**Origin and Evolution of Phobos and Diemos.** B. Gladman[1], [1]Department of Physics and Astronomy, Institute of Planetary Science, University of British Columbia, 6224 Agricultural Road, Vancouver, BC, V6T 1Z1, Canada. Email : gladman@astro.ubc.ca .

**Introduction:** Surely the most outstanding issue concerning Phobos and Deimos is their origin. How did two object now resembling outer main-belt asteroids get to be in orbit around Mars[1]? No plausible capture scenarios have yet been well developed that could take an asteroidal flyby and convert the captured object eventually into the nearly-circular orbits currently in the equatorial plane of the planet. Key to studies of both their origin and their relation to Mars is the question of their true surface and near-surface properties.

**Capture scenarios :** Any proposal for the capture of these moons must explain why a similar process did not occur around the other 3 terrestrial planets (although one may be able to ignore the Earth due to the catastrophe of the Moon's formation). Although scenarios like atmospheric drag or three-body interactions between two object simultaneously encountering Mars could result in a bound orbit, satellites as small as Phobos and Deimos are simply not capable of using tidal interactions with Mars to bring their orbits down in semimajor axis, eccentricity, and inclination to the small observed values of the present moons (unlike Triton's capture and subsequent evolution into a nearly-circular orbit around Neptune for example [2] [3]) . Formation of just two tiny moons out of an impact-generated disk (like the formation of Earth's moon) seems implausible.

**Could they be cloaked? :** The martian moons exist in a dynamic environment near the main asteroid belt. Since space-weathering studies show that even near-Earth asteroids show a wide range of spectral properties due to the so-called `space weathering' process [4], we should keep in mind that the spectral signature from the upper microns of the martian moons could be influenced by contamination from the continuous rain of in-spiraling dust from the main asteroid belt. We must therefore be cautious of remote-sensing interpretations as to the true nature of the bulk of the Moon, since such observations only probe the upper few wavelengths of the surface. Recent moderate impacts on the two moons would hopefully have mined through this covering layer, as possibly supported by the heterogeneous surface (albedo and color) of the surfaces. Since the biggest ejecta blocks seen on Phobos are likely pieces of the moon itself excavated by cratering events on the moon, these should be the principal targets of ground-truth if a lander is deployed.

**Martian material in the regolith of the moons? :** Could there be intact martian material in regolith of Phobos and Deimos? Calculations by this author indicate that the cross-section of these moons is so tiny that in the last few billion years only a handful of rocks (of the level of the martian meteorites or larger) have struck the moons. Even these (lucky?) fragments will have encountered the surface at speeds of approximately 2 km/s (faster than the speed of sound in the target), and are unlikely to have survived the collision intact. Searching for the fragments of this material mixed into the regolith of the moons seems hopeless, and since such material has no geologic context (in terms of where on Mars it came from) it is unlikely to teach us much that the martian meteorites have not already revealed.

**References:**

[1] Burns, J.A.. B. (1992) in *Mars* (University of Arizona Press), 1283–1301. [2] McKinnon, W.B., Lunine, J.I., and Banfield, D. (1995) in *Neptune and Triton* (University of Arizona Press), 807. [3] Cuk M. and Gladman, B. (2005) Astrophysical Journal., *626*, 113-116. [4] Binzel, R., Rivkin, A., Stuart, S., Harris, A., Bus, S., Burbine, T. (2004) Icarus, *170*, 259-294.