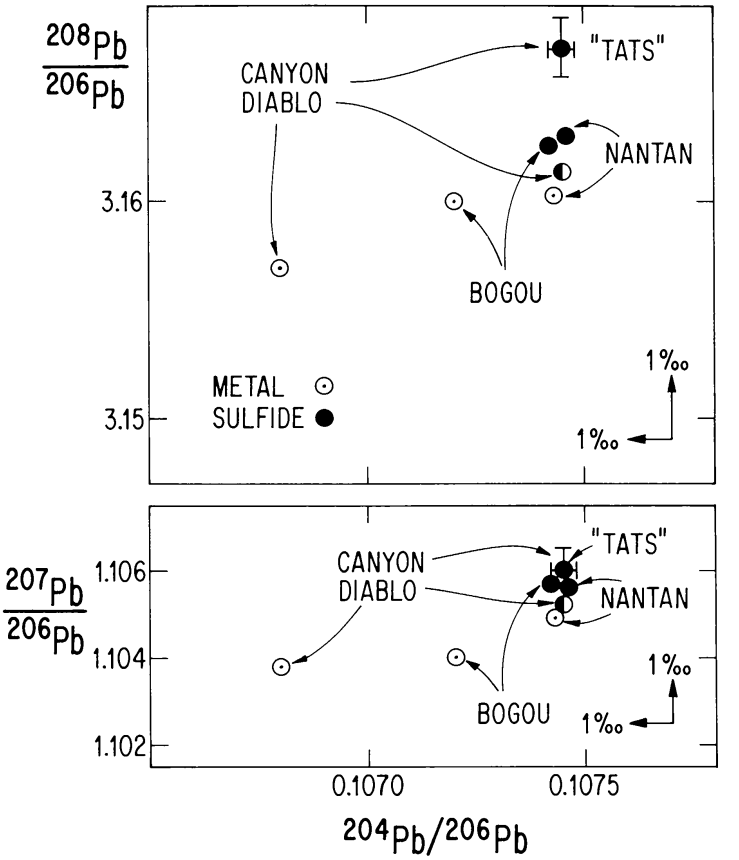

Fig. 2

(β/α) and $^{204}Pb/^{206}Pb$ (l/α) the same within errors as found in Tatsumoto *et al.* (1973). The Pb isotopic composition from both metal and troilite from Nantan (IIICD) are also indistinguishable from the most primitive Pb found in CDT. However, $^{208}Pb/^{206}Pb$ (γ/α) in Nantan and our Canyon Diablo samples are 1.5-2‰ lower than reported by Tatsumoto *et al.* (1973). The difference in γ/α cannot be attributed to mass fractionation. Toluca (IA) metal gave $l/\alpha \sim 12$‰ lower than that of PAT. Pb in the metal of Mundrabilla (UN) is slightly radiogenic and identical to that found for Toluca metal; however, the troilite Pb is highly radiogenic. The exterior of the troilite has more radiogenic Pb and the Pb content is ~ 70 times greater than the interior. The wide variation in Pb isotopic composition in different phases of Mundrabilla had also been found in Cape York (IIIA) and Derrick Peak (IIB). The Pb isotopic ratios in metal, sulfide and schreibersite of Derrick Peak are variable and plot close to that for modern terrestrial Pb (e.g., LAB, Fig. 1). All data reported here plot between a 4.56 AE isochron and a line connecting LAB and PAT. It is evident that substantial fractions of Pb in different phases of many iron meteorites may contain "modern" radiogenic Pb. While acid etching appears to remove Ag contamination, and reveal $^{109}Ag^*$ (cf. Grant, Cape York, and Derrick Peak), it appears that this procedure does not completely remove radiogenic Pb. As all meteorites mentioned above are "finds," it is possible that part of the radiogenic Pb was added during a long terrestrial exposure. We therefore analyze metal and troilite from Bogou (IA) (a "fall"). The Pb in Bogou troilite is identical to that found for CDT (Fig. 2), and is more primitive than reported by Oversby (1970). The Pb content in Bogou metal is ~ 210 times less than that in the troilite and $1/\alpha$ ratio is 2.5‰ less. In summary, all data reported here are compatible with a well-defined primordial Pb PAT. The l/α and β/α values determined here for PAT agree with that reported previously (Tatsumoto *et al.*, 1973), but γ/α is 1.5-2‰ less. Most iron meteorites contain "modern" lead which is very penetrative and tightly bound.

Div. Cont. No. 3927(446).

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