Petrography, mineralogy and geochemistry of the K/Pg layer at the Bottaccione Gorge of Gubbio, Italy

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In 1980, Walter Alvarez discovered an iridium (Ir) anomaly (5.5 ng/g) within a pelagic clay greenish layer in the Umbrian-Marche Apennines of the Bottaccione Gorge in Gubbio, central Italy. This clay layer (about 1 cm thick) dated 66 million years ago corresponds to the Cretaceous/Paleogene (K/Pg) boundary and marks the mass extinction occurred on our planet that caused the disappearance of 75% of living species. Such discovery led to the asteroid impact theory (Alvarez et al., 1980) as main mechanism for the K/Pg extinction that followed the formation of a 180km-diameter Chicxulub impact crater, buried under the Yucatán Peninsula, Mexico. Following the discovery by Alvarez, Ir anomalies have been found at over 80 K/Pg sections distributed worldwide, making this a globally recognizable feature. Noteworthy, Ir enrichments up to 7.5 ng/g have been reported also in ash particulates from an eruption of the hot-spot volcano Kilauea in the Hawaiian belt (Finnegan et al., 1990), and in volcanic-origin debris belts in Antarctica stranding zones (Koeberl, 1989). Across the Cretaceous-Paleogene boundary, Deccan Traps were active and erupted over $>10^6$ km^3 of flood basalts that might have contributed to the anomalies of Ir, but also Hg as often reported in literature. Mercury (Hg) anomalies in sedimentary rocks are extensively used as a geochemical marker of large magmatic events (e.g., Gu et al. 2022).

In this study we sampled the K/Pg layer at the Bottaccione Gorge in Gubbio (Italy) and some samples from the Scaglia Rossa formation at the top and bottom of the Ir-rich layer. The samples were analysed by scanning electron microscope (SEM), X-ray powder diffraction (XRPD), and optical microscopy with polarized transmitted light. Additional measurements consisted of Hg and total organic carbon (TOC) analyses.

The results will allow us to verify whether an asteroid impact or large magmatic events produced geochemical correlations between the anomalous elements especially Hg and Ir, and the results of a comparative study will show the Ir bulk content of Earth and partitioning between primitive melts and rock-forming minerals.

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