Sears, D. W. G. (1997d) Editorial – "The evolution of igneous asteroids: focus on Vesta and the HED meteorites" Houston, Texas, 1996 October 16-18. *Meteorit. Planet. Sci.*, volume 32, page 3.

Meteoritics & Planetary Science 32, 3–7 (1997)
© Meteoritical Society, 1997. Printed in USA.

From the Editors

"The Evolution of igneous asteroids: Focus on Vesta and the HED meteorites" Houston, Texas, 1996 October 16–18

One of the most fascinating topics in current meteorite research is the identification of meteorite parent bodies. With the rejection in the early 1960s of the idea that most meteorites came from the moon, meteorite parent bodies became vague, misty intellectual constructs about which we knew little but speculated much. This changed a little in the 1980s, first with the discovery of the lunar meteorites and then with the realization that SNC meteorites were from Mars. But while fascinating discoveries of the utmost importance, these are a small rare classes of meteorites. We are still left to ponder on the parent bodies of the majority of meteorites.

McCord *et al.* (1970) triggered a major effort when they pointed out that the spectral reflectivity properties of Vesta matched those of the Nuevo Laredo eucrite. The questions surrounding a potential relationship between Vesta and the howardites and the related eucrite and diogenite meteorites (HED, or better HEDM to include the mesosiderites) were aired at an energetic, but good humored, two and a half day workshop at the Lunar and Planetary Institute, Houston.

In debate mode, with formal presentations and rebuttals, Binzel and Wasson argued the pros and cons of Vesta being the HED parent body. Binzel argued that there was a logical sequence of observations from the spectral reflectivity data for Vesta, which seems to indicate much cratering and with eucritic and diogenitic material on the surface, to the recent discovery of numerous "Vesta chips" (or "Vestoids") linking Vesta to the 3:1 and ν_6 resonances, the resonances being the dynamic highways to Earth. Wasson argued the "con" case, pointing out that the great many iron meteorite classes suggests the presence of many asteroids that are really exposed cores, so that there must be an abundance of small basaltic crust fragments in the asteroid belt that could be supplying the meteorites. He also argued that "space weathering" of asteroids is misleading spectroscopists. In true debate tradition, there was also a vote and "pros" handsomely won. However, Science does not obey democratic principles, and time will really tell.

The rest of the meeting reviewed astronomical data for Vesta and its orbital and cratering history, work on the igneous history of the meteorites, geophysical and petrological modelling of Vesta, and a discussion of their metamorphic history. The Hubble space telescope has made Vesta the best known major asteroid. It is not a perfect sphere, but is slightly oblate with high and low topographies. A basin lies at a longitude that coincides with a region whose spectrum shows evidence for olivine. There was some tendency to describe this region as "diogenitic", but the spectral data could be consistent with higher amounts of olivine that are observed in typical diogenites.

It was repeatedly pointed out that it is theoretically unlikely that a surface as heavily impacted a Vesta's could have survived for the age of the solar system. The asteroid should be regarded as something of an anomaly. It was also argued by some that impact could have sent ejecta directly to Earth, in contrast to the current view that the meteorites are fragment of the Vesta chips rather than Vesta itself. There was also considerable discussion of the geochemical and chemical history of the HED meteorites in the light of Vesta being the probable parent body. Discussions ranged from theoretical modelling of the thermal history of the entire body, to geophysical models for the movement of magma to the surface, to explanations for trace element abundance patterns in bulk samples and mineral separates.

The HED meteorites are often likened to basalts from other bodies, in particular the moon. Their main difference is that the meteorites have suffered fairly intense moderate-temperature metamorphism and this has homogenized mineral compositions, caused the exsolution of certain phases and caused an increase in TL sensitivity. Most participants at the meeting now believe that the metamorphism occurred early in the history of these meteorites, but the present writer adheres to an earlier view that it was associated with the widespread resetting of Ar-Ar ages ~3.8 Ga. If there was one major topic missing from the workshop, it was the important Ar-Ar ages for these meteorites (Bogard, 1995).

The conference ended with a discussion of a proposed spacecraft mission to Vesta and with arguments about the relative merits of such a mission *vs.* those to other asteroids. It was an excellent topic to finish on because it not only did it focus attention on future activities, but it prompted a brief discussion on what is known and what is speculated. It is planned that papers resulting from the meeting will appear back-to-back in the 1997 November issue of *Meteoritics and Planetary Science*. In the meantime, it is exciting to realize that while we do not have absolute certainty that Vesta is the ultimate HEDM parent body, it is a very strong possibility, and that this is prompting substantial interactions between specialists in meteorites, asteroids, and planetary spacecraft missions. This is certain to extend to other asteroids and other meteorite classes.

Derek Sears
Editor

REFERENCES

BOGARD D. D. (1995) Impact ages of meteorites: A synthesis. *Meteoritics* **30,** 244–268.

MCCORD T. B., ADAMS J. B. AND JOHNSON T. V. (1970) Asteroid vesta: Spectral reflectivity and compositional implications. *Science* **168,** 1445–1447.