The internal structure of JFC's. A Deep Impact contribution.

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We propose that the ubiquitous layering observed on the surface of 9P/Tempel 1 during the Deep Impact mission [1, 2] is an essential element of the internal structure of most Jupiter family comet nuclei . We suggest that this layering is the natural outcome of low velocity collisions with other primitive Kuiper Belt bodies that must have occurred during the late accumulation stage of these objects in the solar nebula [6]. In this picture the layers were laid down over 10^5 – 10^6 yr [3] and some may have had very short exposure time to the nebula environment. We envision a structural model for the interior, called here the Talps or 'layered pile' model, that has an inner core transitioning to an outer mantle consisting of a sequence of thin, randomly stacked, layers, each of limited area and, possibly showing small differences in composition, out to the surface. As presented here this model predicts a correlation between the radial distance and the average thickness of the layers. As long as gravity plays a minor role large nuclei are expected to have thicker surface layers and vice versa.

Mesas are formed, following the suggestion by Britt *et al.* [4], as a result of erosional sublimation at the boundaries of the outermost layers during passages near the sun. Cometary splitting and tidal disruption is seen as the result of detachment of entire layers or, possibly, disassembly of essentially the entire, presumably weakly bonded, layer structure. This model is related to the original primordial rubble pile model of Weissman [5] but is distinct from it since rather than being a loose accumulation of primordial bodies and collision fragments that largely retain their individual structures, the accumulating nebula condensations are grossly distorted in the low velocity collisions and effectively flow onto the surface of the growing nucleus; the structure is more like a pile of layers. We visualize this layering process as analogous to the behavior seen in the relatively higher velocity collisions of small dust aggregates in the laboratory by Wurm *et al.*[6]

This model makes definite predictions for the outcome of certain experiments on the *Rosetta* mission at 67P/Churyumov-Gerasimenko. In particular, the CONSERT experiment [7] should, providing its spatial resolution is adequate, be able to detect layering deep into the interior and and possibly map the predicted reduction of mean thickness of the layers with depth and possibly detect a transition to an inner core structure, The OSIRIS Camera [8] should find widespread geological evidence of the same kind of layering as seen at 9P, 19P and 81P since 67P has approximately the same effective radius [9]. *This research was funded by NASA through the Deep Impact Project*

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