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COULD ICY IMPACTS RECONCILE VENUS WITH EARTH AND MARS? T. Owen, Department of Earth and Space Sciences, State University of New York, Stony Brook, NY 11794.

The explanation of the origin of Earth's moon by a giant impact implies that the earliest atmosphere of our planet was lost. As Cameron (1) has emphasized, a long epoch of impacts resulting from its proximity to the main asteroid belt should also have removed much of the original atmosphere of Mars. This would explain that planet's surprisingly low volatile inventory as deduced from current observations (2). Venus, being larger than Mars and further from the asteroid belt, was spared this level of punishment and apparently also escaped a major, moon-forming impact. The abundances of noble gases in its atmosphere today may reflect the effects of a different mixture of volatile-carrying material that was present in the earlier phases of planetary accretion but not widely abundant after the time of the formation of the Earth's moon. Alternatively, Venus may simply have been subjected to a random event-collision with a planetesimal of unusual composition.

In either case, icy planetesimals from the outer solar system provide one possible source of suitable material (3). This idea gains support from the recent work of Mayer and Pletzer (4) and Bar-Nun et al. (5) which demonstrates that gases can be adsorbed by amorphous ice without forming clathrate hydrates. Under these conditions, the abundance ratios in the original gas mixture are preserved. Thus one expects argon, krypton and xenon to exhibit solar abundance ratios (as they do on Venus) while neon will not ordinarily be adsorbed. The neon on Venus would then have to be supplied by another source, presumably the early solar wind.

This hypothesis can be tested by observations of noble gases in comets. The recent encounters with Comet Halley may therefore provide the necessary information.

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3. Owen T. (1985) in Ice in the Solar System, Proceedings of a NATO Symposium, ed. J. Klinger (D. Reidel).
4. Mayer E. and Pletzer R. (1986) Nature, p. 298-301.
5. Bar-Nun A., Dror J., Kochavi E. and Laufer D. (1986) Phys. Rev. B (submitted).