WORLDWIDE SIZE DISTRIBUTION OF SHOCKED QUARTZ AT THE K/T BOUNDARY: EVIDENCE FOR A NORTH AMERICAN IMPACT SITE; B. F. Bohor and G. A. Izett, U.S. Geological Survey, Box 25046, Denver, CO 80225

The discovery of shocked quartz grains at the K/T boundary in Montana (1-3) provided conclusive mineralogical evidence that a large asteroid struck Earth 66 m.y. ago in accord with the Alvarez impact hypothesis. A worldwide search for shocked quartz at K/T boundary sites (4) confirmed the association of shocked quartz with positive iridium anomalies as indicators of an extra-terrestrial impact powerful enough to disperse impact ejecta globally. Shocked minerals have been identified in North America (4 sites), Europe, (5 sites), New Zealand, and the North Pacific. Determination of the size of shocked minerals at these sites might narrow the search for the location of the K/T boundary impact. Using a petrographic microscope, we searched for and measured the largest grains of undoubted shocked quartz in clay-free separates mounted in immersion oils. The identification criterion for shocked quartz was the presence of multiple intersecting sets of shock lamellae. Izett and Pillmore (5, 6) recently discovered shocked feldspar grains at the K/T boundary in the Raton Basin, but shocked feldspars are difficult to identify in grain mounts in immersion oil and their size was not measured in this analysis.

Table 1 gives the results of our preliminary size measurements. Because of the small number of shocked quartz grains in the samples used, we are not sure that the measured maximum diameters represent the true maximum diameter, especially at sites outside of North America where shocked quartz is rare. If the size distribution of impact ejecta reflects a dispersal and settling function, analogous in some respects to that for the dispersal of ash following large pyroclastic eruptions as suggested by Izett and Pillmore (6) and French (7), then the results suggest an impact in North America (fig. 1). Our data show that the maximum size of shocked quartz decreases away from sites in North America, indicating a strike in the higher latitudes of this continent. On the basis of mineralogic evidence, Izett and Pillmore (6) suggested that the asteroid struck an area of highly silicic target rocks and speculated, as did French (7) earlier, that the Manson, Iowa impact structure might be the location where the Alvarez asteroid struck. Considerable uncertainty exists relative to the size, composition, velocity, and the angle of incidence of the Alvarez asteroid and, accordingly, the diameter of the resulting crater is highly speculative. Despite these great uncertainties, some believe that the Manson impact structure is too small. A possibly more suitable candidate for the impact site on the basis of size, location, and target rock type is the Nastapoka arc structure on the east shore of Hudson Bay, Canada. However, present geological data do not support the idea that this structure is of impact origin.

REFERENCES: (1) Bohor, B. F., (1983) Prog. with abstracts, 20th Ann. Meet., Clay Min. Soc,. (Dept. of Geol. Sci., SUNY), p. 48; (2) Bohor, B. F., Foord, E. E., Modreski, P. J., and Triplehorn, D. M. (1984a) LPSC XV, pt. 1, p. 74-75; (3) Bohor, B. F., Foord, E. E., Modreski, P. J., and Triplehorn, D. M. (1984b) Science, v., 224, no. 4651, p. 867-869; (4) Bohor, B. F., Foord, E. E., and Modreski, P. J., (1985) LPSC XVI, pt. 1, p. 80-81; (5) Izett, G. A., and Pillmore, C. L., (1985a) Abs. with Programs, GSA Ann. Meet., v. 17, no. 7, p. 617; (6) Izett, G. A., and Pillmore, C. L., (1985b) EOS, v. 66, no. 46, p. 1149-1150; (7) French, B. M. (1984) Science, v., 226, p.353; (8) Smith A. G., and Briden, J. C., (1977) Cambridge University Press, 63 p.

Table 1.--Maximum size and relative abundance of shocked quartz grains from the K/T boundary in North America, Europe, the North Pacific Ocean, and New Zealand

Location	Maximum grain size (millimeters)	Ratio of shocked to unshocked quartz grains
Raton Basin, Colo., and N. Mex.	0.58	High
Brownie Butte, Mont.	.50	High
Red Deer Valley, Alberta	.52	High
Morgan Creek, Saskatchewan	.40	High
North Pacific Ocean (GPC-3)	.16	High
Stevns Klint, Denmark	.15	Low
Nye Klov, Denmark	.18	Low
Petriccio, Italy	.19	Low
Pontedazzo, Italy	.12	Low
Caravaca, Spain	.11	Very Low
Woodside Creek, New Zealand	.11	Very Low

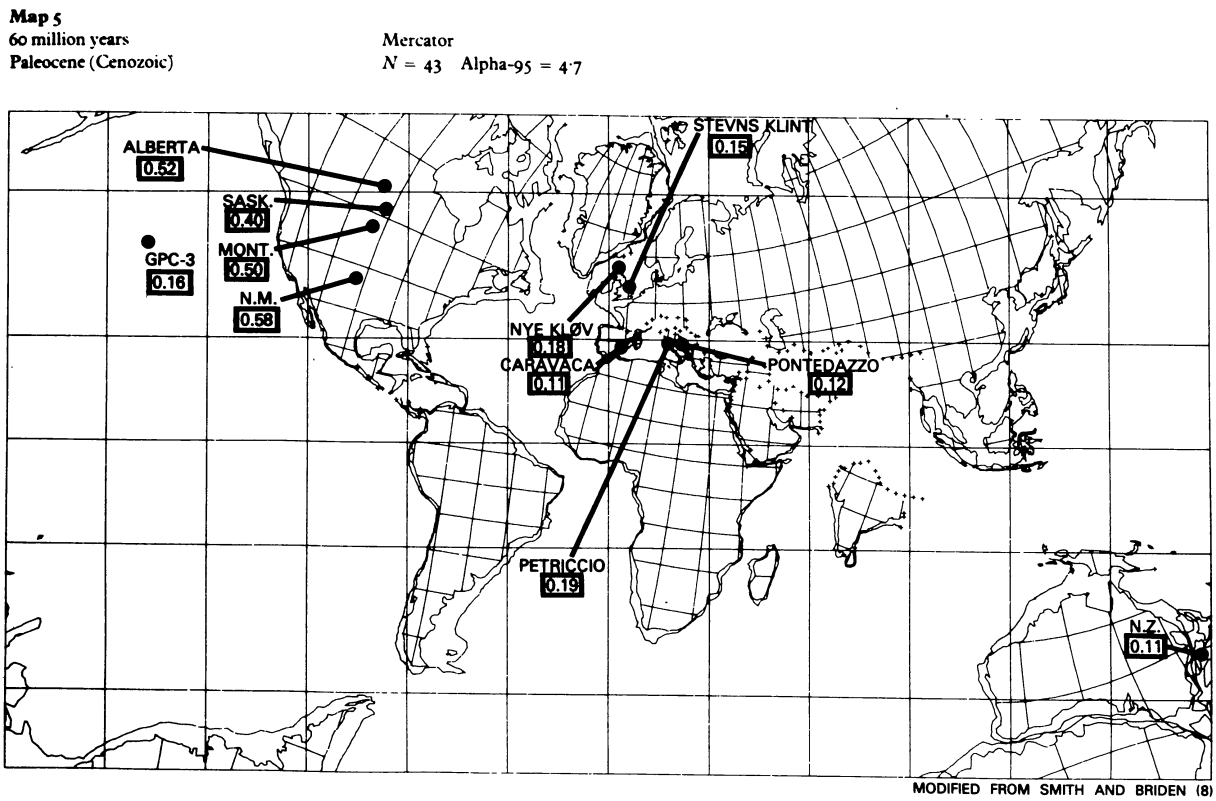

Fig. 1--Paleogeographic world map during Danian time showing the maximum grain diameters (in millimeters) of shocked quartz at K/T boundary sites