ASTEROID 29 AMPHITRITE: SURFACE MINERALOGY AND HETEROGENEITY. J. F. Bell[1,3], M. J. Gaffey[2], J. C. Gradie[1], B. R. Hawke[1,3], and T. B. McCord[1]. ([1]Planetary Geosciences Div., Hawaii Inst. of Geophysics, Honolulu HI 96822; [2]Geology Dept., Rensselaer Polytechnic Inst., Troy NY 12181; [3]Visiting Astronomers at the NASA Infrared Telescope Facility.)

INTRODUCTION: 29 Amphitrite is a large (D=200km) S-type asteroid which may be the target of a flyby by the Galileo spacecraft in late 1986. If this option is actually exercised, it will become the only asteroid for which high-spatial-resolution data is available. To aid in understanding the relationship between the possible Galileo data sets and the multi-asteroid ground-based data, we summarize current knowledge of Amphitrite and present previously unpublished telescopic observations which provide new insight into the composition of its surface.

BASIC PARAMETERS: 29 Amphitrite is located approximatly in the middle of the main belt (a=2.55 a.u.). Lightcurves (1,2) indicate a rotation period of 5.39 hours, and a markedly nonspherical shape (longest axis at least 15% greater than shortest axis). Attempts to deduce the orientation of the rotational axis have produced results that differ by as much as 96^{o}. Thermal radiometry (3) and optical polarimetry indicate an diameter of ≈200km and geometric albedo of ≈0.15. Polarimetry also indicates that the optically visible surface consists of a dusty regolith (4).

INFRARED SPECTROPHOTOMETRY: Figure 1 summarizes the existing high-resolution spectral data. Crosses are data points taken from Ref. 5. Squares represent previously unpublished data obtained in December 1983 at IRTF by J. F. Bell and B. R. Hawke as part of an extensive "52-color" IR spectral survey of asteroids (6) which has included 66 asteroids to date. The principal spectral features resolved are the general overall curved red continuum probably due to NiFe metal, the band near 0.95µm due to an unresolved mixture of pyroxene and olivine absorptions, and the band near 1.95µm due to pyroxene alone. The overall spectral contrast is somewhat less than average for S-type asteroids but well within their range.

MINERALOGY: The steeply reddened spectral continuum of Amphitrite indicates the presence of abundant elemental iron in the optically visible regolith. Simulated regoliths derived from ordinary chondrites do not show this spectral signature (7), even when metal abundance is enhanced by magnetic separation. Comparison of the areas of the two silicate absorption bands with a calibration curve derived from lab spectra (7,8) indicates approximatly 60% (weight) orthopyroxene and 40% olivine. Absorption band positions indicate a low-Ca(≈5%), medium-Fe(≈40%) pyroxene. This pyroxene chemistry could be consistent with an LL chondrite, but the pyroxene/olivine ratio is typical of H chondrites. The mineralogy is therefore inconsistent with any known chondritic mineralogy. Both metal and silicate components of the surface are characteristic of differentiated assemblages. Stripping away of the upper layers of a larger differentiated parent body could account for both the shape and mineralogy of Amphitrite.

METEORITICAL ANALOGS: The mineralogy of Amphitrite as derived from the above preliminary analysis of the new IR spectra corresponds in general to a few rare types of meteorites, grouped as "anomalous stony-irons" or "primitive achondrites" (9): lodranites, winonaites, and some so-called irons actually rich in silicate inclusions. It is not yet possible to make detailed comparisons with any of these types; however the large number

potential parent bodies makes it statistically unlikely that any known meteorite is from Amphitrite.

SURFACE VARIEGATIONS: Recent studies of the rotational lightcurve of Amphitrite (2,10,11) have revealed no color variations above the 3% level. However a careful reexamination of the data suggests that variations at the 1-2% level may exist. Fig. 1b of ref. 2 indicates that B-V colors are systematically 0.015mag higher near the principal lightcurve maximum and lower by the same amount near lightcurve minimum (at the 1982 apparition). 0.35-1.0µm spectra obtained by M. J. Gaffey in August 1978 show an apparent 2-3% variation in the blue-UV absorption and ≈1% variations in the region of the 0.95µm absorption band. No duplicate rotation coverage was obtained at either opposition, so the variations are not confirmed. Amphitrite's irregular shape suggests that various areas on the present surface correspond to different depths in the original uneroded parent body. IR spectral maps returned by Galileo may thus probe the interior stratigraphy of a differentiated planetesimal. The authors plan to obtain time-resolved 0.6-2.5µm reflection spectra at the May 1985 opposition to further search for mineralogical units on Amphitrite.

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FIGURE 1