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Geochemical and mineralogical investigations of the Bonarelli level (Gubbio, Italy): evidence of Hg anomalies

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The emissions of volcanic gases over the Earth's history have played a major role in changing the chemistry of the terrestrial atmosphere with implications for life development and sustainability (Kasting and Catling 2003). Sedimentary rocks record geological processes that occurred at the interface between water and/or surface and atmosphere such as volcanic eruptions and other (extra)terrestrial catastrophic events. In the last decade, anomalous concentrations of mercury (Hg) in the sedimentary record have been used as a global tracer of extensive volcanism, although other sources of Hg must be taken into account as massive wildfires and continental weathering (Grasby et al. 2019). In this ongoing study, we aim at establishing the relation between geochemistry and mineralogy to explain the occurrence of Hg anomalies in sedimentary rocks distributed at regional scale. We investigated the *Bonarelli level*, a 0.87-m thick layer made of organic-rich shales, that outcrops at Valle della Contessa section in Gubbio (Italy). This layer records the Oceanic Anoxic Event 2 (OAE2; Cenomanian-Turonian, ~93 Ma), an event likely triggered by submarine volcanic emission of High Arctic and Caribbean large igneous provinces (Turgeon and Creaser 2008).

We collected rock samples from ~1 m below up to ~1 m above the *Bonarelli level* every 5 to 10 cm including the confining limestones. Measurements of absolute Hg concentrations were performed using the Direct Mercury Analyzer (DMA-80 Tricell) and combined with the mineralogical abundance at each layer determined by X-ray diffraction (XRD). Additional measurements were carried out to determine the concentrations of trace elements using the inductively coupled plasma-mass spectrometry (ICP-MS). Analyses of $\delta^{13}C$ and total organic carbon (TOC) were also performed on the collected samples.

Preliminary results show low Hg concentrations measured in the limestones less than 20 µg/kg, but anomalous high contents up to ~1600 µg/kg within the *Bonarelli level*. These high Hg concentrations correlate positively with chalcophile elements such as Cu, Ni and Fe. XRD semi-quantitative analysis show that oxidized (barite, jarosite) and reduced (pyrite) S-bearing minerals

are among the minerals occurring in the *Bonarelli level* that, along with the organic matter, are good candidates to host the Hg released to the atmosphere by extensive volcanic eruptions.

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