# The Role of Fatigue Fracture and Erosion in the Production of Icy Cometary Grains

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In addition to the materials sublimated or lifted directly from the cometary surface, the cometary coma is enriched by the presence of sublimating grains containing volatile ices and dust. Several mechanisms for icy grain production have been suggested, including the quiescent lifting of grains in the free molecular flow of sublimated volatiles and outbound rides on larger chunks expelled in energetic blowouts of pressure pockets or broken due to thermal stresses. However, the processes which inject icy grains into the coma are poorly quantified. Discrete active areas, making up perhaps only 10 % of the total surface area of the nucleus, produce the materials in the coma, including the icy grains. The exact nature and geometry of the active areas is unknown, but observations of collimated jets and outbursts suggest that they are depressions, pits, or even deep crevices. This work investigates the effects of erosion of active areas by the free stream flow of dust particles and/or icy grains and the production of new icy grains through the action of fatigue fracture. Erosion of the surface of an active area occurs due to the fatigue chipping of embedded grains by the flow of previously released particles. Fatigue cracks propagate along grain boundaries leading to dislodging of grains and their incorporation into the stream flow away from the active area. Major assumptions in this analytical work are: "target sites" are randomly oriented; Each particle collides only once; Expulsion occurs due to fatigue cracks; gas/particle stream is in free molecular flow; fracture is brittle; velocity is relatively low. This model is applied to the conditions predicted for Comet P/Tempel1, the destination of the Deep Space 4/Champollion comet landing mission. An analysis of the volume of material lost per unit time per unit area due to erosion, based on estimates of material properties, will be presented. Implications for the evolution of active areas will be discussed.