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An integrated approach to dating the geochronology of the Soufriere Hills Volcano, Montserrat, within marine sediments

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Tephrochronology is commonly used to create a chronological framework on which palaeoenvironmental data can be placed, this is particularly useful within the Quaternary. It can also be used, however, to assess the volcanic history of a region, to correlate volcanic events, assess the dispersal of tephra, and to answer fundamental questions on magma genesis and the evolution of a volcano. However, to successfully utilise these techniques a variety of dating methods must be used in order to fully determine the age of the tephra layers. This research looks at dating volcanic events of the Soufrière Hills volcano, Montserrat, West Indies, and building up a comprehensive geochronological record from marine cores, of subaerial and submarine events occurring over the last 135 ka.

Montserrat is one of the smaller volcanic islands in the Lesser Antilles Island Arc, with a volcanic history spanning from $\sim$2.5 Ma to the present day. The youngest of four volcanic centres, the Soufrière Hills, has been active for $\sim$135,000 years, and most recently has undergone a number of cyclic dome growth and collapse events since the present phase of eruption began in 1995. These collapse events have generated pyroclastic flows down the flanks of the volcano into the ocean. More than 90% of the 0.7 km^3 of extruded magma has been redistributed into the ocean in this

way. Upon entrance into the ocean the large, dense blocks settle rapidly from the base of the flow, whereas the finer ash grade components mix with the overlying water column to form turbidity currents that flow distances in excess of 30km from their source. Analysis of marine cores collected during 3 recent research cruises (2002, 2005 and 2007) indicate similar volcanogenic turbidites, as well as ash fall tephras, have been deposited during previous phases of eruption, occurring over the last 10 ka. The sediment cores were collected from around the island, both proximal and distal to Montserrat, and using sedimentological studies and compositional analysis the events observed within them have been defined and correlated. In order to assess these events fully, however, an accurate geochronological framework is required and this was carried out using high-resolution oxygen isotope stratigraphy, along with carbon-14 dating and micropalaeontological dating techniques such as *Globorotalia menardii* zonations. This multiproxy approach has led to a clear chronology of the events from the Soufrière Hills, and has additionally provided data on the flow dynamics of volcanogenic turbidites in the marine realm.

Correlation of these events with those observed and dated onshore using Ar/Ar dating provides us with a unique record of the events that occurred on Montserrat through the late Pleistocene and Holocene and further substantiates the importance of studies utilising multiproxy dating techniques.