OUTBURSTS ON TEMPEL 1, LOCATIONS, TIMING, AND THE VIEW FROM THE NExT MISSION.

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Introduction:

Observations of ten outbursts seen from the Deep Impact (DI) spacecraft and one from the Hubble Space Telescope (HST) have been used to locate their source regions on the nucleus of 9P/Tempel 1. The locations and the timing of the outbursts show that they occur both during the day and the night. Evidently, they do not occur when the surface is warming (e.g. near dawn) but do happen when the surface is cooling (e.g. afternoon, dusk, nighttime). The outbursts occur at two, possibly three, tightly constrained places on the surface that are situated near those regions that are furthest away from the center of figure, i.e., regions where the effective surface gravity is lowest.

Physical model: Images of six of the outbursts show evidence of an ejecta curtain and a comparion of the brightness of a typical outburst with the DI artificial impact plume suggests that ~10^6 kg of particulates are released. Although these outbursts are not strictly periodic (1) they may possibly repeat at the same site on every rotation, at least during the period near perihelion passage when DI was making its observations. The co-incidence of the locations of the outbursts with regions of the lowest surface gravity indicates that the weight of the sub-surface material may be involved in the outburst mechanism. In addition their occurrence when the surface is cooling suggests that processes at the surface, e.g., thermal tensile stresses or, perhaps, associated with the vaporization (or condensation) of H_2O, may be involved as a triggering mechanism.

Relationship to the NExT mission: It is the intention of the NExT team to arrive at Tempel 1 when a large part of the surface previously imaged by DI is illuminated and can be re-imaged to investigate changes that have occurred during the last perihelion passage. If possible, the imaging strategy will be arranged to attempt very high resolution imaging of the DI artificial impact crater, which is located at 11E, 26S. The prime locations for the source of outbursts are A(221E, 6N), B(60E, 20S) and, possibly, C(330E, 20N) (see fig.1). depending on the final NExT targeting strategy, at least one of these sites will be illuminated and the probability of obtaining images is high.

Using the physical model of a typical outburst outlined above, we have indentified three regions in the area imaged by DI where outbursts may have occurred in the past. These include a *rimless depression* (2), which features multiple craters within its walls, and two fields of *close-packed depressions* (2). Both of these are shown in fig. 2. NExT may be able to improve on the resolution and foreshortening at which these features have previously been imaged.

References: (1) Farnham, T. L. et al.(2007) *Icarus*, 187, 26-40; (2) Thomas, P. C. et al. (2007), 187, 4 – 15.

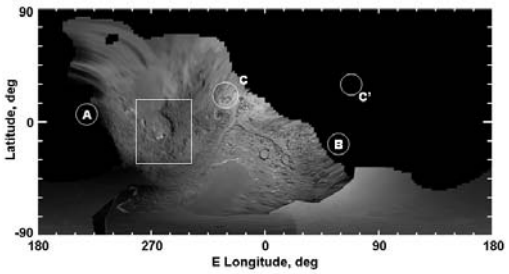

Figure 1. Location of the outburst source regions on the DI image map of the surface. The DI impact was at 11E, 26S.

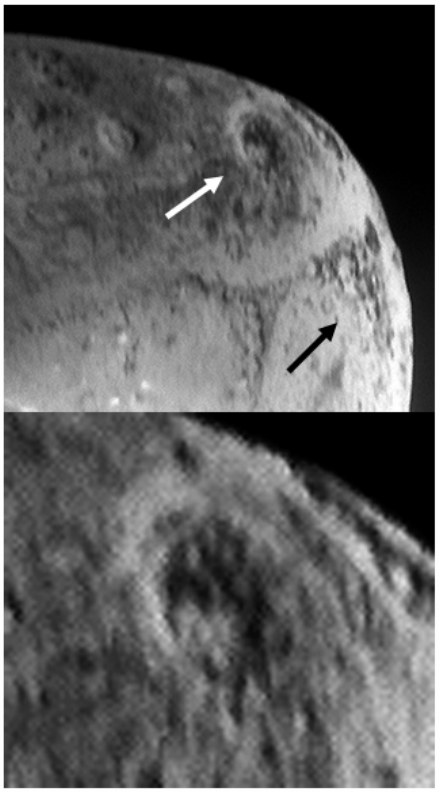

Figure 2. Possible sites of past outbursts on 9P/Tempel1. The white arrow points at a *rimless depression* with multiple craters in its interior. The black arrow points at a triangular field of *close-packed* depressions.