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Hydrological response to the Toba eruption as recordered in the Quaternary sediments of the Son river,Madhya Pradesh, India: implications for landscape evolution and Middle-Palaeolithic human settlements

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The climatic and environmental impacts of the Youngest Toba Tuff (YTT, 74 kyr +/- 2 BP) eruption from Toba volcano, Northern Sumatra, are hotly debated in the literature. Intense global cooling and the onset of a glacial period has been attributed to aerosol and ash emitted by the eruption, although recent studies suggest that the impacts were far less severe. Following this theme, it has also been suggested that the YTT eruption played an important role in shaping the genetic diversity of modern human populations.

The Middle Son Valley, India, was the first locality in the Indian Subcontinent reporting presence of YTT. The ash extends for more than 30 km and forms a discontinuous layer, showing in few selected sites primary deposits topped with secondary re-washed ash. The ash has been investigated since the ‘90s to assess both the global palaeo-envrionmental and human impact of the Toba eruption, with discordant results. Nevertheless, the exact position within the alluvial stratigraphy and absolute dates relative to the Quaternary sediments surrounding the ash are still unclear.

Here we report on the stratigraphic context of ash layers present in alluvial deposits in the area Rehi-Ghoghara-Khutiali, in order to assess: i) the Son River geomorphology before and after the eruption; ii)the landscape response to the ash fall-out; iii) the validity of the YTT as chronostratigraphic marker for palaeo-environmental and archaeological studies. Using stratigraphic logs and sedimentological reconstruction, we have studied the lithostratigraphic units of the receiving environment at the time of the eruption and the river evolution after the ash fall-out. Facies associations have been used to determine the geomorphology of the river and a new hydrological, geomorphologically constrained model for the Son River is here proposed. We suggest the recovery of the ecosystem lasted 10-15 years, after which the river returned to its previous conditions but within a post-ash geomorphological setting.