

The Thermal Histories of Hyaloclastite Glasses from the HSDP Drill Core

A R L Nichols (Institute for Mineralogy, Petrology and Geochemistry, University of Munich, Theresienstrasse 41/III, 80333 Munich, Germany; ph +49 (0)89 2394-4272; fax +49 (0)89 2394-4176; e-mail nichols@petrol.min.uni-muenchen.de); J Gottsmann (Department of Earth Sciences, The Open University, Walton Hall, Milton Keynes, MK7 6AA, United Kingdom; ph +44 (0)1908 659776; fax +44 (0)1908 655151; e-mail j.gottsmann@open.ac.uk); D B Dingwell (Institute for Mineralogy, Petrology and Geochemistry, University of Munich, Theresienstrasse 41/III, 80333 Munich, Germany; ph +49 (0)89 2394-4249; fax +49 (0)89 2394-4176; e-mail dingwell@petrol.min.uni-muenchen.de)

Fresh basaltic glasses from the matrices and clasts of hyaloclastite sequences in the drill core recovered in the Hawaii Scientific Drilling Project (HSDP) have been analyzed using relaxation geospeedometry in order to determine their natural quench rates across the glass transition. The glass transition is defined as the temperature interval over which a system changes from liquid-like behavior to solid-like (glassy) behavior. The technique involves the calorimetric quantification of the enthalpy relaxation processes that occur as a liquid is cooled or reheated across its glass transition. Modeling the enthalpy relaxation of the volcanic glasses during a thermal calibration procedure allows us to determine their natural cooling rates across the glass transition. Initial results suggest that there is a significant difference between the cooling rates measured in glass from the rims of clasts (151 K/min) and glass fragments taken from the surrounding hyaloclastite matrix (815 K/min), using similar thermodynamic parameters in the modeling. In addition the cooling rates of glasses from the rims of pillows taken from pillow basalts recovered in the HSDP drill core have been measured and range widely from 28 to 1230 K/min. Each of the thermal models for these pillow glasses require similar thermodynamic parameters, which are systematically different from those used to model the hyaloclastite glasses. It is possible that these differences may be used to distinguish pillow glasses from those in hyaloclastites. These observations have important implications in understanding the mode of emplacement of the matrix and clasts in a hyaloclastite unit. Our data may help to constrain whether one or both components are primary products produced in explosive eruptions, or whether they are derived through the reworking of other eruptive products such as pillow lavas during slumping and sliding events.