

The entire magmatic history of the Toba Caldera Complex that influenced human evolution, northern Sumatra, inferred from zircon U-Pb geochronology

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The entire magmatic history of the Toba Caldera Complex (TCC), which involves the climactic Youngest Toba Tuff (YTT) super-eruption at ~74 ka, was investigated using zircons from the Oldest Toba Tuff, a post-caldera lava dome and detrital zircons from Toba lake sediments (whitish tuffaceous fine sand) deposited after the YTT activity. It was reconfirmed by U-Pb method that magmatic activity of the TCC started at ~1.3 Ma and it was newly found that the zircon-forming magmatic activity of TCC culminated at ~0.3 Ma, well before the ~0.07 Ma YTT eruption. Therefore, the climatic YTT eruption was not triggered by intensive/rapid magma supply at the time of eruption. The trigger should have been a small magmatic input or some other mechanisms (such as mechanical roof failure and roof subsidence into the magma reservoir). The TCC magma was stored incrementally over 1 million years as cold storage and finally it vented voluminous tephras at ~0.07 Ma. The remarkable accordance of zircon U-Pb age distribution between YTT and a post YTT lava dome (Tuk Tuk lava dome) indicates that post-caldera magmatic activity/resurgence occurred using essentially the same magma with YTT.

Keywords: super-eruption, Toba Caldera, U-Pb dating