ABSTRACT FINAL ID: DI22A-08;

TITLE: Post-shield and rejuvenated lavas sample homogeneous components in the source of the Hawaii mantle plume

SESSION TYPE: Oral

SESSION TITLE: DI22A. Mantle Plumes: Combining Perspectives from Geophysics, Geochemistry, and Geodynamics II

AUTHORS (FIRST NAME, LAST NAME): Dominique Weis[1], Diane W Hanano[1], Michael O Garcia[2], Dennis Geist[3]

INSTITUTIONS (ALL): 1. Earth and Ocean Sciences, University of British Columbia, Vancouver, BC, Canada.
2. Dept. of Geology and Geophysics, University of Hawaii, Honolulu, HI, United States.
3. Dept. of Geological Sciences, University of Idaho, Moscov, ID, United States.

Title of Team:

ABSTRACT BODY: The origin, scale and location of mantle heterogeneities, as sampled by oceanic basalts, have been debated for many years. Individual Hawaiian volcanoes evolve through four different growth stages (pre-shield, shield, post-shield and rejuvenated) that sample varying mixtures of components in the Hawaii mantle plume. Post-shield and rejuvenated stages correspond to smaller degrees of partial melting than the shield stage and provide finer resolution of compositional variations in the plume source. In this study, we compiled all recent literature data on late-stage lavas (130 samples for Pb and 103 for Sr, Nd and Hf isotopes), added our own new data for Kaula and Middle Bank volcanoes (32 samples) and compared them to shield lava compositions (841 and 597 samples respectively). Shield lavas define two clear geochemical trends (Loa and Kea) extending back in time on all the Hawaiian volcanoes [1, 2]. Except Hualalai with a very distinct Loa signature and the least radiogenic Pb ratios on Hawaii, most post-shield lavas plot on the Kea side of the Pb-Pb boundary with a more radiogenic signature than rejuvenated lavas, also dominantly (>95%) with a Kea Pb signature. The late-stage lavas have distinctly more depleted Sr, Nd and Hf isotopic compositions (lower $^{87}Sr/^{86}Sr$, higher ε_{Nd} and ε_{Hf}) than those of the corresponding shields. Mixing trends on all geochemical data do not allow for contributions from Pacific lithosphere to account for these depleted signatures and indicate that the depleted component is part of the Hawaii mantle plume. Rejuvenated lava compositions show a very narrow range of variations and are altogether very homogeneous in all isotopic systems, almost overlapping within analytical uncertainty. As observed for their shield lavas [2], post-shield lavas from Kohala and Mahukona volcanoes are the only significant exceptions to these general observations. These two volcanoes formed at a time when the activity of the Hawaiian mantle plume appears to show a sharp increase in volume flux [3, 4], accounting for their atypical compositions. Most post-shield and rejuvenated lavas on Hawaii are devoid of the enriched signatures present on Loa trend volcanoes that have been related to sampling of the Pacific ultra-low-velocity-zone [2]. This implies either that this enriched material is not sampled by lower degrees of partial melting, or that the late-stage lavas only derive from the northeast part of the plume, which is more homogeneous and is controlled by the Kea component. Such mechanisms may explain why the Kea signature dominates the history of the Hawaii mantle

plume over 82 million years. The homogeneity and consistency of late-stage lava compositions reveal new constraints on the scale and distribution of heterogeneities in the Hawaii deep mantle source.

KEYWORDS: [1025] GEOCHEMISTRY / Composition of the mantle, [1038] GEOCHEMISTRY / Mantle processes, [1040] GEOCHEMISTRY / Radiogenic isotope geochemistry, [3037] MARINE GEOLOGY AND GEOPHYSICS / Oceanic hotspots and intraplate volcanism.

(No Image Selected)

(No Table Selected)

SPONSOR NAME: Dominique Weis

Additional Details

Previously Presented Material: 10 percent at Goldschmidt 2011

Contact Details

CONTACT (NAME ONLY): Dominique Weis

CONTACT (E-MAIL ONLY): dweis@eos.ubc.ca