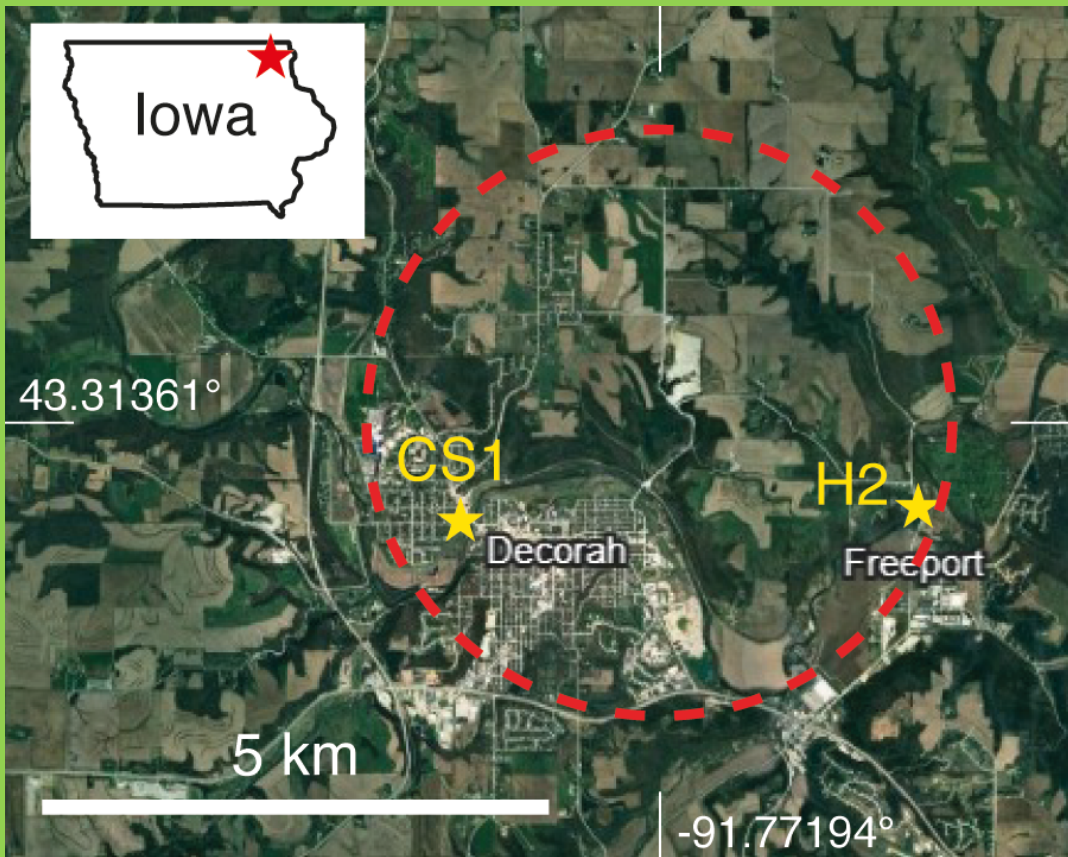


Impact structure reveals target water depth and paleoenvironment in present-day non-marine location



Location of the Decorah impact structure in Iowa, United States (red star in inset), the crater rim (red stippled line), and the drill sites of the investigated H2 and CS1 cores (yellow stars). The buried impact structure has no topographic expression, nor obvious influence on the drainage pattern of the area. Adapted from Ormö et al. (2026).

Reconstructing paleoenvironments—particularly aquatic ones—is essential for identifying potential habitats for life, both on early Earth and early Mars. Impact craters often serve as effective sediment traps that are relatively shielded from erosion. In aquatic settings—most commonly in shallow marine environments—where seafloor craters can form, the return flow of water during the early stages of crater modification can produce distinctive “resurge deposits.” Analyses of such deposits from drill cores at various marine-target impact structures, including the Decorah structure examined in this study, reveal a direct correlation between average clast frequency per meter, impact event magnitude (i.e., projectile diameter), and the depth of the target water. If two of these parameters are known, the third can be inferred. In this study, we analysed two drill cores obtained from the interior of the Decorah impact structure to gain insights into the paleoenvironment at the time of impact. Applying the aforementioned relationship yields an estimated target water depth of 40–90 meters, thereby situating the Decorah paleoenvironment within a defined range of the ancient marine realm.