Marine impacts:
Sedimentologic fingerprint of event magnitude

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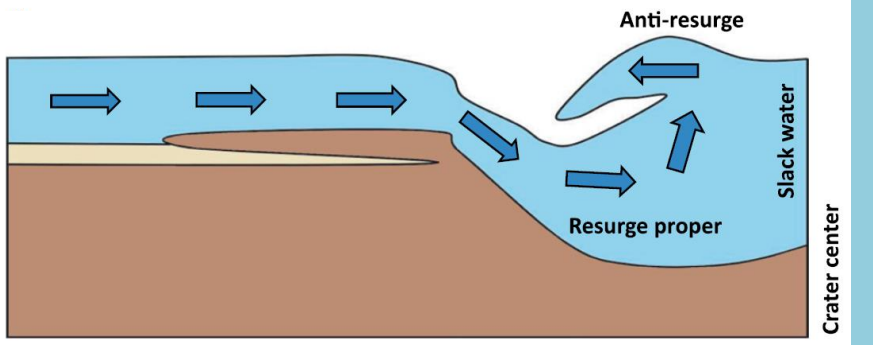
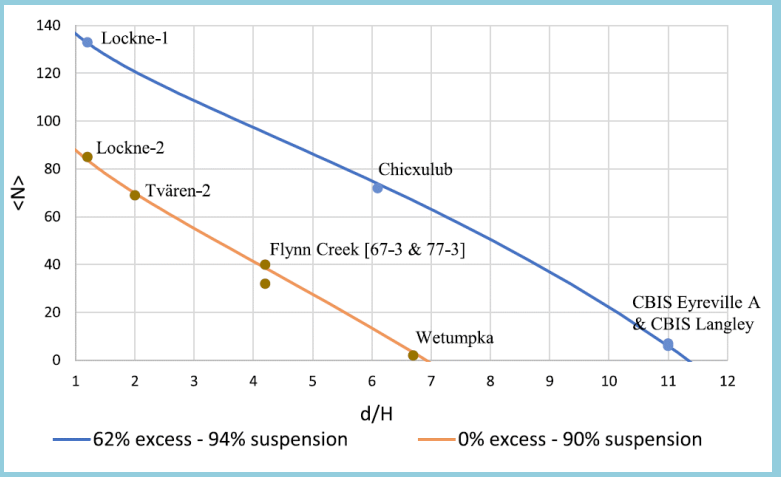
Development of a turbulent region due to collision of the resurge and anti-resurge after the collapse of the central water plume after a cosmic marine impact.





Model results (curves) versus observational data (dots). Model represents the relation between mean clast frequency per unit length in drill cores, ⟨N⟩, and event magnitude (i.e., projectile diameter, d) relative to target water depth (H).

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Our model allows a first evaluation of the magnitude of a marine impact by just measuring the mean clast frequency along with an estimation of the target water depth obtained from independent sources.

Previous studies of resurge sediments in drill cores from several marine-target impact craters indicated a relationship among the sedimentology, the target water depth, and the magnitude of the event. This offers a potentially valuable opportunity to obtain one of these variables if the other two are known. However, the mechanisms controlling the relationship have remained enigmatic so far.

We present a fractal model for the study of size segregation and particle settling after an impact event in a marine target. The model assumes that the coarse particles will develop a different settling velocity depending on the volumetric concentration of fine particles, giving rise to a variety of size segregation patterns depending on the solid/water mixture properties.

The model explains the observed tendency in nine cores obtained from six natural impact craters, shedding light on the physical processes behind the observations. The most significant feature of our model is that it allows a first evaluation of the magnitude of the marine impact, d, by just measuring the mean clast frequency in core samples, <N>, along with an estimation of the target water depth, H, obtained from independent sources such as paleogeography or paleoecology.

This model will be useful to predict the impactor size, d, or the water depth, H, from clast frequencies in drill cores, <N>. It will also be useful for more relevant drill-site selection in future core drilling campaigns, as well as assisting in the interpretation of the cores. Furthermore, it will allow paleogeographic reconstruction of areas with disputed water depths if the event magnitude is known.

M.I. HERREROS, J. ORMÖ, GEOLOGY, 2022; HTTPS://DOI.ORG/10.1130/G50250.1