INSIGHTS INTO GEOCHEMICAL AND SULPHUR ISOTOPE CHARACTERISATION OF PYRITE GRAINS FROM AN IMPACT MELT-BEARING ROCK FROM LONAR CRATER, INDIA.

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Introduction: Lonar forms a well-preserved simple bowl-shaped meteorite impact crater in the vastness of ~65 Ma Deccan tholeiitic flood basalts [1]. The emplacement of crater entirely on a basaltic terrain has attracted the global attention and has been well-studied for years. The crater has a diameter of 1.88 km with a depth of ~150 m [2]. Around six basaltic flows have exposed in the area. Lonar has been widely studied as a planetary analogue for Lunar and Martian impact craters with respect to geomorphology, ejecta emplacement, surface modification and evolution [1, 2, 3]. An impact melt-bearing rock from the crater shown the presence of discrete pyrite grains having unusual geochemical properties and $\delta^{34}S$ values, which is subjected to detailed study for analyzing the influence of impact event in generating the pyrite grains.

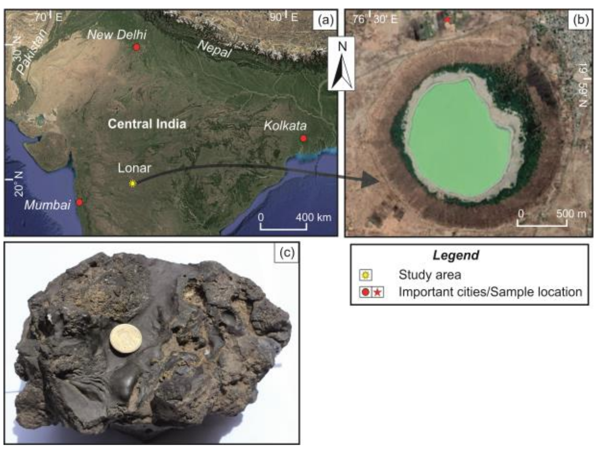

Fig. 1. Location map of the study area. (a) Google Earth image of Central India (b) Google Earth image of Lonar Crater (c) Melt-bearing rock collected from the ejecta layer of Lonar Crater**.**

Samples and Methodology: The impact melt-bearing rock has been collected from the northern part of the Lonar crater during field observation conducted in May 2018. For a detailed examination of the rock it has been subjected to mineral grain separation and it resulted in getting ~33 grains of pyrite along with other mineral grains like zircons, rutile, magnetite and cristobalite. The pyrite grains were subjected to Laser Raman analysis and trace and rare earth element (REE) geochemistry. The sulphur isotope analysis has been conducted using a CAMECA IMS1280 large-geometry ion microprobe at the Centre for Microscopy, Characterisation, and Analysis (CMCA) of the University of Western Australia, Perth.

Results: The pyrite grains are found to be discrete, minute (<100 μm), euhedral to sub-hedral and having skeletal crystal margins. Inclusions of host rock can be seen in the grains. Separated grains were showing Raman peaks at 340 and 377 cm^{-1} that are corresponding to pyrite. The trace and REE geochemistry of pyrite grains are highly heterogeneous. Lonar pyrites with wide range of trace element and REE geochemistry is different from the restricted range shown by standard pyrites, target Deccan basalts, impactites and Archean basement rocks. The $\delta^{34}S$ values show a wide range from -2.0 to 22.7‰ for some selected eleven pyrite grains.

Discussion: Pyrite, the most abundant and widespread sulphide mineral can form in diverse terrestrial settings [4]. The highly heterogeneous trace and REE geochemistry of pyrite grains from impact melt-bearing rock is reflecting the contribution from diverse sources and high degree of fractionation. Most of the trace elements are found to be incompatible in the pyrite samples except Cr, Co, Ni, Cu, Zn, Ba, Pb and U. Geochemical discrimination diagrams plotted between REEs show that the samples occupy both magmatic and hydrothermal fields of origin, while ruling out the possibility of sedimentary origin. Lower REE contents and flat chondrite-normalized REE pattern are comparable to that of chondrites among different types of meteorites. The large variability of $\delta^{34}S$ is not so common and need further introspection.

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