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New proxy to identify past volcanic eruptions in ice cores

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Volcanic eruptions are widely used in ice core science to date or synchronize ice cores. Volcanoes emit large amounts of SO_2 that is subsequently converted in the atmosphere into sulfuric acid/ sulphate. Its discrete and continuous quantification is currently used to determine the ice layers impacted by volcanic emissions, but available high-resolution sulphate quantification methods in ice core Continuous Flow Analysis (CFA) struggle with insufficient sensitivity. Here, we present a new high-resolution CFA chemiluminescence method for the continuous determination of Fe2+ species in ice cores, which shows clear Fe2+ peaks concurrent with volcanic sulphate peaks in the ice core record. The method, applied on a Greenland ice core, correctly identifies all volcanic eruptions from between 1588 to 1611 and from 1777 to 1850. The method has a detection limit of ∽5 pg g–1 and a quadratic polynomial calibration range of up to at least 1760 pg g–1. Our results show that Fe2+ is a suitable proxy for identifying past volcanic events.

These findings represent a first step to further investigate, together with other proxies, the possible ocean fertilization effect promoted by the bioavailable and soluble iron emissions from past volcanic eruptions.