Ejecta emplacement from a cosmic impact at sea

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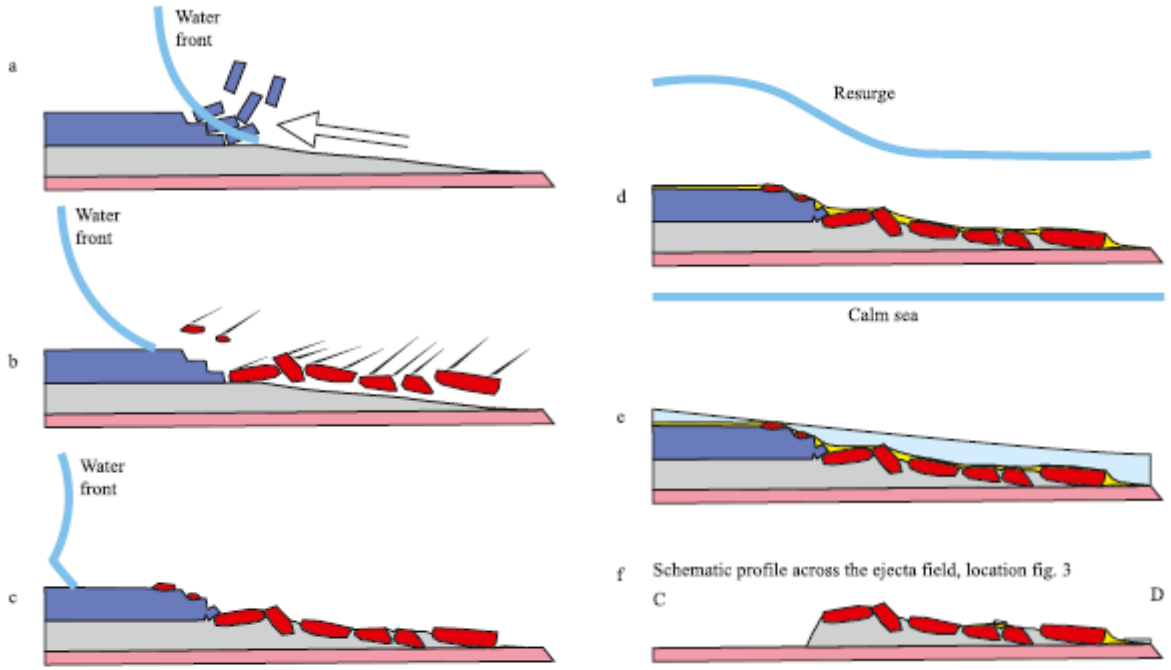

The suggested sequence for the formation of the ejecta field along a profile across the southern ejecta field of the Lockne impact structure , Sweden. (a) Expansion of the outer crater due to shallow excavation flow. (b) Inner crater basement ejecta striking the floor of the outer crater. (c) The moment of initiation of resurge flow from the collapsing water cavity. (d) Deposition of resurge material (yellow) over the ejecta layer. (e) Post impact secular sedimentation of marine Dalby Limestone. Blue line shows the position of the water cavity.

Sturkell, E., Ormö, J., Hegardt, E. A., Stockmann, G., Meland, E., & Wikström, T., 2023: "The proximal ejecta around the marine-target Lockne impact structure, Sweden". *Journal of Geophysical Research: Planets*, Vol. 128, e2023JE007777. https://doi.org/10.1029/2023JE007777.

Very few terrestrial impact structures have preserved ejecta blankets. Generally, the strong erosion affecting Earth's surface, and the often frail character of the ejected material, hampers their preservation. Despite its high age of 458 million years, the Lockne impact structure is a rare exception due to a combination of a target with 500 m of seawater, 80 m of limestone, and 30 m of clay resting on a flat granitic basement, and rapid burial by subsequent marine sedimentation. The seawater was expelled outward, and the expanding crater reached deep into the basement. Limestone surrounding the basement crater was blasted off like a carpet. The impact structure obtained a "soup-plate" shape with a 7.5 km wide nested crater in the basement surrounded by a 3.5-km wide, shallow "brim". The more difficultly mobilized clay and exposed basement rock of the brim got bombarded by granitic ejecta forming a blanket. After less than 2 min, the 2 km high water wall collapsed and water rushed back to flood the dry impact crater, leaving only larger ejecta fragments and more consolidated parts of the ejecta blanket. This sequence of events only occurs in marine and stratified target settings, such as at Lockne.