Geophysical Research Abstracts
Vol. 16, EGU2014-1915, 2014
EGU General Assembly 2014

A new rapid and non-destructive method to detect tephra layers and cryptotephras: applying to the first distal tephrostratigraphic record of the Chaîne des Puys volcanic field (France).

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Tephrostratigraphy has been considerably developed for 30 years, mainly in palaeo-environmental studies. In such studies, distal tephra layers are important chronological markers, but they are also tools to establish or specify record of past eruptions of a volcanic field.

Nowadays, development of effective rapid methods to detect tephra layers in sedimentary records of various compositions is a challenge. Many classic methods for detection of tephra layers, like regular sampling or magnetic susceptibility measurements, have shown their limits. Regular sampling takes a long time, and finding tephra layers remains uncertain. Moreover, magnetic susceptibility maesurements, although it is a non-destructive method, is ineffective when tephra layers are made of volcanic glass shards with differentiated magma composition. X-ray fluorescence (XRF) is also a non-destructive method but it takes a very long time to analyze a core with sufficient high resolution, and measurements only concern the surface of the sediment.

We propose a new method allows detection of tephra layers with, for the first time, a 3D resolution: the Computed Tomography Scan (CT- Scan). This method, regularly used in medicine, allows there to obtain pictures of materials density on 3D with inframillimetric measurement ranges. Then, it is possible to detect tephras, cryptotephras (invisible by naked eye), reworked tephra layers even when tephra layers don't outcrop at the surface of the sediment (and are therefore undetectable by usual methods like XRF and magnetic susceptibility). This method has been tried out on tephras sedimented in different types of sediments (silicated, carbonated and organic matter). Our results show that this method is very efficient for peaty environment. Used on coring carried out in Forez Mountains (French Massif Central), CT-Scan allows to detect more tephra layers than usual methods (XRF and magnetic susceptibility). Results presented here allow to build the first tephrostratigraphic record of distal tephras of the Chaîne des Puys volcanic field (France). We also present new chemical datas which characterize the chronological history of volcanic activity for 13 500 years, and a new and young volcanic eruption in the Chaîne des Puys.