Marine tephrostratigraphy: a powerful geological tool to better understand the eruptive history of Montagne Pelée in Martinique, Lesser Antilles.

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ABSTRACT

Understanding the past eruptions of volcanic systems in term of frequency, chronology, geochemistry and eruptive dynamics is a fundamental and crucial point for the assessment of future volcanic risk on society and climate. But, quite often scientists have a narrow and fragmented view about volcanic and magmatic history in the past, due to the sedimentary gaps in the land records especially in regions affected by high erosion rate and lack of outcrops (tropical zones). However, tephrostratigraphy of marine deposits can represent a most useful tool to much better constrain the chronology and the features of lacking eruptions.

In this perspective, we are studying pristine fragments of volcanic glasses (e.g. tephra) recorded in two sedimentary marine cores, which have been collected offshore Martinique, on the western and eastern side of the island during the IODP Expedition 340 (April 2012, Joides Resolution) and the CASEIS cruise (2016, N/O Pourquoi Pas?), respectively. With these two locations, we hope to access to the complete history of Montagne Pelée during the last 120 ka and to identify the most significant volcanic events in the central Lesser Antilles Arc. For this purpose, we firstly distinguished tephra layers *s.s.* (primary deposits) from the reworked volcanoclastic layers (secondary deposits) and then developed and implemented an assay protocol for the best analysis of tephra using the morphological (*i.e.* SEM) and in-situ geochemical characterization (*i.e.* EPMA and LA-ICP-MS-MS).

We show here that this multidisciplinary investigation method that combine the use of tephro-chronostratigraphic ($\delta^{18}O$), observations and the fine geochemical analysis is a great potential tool to more correctly reconstruct the magmatic history of active volcanoes and to more precisely pinpoint the time synchronous marker horizons (isochrons) for each volcanic event or phase (*e.g.* the new Grand Rivière phase of Montagne Pelée during the period 22-29 ka). Consequently, these new insights could help to establish a potential causal chain of events, namely to correlate the eruptive events with the paleoenvironmental and paleoclimatic archive. In this regard, future work concerns the estimate of the impact of volcanic (ash) eruptions on the marine ecosystem by studying the biocalcification of planktonic foraminifera in these same marine sedimentary sequences.

Key words: Volcanology, Sedimentology