COLLISIONAL DE–WEATHERING OF ASTEROIDS?

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In a recent paper (Lazzarin et al., 2006) it has been shown that the concept of space weathering, i.e. the evolution of spectroscopic surface properties with time, due to the exposure to external effects, can be extended from the S–complex asteroids to almost all asteroids. In general, the spectral slope changes with the exposure and, as a general rule, the weathering causes reddening, even if the effect is more pronounced for S–type objects, less for the others.

However, other effects are present. This consideration follows from a few evidences:

- The timescale for reddening, as far as we estimate it from laboratory experiments, is shorter than the typical asteroidal ages: thus for most bodies the weathering should be essentially saturated, thus masking the slope–exposure relation, which we find.
- It can be shown that other effects, for instance those connected to close encounters with planets, interact with the usual weathering; the resulting scenario is thus more complex (Paolicchi et al., 2007).
- The analysis of C–complex Near Earth Asteroids shows a different behaviour, both a reversed slope–exposure relation and a by far rarer –compared to Main Belt– presence of aqueous features in the observed spectra; some anomalies involve also the C–complex asteroid families. These properties are yet unexplained, but some suggestions have been presented (Paolicchi et al., 2006).

In general, we will probably have to refine the weathering models to take into accounts a few additional effects, such as heating, which can be due either to the proximity of the Sun (at least for NEAs) or to collisions, and surface alterations due to non–catastrophic collisions (jolting, regolith mixing). We suggest, for the moment at a semi–qualitative level, that the role of collisions should be critical for several features of the spectroscopic evolution: slowing down of the reddening asteroidal timescales and, maybe, also other more selective effects due to heating. In general, we state that collisions should have a de–weathering effect.

References

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