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The 28 Ma Mont Havergal flood basalts sequence : insight into old flood basalt genesis on the Kerguelen Archipelago (South Indian Ocean)

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The Kerguelen Islands (South Indian Ocean) represent the apex of the Kerguelen-Heard oceanic plateau, which is the second largest oceanic plateau on the Earth. The Kerguelen Plateau has been the result of a voluminous magma output from the long-lived Kerguelen Plume since 115 Ma. The Mont Havergal is a 550 meters high sequence of flood basalts in the northwestern part of the Kerguelen Archipelago which correspond to one of the oldest magmatic activity on the Archipelago. Preliminary K/Ar dating on the lower and upper part of the sequence indicate it has been emplaced in about 3 Ma (28.5-25.5 Ma). The sequence is composed of flows of microlitic or porphyritic picrobasalts to basalts, with the occurrence of one trachy-andesitic flow in middle of the sequence. They contain phenocrysts and/or microcrysts of olivine+clinopyroxene+plagioclaseśilmeniteśTi-Magnetiteś Magnetite in a matrix that has the same mineralogical assemblage. Seven samples out of eleven have high MgO contents between 8 and 14 wt% compared to other Kerguelen Archipelago flood basalts, which commonly have lower than 6 wt% MgO. Some lavas have characteristics of tholeiitic magmas with low Na2O+K2O ratios and low Ca-pyroxene phenocrysts (pigeonite), whereas some others have a more alkaline affinity with higher Na2O+K2O ratios. Mineral major element data indicate that mineral heterogeneity is common in a single flow and disequilibrium between phenocrysts and the matrix. All the lavas have trace-element signatures enriched compared to the primitive man-

tle, with a smooth progressive enrichment towards the most incompatible elements (La, Th, Rb, Ba; La/Yb = 4-14), but with a relative depletion in Th, U compared to their neighbouring trace-elements Ba and Nb (high Ba/Th =69-283). Some key trace-element ratios such as Ba/La, Ba/Nb or Zr/Nb are more representative of an OIB source than a MORB source. Initial 87Sr/86Sr isotopes vary between 0.704209 and 0.705146 and initial 143Nd/144Nd from 0.512673 to 0.512843. The Sr and Nd isotopic variations can be explained by mixing of a depleted source similar to that of the SEIR MORBs and an enriched source similar to that of the Kerguelen plume Major, trace-element and isotopic variations along the flood basalt sequence suggest that fractional crystallisation is an important process in generating the rare evolved lavas (trachy-andesite). However, rapid variations in the ratios of the most incompatible trace elements and rapid isotopic changes between successive flows suggest that the petrogenesis of high-MgO lavas involve rapid changes in partial melting degree and/or changes in source composition with limited amounts of fractional crystallisation.