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Comparative petrographic, geochemical and isotopic characterization of distal ejecta layers

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The formation of large impact structures can be accompanied by the production of a specific type of deposits called ejecta, often distributed over vast areas. These layers are largely composed of crushed and melted dust and rock fragments. More than 2.5 crater diameters away from the source crater, these layers are called distal ejecta (Glass and Simonson, 2012), which are not commonly preserved. Beyond 10 crater diameters from the source crater, the ejecta layer is primarily composed of glassy impact spherules of less than 1 mm, which represent solidified melt droplets and vapour-condensates. If no primary crystals are present within the spherules, these impact spherules are called microtektites, otherwise they are called microkrystites. Compared to the 190 confirmed impact structures on Earth, only roughly 30 distal ejecta layers are currently known, and only c. 7 impact structures have been directly linked to distal ejecta layers (Glass and Simonson, 2012).

To verify the impact origin of terrestrial spherules layers, petrographic (e.g., glassy and altered spherules, Ni-rich spinel crystals, shock-metamorphosed mineral grains), geochemical (e.g., Ir anomalies and other siderophile element enrichments) and isotopic (e.g., Cr and Os isotopic data) characteristics are mostly used. Together with tectonic, stratigraphic and geochronological information, these indicators for impact cratering have also been used to group different spherules layers together (e.g., Paraburdoo-Reivilo; Goderis et al., 2013) and to suggest potential source craters (e.g., spherules in the Zaonega Formation may be linked to the 2.02 Ga Vredefort impact structure; Huber et al., 2014). However, the products of ejecta formation can be highly diverse, as well-illustrated by the Chicxulub case, where crushed, melted and condensed material was deposited in different types and proportions across the globe. This work focuses on the extensive collection of proximal and distal ejecta from various locations and time intervals available at the Vrije Universiteit Brussel by using petrography, SEM-EDS and novel geochemical techniques such as micro-XRF and LA-(MC-)ICP-MS. This way we aim to provide better constraints on impact spherule formation through time and to confirm (or not) links between specific spherule layers and with particular impact structures.

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