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Furthering the Evidences for the Impact Origin of Ramgarh Crater, India through Petrographic and Geochemical Evidences

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Ramgarh structure in western India, with its nearly circular-shaped topographic high, has captivated geologists since the nineteenth century, but with the recent studies confirming its impact origin. Ramgarh crater lies in a flat sedimentary terrain within the vast soil-covered plains of Neoproterozoic Vindhyan Supergroup. This study utilized multi-proxy approach through petrographic, and geochemical evidences to ascertain Ramgarh's impact origin and thus to provide more convincing evidence. From the petrographic study, the lithounits show multiple cracks, intense fracturing, the growth of shock-induced micro-fabrics like breccia, PFs, and PDFs, melted quartz grains, diaplectic quartz glass, and amorphous and vitrified matrix, all of which are strong indicators of an impact origin. Geochemically, the Cr, Ni, and Cu concentrations in the lithounits are high, and the chondrite normalised values that correspond to these concentrations show noticeably higher levels than the crustal average, indicates its interaction with an extra-terrestrial object. Inter-elemental ratios show positive correlation suggesting that the possible impactor is a differentiated achondrite. Furthermore, the zircon U-Pb geochronological study revealed small discrepancy in Pb isotopic ratios with large concentrations of U, which corresponds to the age between 528 and 395 Ma, and hence the impact event is postulated within this age limit. This age falls within the range of the mid-Ordovician Meteor Event (OME) (467.5 ± 0.28 Ma) and is substantially closer to the Precambrian-Cambrian Boundary Thus, the Ramgarh crater age can be further constrained to non-OME duration, as the latter event is associated with a L-Chondrite impactor, unlike the differentiated achondrite impactor at Ramgarh.