Target paleoenvironment caused collapse of crater rim

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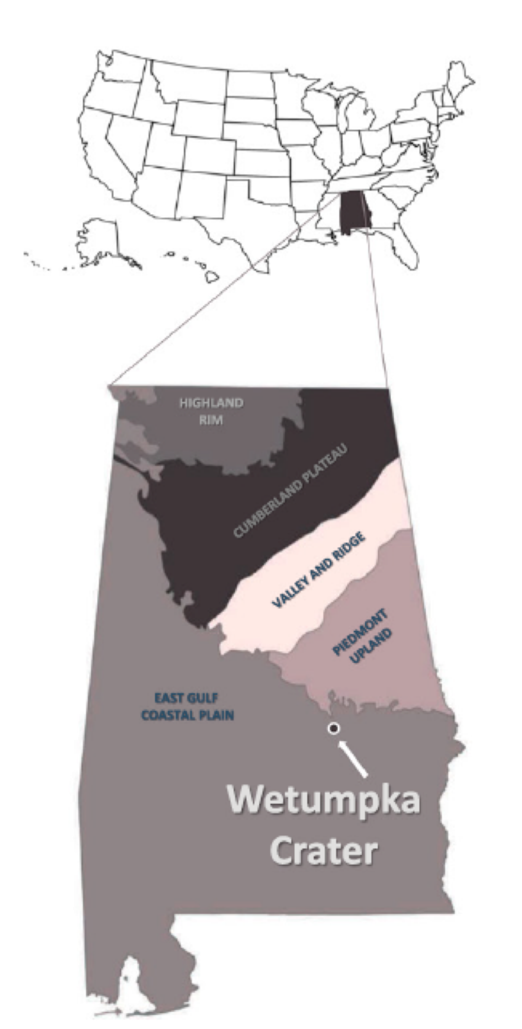

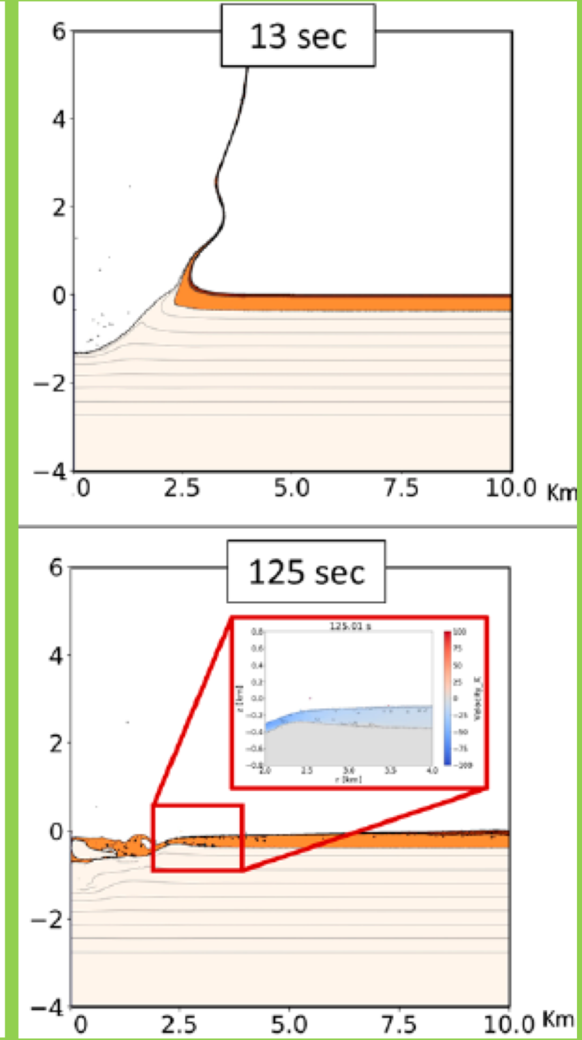

The Wetumpka impact structure in central Alabama (USA), ~5 × 7.6 km in size, formed in a shallow marine setting during the Late Cretaceous. Previous field, core drilling, and gravity studies are expanded here with iSALE-2D hydrocode modeling to examine crater evolution and filling.

The model explains the collapse of the southwestern, seaward-facing rim quadrant, which strongly influenced crater infill. A three-layer target—water, sediments, and granite—was used, with cohesion values derived from tests on micaceous schist from the rim. Simulations varied water depth (62.5–125 m), impact velocity (12–18 km/s), and sediment thickness (100–300 m).

The best match to field and geophysical data resulted from a 400 m impactor at 12 km/s (vertical vector component) striking a target with 62.5 m of water and 300 m of sediment. Modeled pressures correlate well with Wetumpka's observed shock petrography. The study refines understanding of Wetumpka's formation and highlights the value of numerical modeling for impact-crater reconstruction.

Left: Location of the impact structure just off-shore the Late Cretaceous paleo-shoreline. Right: Numerical simulation of the impact event. Light orange, dark orange, and red represent basement, sediments, and seawater, respectively. Inset figure shows the velocity in the x direction to highlight the influx of the sediments and potential water resurge into the crater. Modified from DeMarchi et al. (2025).

DEMARCHI, L., AGRAWAL, V., KING JR., D. T., AND ORMÖ, J., 2025: GEOLOGICAL SOCIETY OF AMERICA BULLETIN, HTTPS://DOI.ORG/10.1130/B38196.1.