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Where is the Toba eruption in the Vostok ice core? Clues from tephra, O and S isotopes

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The ca. 74 ka BP “super-eruption” of Toba volcano in Sumatra is the largest known Quaternary eruption. It expelled an estimated of 2800 km^3 of dense rock equivalent, creating a caldera of 100 x 30 km. The eruption is estimated to have been 3500 greater than the Tambora eruption that created the “year without summer” in 1816 in Europe (Oppenheimer, 2002). However, the consequences of this “mega-eruption” on the climate and human evolution that could be expected for such eruption are still debated and uncertain. There is no evidence that this eruption has triggered any catastrophic climate change such as a “nuclear winter”. One of such lack of evidence lies in the ice.

In the ice core community, this eruption still remains a mystery. Indeed, the estimated size of the eruption should have left a gigantic mark in the ice, at least in the form of a huge sulfuric acid layer but none of the ice records covering this period show any such singularity. The sulfate record seems so common that it is in fact difficult to allocate a specific sulfate peak to this event.

In an effort to synchronize the Vostok ice core and the EPICA Dome C core, (Svensson et al., 2013) have identified three possible sulfuric acid layers for the Toba eruption in the Vostok ice core. In order to see if one of such event could have been the Toba eruption, we have performed the sulfur & oxygen isotope analysis of these three sulfuric acid layers in the hope that it could reveal some particularity. The sulfur results show that 1- all these three events have injected their products in the stratosphere and 2- the sulfur isotopic compositions of these three events share a common array, array that is in lines with other stratospheric eruptions, however one of the three acid layers shows an extremely and unusual weak oxygen anomaly, potentially indicating a major eruption. In order to remove the last doubts about the existence or not of one or a series of eruptions related to TOBA, the geochemical analysis of volcanic glasses trapped in the ice will be performed and presented.