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Tephrochronology of marine sediments around the island of Montserrat, Lesser Antilles Volcanic Arc: the key to episodic volcanism and turbidite flow dynamics

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The island of Montserrat is part of the Lesser Antilles volcanic arc, and has a well-known eruption history stretching back over 2.5 Ma. Three volcanic centres have been identified: the Silver Hills (2.6-1.2 Ma), the Centre Hills ($\sim$950-550 ka) and the most recent, which this research focuses on, the South Soufrière Hills-Soufrière Hills complex (at least 174 ka to present). Until recently these data have been based solely on sub-aerial deposits and ^{40}Ar-^{39}Ar age data (Harford *et al*., 2002). However, marine sediment coring during recent cruises in 2002 and 2005 have recovered a record of intermittent volcanic activity over the last $\sim$250 ka, which is more continuous and more complete than the coeval sub-aerial terrestrial deposits (Le Friant *et al*. 2008). The presence of such unusually detailed information enables a chronology of events spanning the volcanic history of island to be developed. However, in order to link sub-aerial and sub-marine records further more precise age control is required.

This current research forms part of an ongoing study into understanding the timing, deposition and dynamics of mass flow events into the seas around Montserrat, and aims,

with the use of oxygen isotope stratigraphy, ^{14}C dating and detailed micropalaeontology, to build up a definitive framework of timing of these events, further developing our knowledge of the evolution of Montserrat's volcanic history over the last $\sim$250 ka, and that of episodic volcanism.

Sedimentological techniques have been used correlate a number of bioclastic and volcanoclastic turbidite units from proximal to distal regions around the island, with 8 events being found throughout 54 cores drilled on the cruise JR123 in May 2005. However, to fully correlate the units, both with each other, and with those subaerial events dated on Montserrat, detailed dating must be undertaken.

In this study a number of cores have been analysed to correlate and date events both proximal and distal to the volcanic source, from: (1) the south east of Montserrat into the Bouillante-Montserrat graben; (2) to the west of Montserrat and (3) to the north east of Montserrat. Each core contains at least one of the defined turbiditic units, bounded by hemipelagic sediments, which have been used for high resolution analysis. Results from these cores show a clear δ^{18}O stratigraphy spanning $\sim$130 ka in the most distal cores, and clear *Globorotalia menardii* Zones supporting the glacial-interglacial periodicity seen in the oxygen isotopes. ^{14}C results in 2 of the cores also support dates suggested by isotope stratigraphy for the younger events and correlate well with defined subaerial events seen on Montserrat. These results enable us to clearly date, with the use of multiproxy data, the events seen within these marine cores, and further enable us to assess in more detail the flow dynamics of these events, particularly related to sea floor erosion as the turbidite evolves and travels to more distal localities.

This unique study provides the opportunity to assess controls on episodic volcanism, the cause of large-scale edifice collapse, and the dynamics of turbidity currents. A high quality geochronological record, linking subaerial and submarine events, is essential to address these issues.

Harford, C.L., Pringle, M.S., Sparks, R.S.J. and Young, S.R., 2002. The volcanic evolution of Montserrat using ^{40}Ar/^{39}Ar geochronology. In: Druitt, T.H. and Kokelaar, B.P. (eds), *The Eruption of Soufrière Hills Volcano, Montserrat, from 1995 to 1999.* Geological Society, London, Memoirs, **21**, 93-113.

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