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HSE and Os isotope variations in OIB type alkaline lavas from NW Turkey: Implications for the effects of post-melting processes on primary melt compositions

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We have examined Highly Siderophile Element (HSE) and Os-isotope variations in suites of variably fractionated lavas from the Late Cenozoic mafic alkaline volcanic province of NW Turkey in order to evaluate the source characteristics and possible effects of post melting differentiation processes on HSE signatures of these lavas. The results reveal that the behavior of Os and other HSEs changes during magma differentiation. The concentrations of Os, Ir and Ru (IPGE) strongly decrease with increasing fractionation for melts with MgO>10 wt.%, suggesting that these elements are sited in olivine and associated HSE retaining trace phases and behave compatibly during olivine-dominated fractional crystallization. Fractionation trends indicate significantly lower bulk partition coefficients for IPGE in lavas with less than 10 wt.% MgO when compared to values for more primitive lavas with MgO>10 wt.%, possibly reflecting a change in the fractionation assemblages. Platinum, Pd and Re, on the other hand, show poor negative correlations with MgO, indicating that these elements behave moderately incompatibly during crystal-liquid fractionation. The Os-rich primary lavas (>10 wt.% MgO, >50 ppt Os) display a narrow range of 187Os/188Os ratios (0.1361–0.1404), which likely represent the mantle signature of OIB-type alkaline lavas in the region, with some xenolith-bearing lavas displaying depletions in 187Os/188Os ratios (0.1131-0. 1232) relative to the common sources for OIB magmas, possibly indicating slight compositional modification of primitive melts through contamination with highly depleted, Os rich lithospheric mantle. However, Os-isotopic ratios become more radiogenic (187Os/188Os >0.1954) with decreasing MgO and Os content in evolved lavas. This reflects contamination of low 187Os/188Os melts with high187Os/188Os crustal material during shallow differentiation of the magmas. The modeling suggests that Os-isotope ratios are very sensitive to contamination by radiogenic material and even very small amount of crustal input could produce the most radiogenic Os-isotope ratios recorded in the evolved lavas. When combined with the other isotopic tracers it has been demonstrated that this small amount of crust assimilation has an insignificant effect on the Sr, Nd, Hf and Pb isotopic compositions of the lavas and that these isotopic ratios represent the composition of the mantle source of the alkaline melts.