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Paleointensity results for 0 and 4 ka from Hawaiian lava flows: a new approach to sampling

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Paleointensity data are typically generated from core samples drilled out of the massive parts of lava flows. During Thellier-Thellier type experiments, these massive samples suffer from very low success rates (∼20%), as shown by failure to meet statistical criteria. Low success generally occurs for two reasons: 1) alteration of the sample during the heating process, and 2) multi-domain behavior of massive material. Moreover, recent studies of historical lava flows show that massive samples may not accurately reflect the intensity of the magnetic field even when they are successful (Valet et al., 2010). Alternatively, submarine basaltic glasses (SBG) produce high success rates (∼80%) for Thellier-Thellier type experiments, likely due to near instantaneous cooling rates which produce single-domain magnetic grains. In addition, SBG have been proven to produce accurate records of the magnetic field (e.g., Pick and Tauxe, 1993). In this study we investigate the success of paleointensity experiments on subaerial quenched basalts from Hawaii in the quest for single domain, rapidly cooled subaerial analogs to SBG. We also examine the effects of grain size and cooling rate on the accuracy of paleointensity results. During March 2011, we collected samples from 31 dated lava flows (0-3800 BP), including the historical 1950 C.E. and 2010 C.E. flows. Each lava flow was additionally subsampled when unique cooling structures within the unit could be identified. Single-domain, rapidly quenched glasses from the 1950 and 2010 flows are ideally behaved, i.e. straight Arai plots, and accurately record the expected geomagnetic field strength. However, slower cooled specimens from the same flows produce sagged Arai plots and consistently underestimate expected geomagnetic field intensity. Results from ideally behaved glasses over the last 4 ka indicate periods of rapid field change in Hawaii and a possible high intensity field spike around 2.7 ka. We will present new results from our comprehensive data set of Hawaii paleointensity on about the last 4 ka.