What Type of Event Deposited Magnetic Spherules and Spherule Aggregates in Holocene Sediments of the Gulf of Carpentaria?

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An impact crater is a geologic structure with deformed bedrock produced by impact onto a planetary surface. Holocene impact events could have taken place much more frequently than originally thought because they were not recorded in written records. During an impact event, spherules and tektites of varying compositions will be distributed to the area around the impact site. We found tektite-like magnetic spherules in the Gulf of Carpinteria that are preindustrial and of probable Holocene age. Using gravity gradient data, a possible impact crater was delineated in the Arafura Sea (1). If this feature is the source of spherules in the Gulf of Carpentaria, they should have a tektite-like morphology and their modal size should be relatively large, on the order of 100 µm (2). The spherules in MD 29 have a median diameter of 89.16±12.36µm at the 95% confidence level (N=150) and a mean ellipticity of 0.242±0.014 (N=147). The spherules in core MD 30 have a median diameter of 89.15±15.2 at the 95% confidence level (N=86) and a mean ellipticity of 0.235±0.019 (N=69). For comparison, the purely biological spherules of *Orbulina universa* have a mean ellipticity of 0.068 ± 0.006. Additionally, native iron, which is an accepted indicator of an extra-terrestrial impact (3) has been found to be present in the spherule bearing layers. We picked benthic foraminifera from just below the spherule layer for AMS ^{14}C dating to determine a more accurate age for the event.

1. Sandwell, D.T., Müller, R.D., Smith, W.H., Garcia, E. and Francis, R., 2014. New global marine gravity model from CryoSat-2 and Jason-1 reveals buried tectonic structure. *Science*, *346*(6205), pp.65-67; 2. Johnson, B.C. and Melosh, H.J., 2012. Formation of spherules in impact produced vapor plumes. *Icarus*, *217*(1), pp.416-430; 3. Bunch, T.E., Hermes, R.E., Moore, A.M., Kennett, D.J., Weaver, J.C., Wittke, J.H., DeCarli, P.S., Bischoff, J.L., Hillman, G.C., Howard, G.A. and Kimbel, D.R., 2012. Very high-temperature impact melt products as evidence for cosmic airbursts and impacts 12,900 years ago. *Proceedings of the National Academy of Sciences*, *109*(28), pp.E1903-E1912.