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The Dispersal of Pyroclasts from Ancient Explosive Volcanoes on Mars: Implications for the Friable Layered Deposits

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A number of voluminous, fine-grained, friable deposits have been mapped on Mars. The modes of origin for these deposits are debated. The feasibility for an origin by volcanic airfall for the friable deposits is tested using a Mars global circulation model to simulate the dispersal of pyroclasts from candidate source volcanoes near each deposit. The sensitivity of the model is tested with respect to parameters such as ash grain size, height of clast-release from the plume, season of eruption, density of ash, planetary obliquity and orbital eccentricity. The results are compared with the geologic unit boundaries for the friable deposits. It is concluded that the Medusae Fossae Formation and Electris deposits are easily formed through volcanic processes, and that the Hellas deposits and south polar pitted deposits could have had some contribution from volcanic sources in specific atmospheric regimes. The Arabia and Argyre deposits are not well replicated by modeled pyroclast dispersal, suggesting that these deposits were most likely emplaced by other means.