TROJAN ASTEROIDS: A UNIQUE FRONTIER IN SPACE RESEARCH,

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Trojan asteroids comprise two swarms of asteroids that are dynamically independent from the asteroid belt. Calculations indicate that they had a different collisional history and recent observations indicate that they have quite different physical properties, on average, that may mark them as a "missing link" between ordinary rocky belt asteroids and comets.

Calculations of collision rates indicate that the Trojans, by virtue of low number density and low relative velocity, have only a few percent the rate of collisions presently experienced in the belt. These numbers suggest that the Trojans may not have evolved as far in terms of collisional fragmentation as the belt, and raise the possibility of survival of some moderate-sized members from their initial accreted state.

The zonal distribution trends of spectrophotometric class with solar distance continue from the belt into the Trojan swarms. The Trojans are extremely low-albedo (~4%) objects like those of the outermost belt, but extend the low-albedo asteroids' trend toward redder colors with increasing solar distance. Roughly 2/3 of Trojans are class D, a very red, low albedo type virtually absent in the belt (Gradie and Veverka, 1980; Gradie and Tedesco, 1981; Hartmann et al. 1982, 1987a; Vilas and Smith, 1985). Most of the rest are class P, of the same albedo but intermediate in color between the red D's and the neutral-colored C's that dominate the outer belt. The most interesting thing about these statistics is that D's and P's have albedo and color overlapping the range measured for comets nuclei, including Halley. They may thus mark a type of outer solar system planetesimal related to comets.

New lightcurve observations and analysis by Hartmann et al. (1987, 1987)together with older data (e.g. French et al. 1986) show that a sample of 19 Trojans has a significantly greater number of high amplitude light curves than found among belt asteroid samples. Trojans appear to have a greater fraction of very elongated shapes. The largest Trojan, 624 Hektor, with a light ratio 3.0:1 in the equatorial plain, is just one example. It has been suggested to have a dumbbell, "compound asteroid" or contact binary shape. Hartmann et al. (1987, 1988) suggest that the Trojans as a group may represent much more well-preserved primordial accretion products than belt asteroids, with more irregular shapes resulting from the accretion process.

Calculations on dynamical history and observations of a smaller sample of objects suggest that the Hilda asteroids, outliers of the main belt, also have a lower collisional rate and more elongated shapes. Hilda 2483 Guinevere, with a lightcurve amplitude of at least 3.4 and mean diameter ~50 km, is an example.

Thus, spacecraft observation of representatives of the planetesimal population in the solar system will be far from complete even after the Halley encounters and encounters with a few Earth-approaching or belt asteroids. The Trojans represent a distinct population that may provide

clues about the earliest processes of accretion of planetary objects. Closeup observations of Trojans would clarify an important type of composition (spectral class D) and may reveal examples of unusual shapes not encountered elsewhere.

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REFERENCES

French, L., M. Kramer, and H. Vargas S. (1986). B.A.A.S **18**, 796-797.
Gradie, J. and E. Tedesco (1982). Science **216**, 1405-1407.
Gradie, J. and J. Veverka (1980). Nature **283**, 840-842.
Hartmann, W., D. Cruikshank, and J. Degewij (1982). Icarus **52**, 377-408.
Hartmann, W.K. (1987a). Abstracts, Meteoritical Society Meeting.
Hartmann, W.K. (1987b). Icarus **71**, 57-68.
Hartmann, W., D. Tholen, J. Goguen, R. Binzel, and D. Cruikshank (1988). Icarus **73**, in press.
Vilas, F. and B. Smith (1985). Icarus **64**, 503-516.