
Magma ascent triggered by impact crater unloading on the terrestrial planets

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Résumé

On terrestrial bodies other than the Earth, evidence of volcanic eruptions and magmatism often occurs within impact craters. On the Moon, volcanic deposits and evidence of pyroclastic activity and shallow magmatism are frequently located within craters designed as mare-filled and floor-fractured craters (FFCs). On Mars, floor-fractured craters are also observed, suggesting that magmatic activity occurred at shallow depth below impact craters. On Venus, the smooth interior of impact craters showing dark floors on radar images suggests that these craters have been filled by lava subsequently to their formation.

Craters constitute unloadings at the surface of planets. Here, we show, using different types of quantitative observations on lunar mare-filled and floor-fractured craters that the unloading caused by the crater provided a driving overpressure to the magma stalling deep within the crust. This overpressure counterbalanced the melt negative buoyancy, driving its ascent through the crust.

We then use this framework to investigate whether the deformations observed on the floor of Martian craters could be due to magma intrusions and to interpret observations of volcanic flows on the floor of Venusian craters in terms of magma buoyancy in the crust.

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