Atmospheric impact of the Bronze-Age 'Minoan' eruption of Santorini Volcano

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It has been commonly believed that the Bronze-Age ‘Minoan’ eruption, which ejected ash and gases up to 36 km in the atmosphere, had an important environmental impact at a global scale. Here, we assess for the first time the atmospheric impact of this eruption. We have quantified the volatile (S, Cl, F, Br, I) degassing budgets of the Minoan eruption using constraints on eruption magnitude (i.e., total mass of magma erupted) and volatile abundances, which are gathered from field and petrological data, respectively. Our petrological studies have shown that the minoan magma was particularly rich in dissolved chlorine and that a free H2O-Cl-rich fluid phase (vapour and/or brine) may also have been present in the reservoir prior to eruption. By combining petrologic constraints on eruption volatile yields with a global atmospheric chemistry-transport model, we show that the Minoan eruption of Santorini Volcano released far more halogens than sulfur and that, even if only 2% of these halogens reached the stratosphere, it would have resulted in strong global ozone depletion. The model predicts reductions in ozone columns of 20 to > 90% at Northern high latitudes and an ozone recovery taking up to a decade. These stratospheric ozone losses might have generated a significant climate forcing and thus have to be taken into account in the modelling of climate perturbation which followed the eruption.