Distal Impact Ejecta from the Gulf of Carpentaria: Have We Found Cometary Fragments as Part of the Ejecta Suite?

Rodriguez, Laura[1], Abbott, Dallas[2], Breger, Dee[2]

[1]Earth Science, Rice University, 6100 Main St. Houston, TX 77005
[2]Lamont Doherty Earth Observatory of Columbia University, Palisades, NY 10964

Analysis using light microscopy, analytical scanning electron microscopy, and measurements of the magnetic susceptibility of five sediment cores (MD 28-MD 32) from the Gulf of Carpentaria have revealed that each has had an impact layer less than a centimeter (10s to 100s of micrometers) thick prior to bioturbation. The present stratigraphic thickness of the impact layer (result of bioturbation) within every core was determined based on whether or not we had observed at least one of the following impact ejecta types: FeNiCrCl (a recent discovery), metallic spherules (some of which consisted of Fe and Ni), or chlorinated hydrocarbon; the highest peak of magnetic susceptibility correlated with the highest concentration of impact ejecta. We used modeling of the magnetic susceptibility of a hematite-calcium carbonate mixture to constrain the minimum thickness of the impact ejecta layer (prior to bioturbation). Until recently we had been unaware that the red, glassy, semi-spherules we found within the impact layer were in fact FeNiCrCl. Nickel is not abundant within the Earth's crust, thus it is highly likely that these fragments are cometary debris from an impact event within the Gulf of Carpentaria. Furthermore, SEM analysis has confirmed that the chlorinated hydrocarbon was not PVC contamination from the coring process; with such high levels of chlorine the results strongly suggest that the material was a by product of a marine water impact event. In addition, by using impact modeling we deduced that the observed impact ejecta layer could not have been transported via an impact generated tsunami. The model also predicts that the layer could have been produced by a cometary impact event (average velocity 51 km/s) that would have produced the 12 km crater at the site of the Tabban crater candidate.