Q-type asteroids: possibility of having non-fresh weathered surfaces without fine particles

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Itokawa particles not only put an end to the S-complex asteroid problem, but also brought the new mystery that space weathering time scale three orders of magnitude shorter than previously thought mechanisms.
The orbital evolution caluculation in this study (Hasegawa *et al.* 2019, *PASJ* **71**, 103) reveals that the mechanism of refreshing the surface by the close encounter of the planet can be applied to maximally about halves of currently known Q-type asteroids, but not to the remaining about halves.
The results of laboratory experiments on space weathering show that the spectrum of Q-type asteroids in the case of asteroid surface without less than 100 micron particles even when space weathered can be explained.
Solar radiation pressure and electrostatic force can be considered as a mechanism to release particles smaller than 100 micron and it has been found that they can be applied to Q-type asteroids less than 0.5 km in diameter with very small perihelion or less than 0.3 km in diameter.

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