PLATINUM-GROUP-ELEMENT AND RHENIUM ABUNDANCES IN HAWAIIAN PICRITES: COMPOSITIONAL VARIATIONS IN THE MANTLE PLUME AND POSSIBLE SECONDARY MOBILITY. M. D. Norman¹, V. C. Bennett², and M. O Garcia³, ¹Centre for Ore Deposit Research, University of Tasmania, Hobart TAS 7001, Australia (Marc.Norman@utas.edu.au), ²Research School of Earth Sciences, Australian National University, Canberra ACT 0200, Australia, ³Center for Volcanology, School of Ocean and Earth Science and Technology, University of Hawaii, Honolulu HI 96822, USA.

Introduction: The Hawaiian plume is geochemically heterogeneous on scales of tens of kilometers x tens of years. The plume probably originates at considerable depth and it may sample material from sources as diverse as the transition zone, the lower mantle, and the core-mantle boundary. At least some geochemical components in the plume probably originated as recycled lithosphere. ¹⁸⁷Os and ⁸⁷⁹Os isotopic compositions of Hawaiian tholeiites [1,2,3,] show that the plume components record long term differences in relative abundances of siderophile and chalcophile elements, so these elements may provide useful tracers for the origins of mantle plume source regions. To provide additional information on the siderophile element characteristics of mantle plumes, we measured the concentrations of platinum group elements (PGE) and Re in primitive tholeiitic picrites from the major Hawaiian volcanic centers [4].

Results: Five picrites were analysed for PGE and another 10 for Re abundances by isotopic dilution ICPMS. 1-2g aliquots were dissolved by carius tube and HF-HCl. PGE were preconcentrated by Te co-precipitation and Re by anion exchange.

PGE abundances range from 0.04 to 0.3xPM for Ir, 0.09 to 0.3xPM for Ru, 0.3 to 0.8xPM for Pt, and 0.3 to 1.6xPM for Pd. Re abundances range from 0.27 to 0.95 ppb. Picrites from Loihi and Kilauea generally have higher PGE and Re abundances than those from Mauna Loa and Hualalai. Koolau picrites have among the lowest PGE and Re abundances in this suite. The Kilauea 1840 picrite is exceptional in having low Re contents, more similar to picrites from Koolau than to the other picrites from Kilauea.

Discussion: PGE and Re contents of primitive Hawaiian tholeiites appear to be linked with other source characteristics of the mantle plume, as indicated by their good correlations with Os and Pb isotopic compositions and trace element characteristics such as Zr/Nb [3,4]. Similar Os/Pb and incompatible trace element compositions in the Hawaiian plume components [1,3,4] imply generally similar PGE contents in these components, so the variable PGE and Re abundances in the picrites may reflect other differences in source characteristics during melting.

PGE and Re abundances in the mantle are strongly influenced by sulfides, and their concentrations in these picrites can be modeled using variable amounts of residual sulfide during melting, with the higher concentrations of Re and the PGE in the Loihi and Kilauea picrites implying less residual sulfide in the source of these lavas during melting.

Glass rims and melt inclusions in the Loihi and Kilauea picrites have high contents of reduced S (1200-1500 ppm) and small blebs of immiscible sulfides which show the melts were S saturated on eruption. Our limited data indicates generally lower S contents in submarine glasses from Mauna Loa and Koolau, and less abundant sulfide compared to Loihi and Kilauea. Higher concentrations of PGE, Re, and S in the Loihi and Kilauea picrites may reflect either greater solubility or mobility of mantle sulfides in the Loihi and Kilauea parental melts [7] or different D’s for PGE and Re in the residual sulfide during melting.

Secondary alteration also appears to have modified the Re and perhaps the PGE contents of some Hawaiian lavas. For example, the low Re contents of the Koolau and Kilauea 1840 picrites may reflect alteration and partial loss of this element. Most of the picrites studied here have nearly constant Cu/Re ratios that are similar to the mantle value [5], indicated by the line in Fig. 1. In contrast, the Koolau picrites, the Kilauea 1840 picrite, and a 9% MgO tholeiite collected from Pu’u O’o (KIL93) all have low Re contents and high Cu/Re ratios. Subaerial picrites collected from Mauna Kea by HSDP also have high Cu/Re ratios and low Re contents (data from [1,6]). Re depletion in these subaerial lavas may reflect partial loss during outgassing in shallow magma chambers, on eruption, or by weathering. These data raise the possibility that Re and perhaps the PGE contents of subaerial Hawaiian tholeiites may have been modified during evolution and eruption of these lavas.