Geochemical and isotopic constraints on the genesis and evolution of magmas from Mt. Melbourne volcanic filed, Antarctica

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New geochemical and Sr, Nd and Pb isotopic compositions of the Pliocene to Quaternary volcanic rocks from Mt. Melbourne Volcanic Field (MMVF) have been investigated. MMVF covers an area of 30 km (SW-NE) by 60 km (NW-SE) with tens of monogenic eruptive centers, scoria cones, lava flows along the Transantarctic mountains. Primitive mafic rocks in the MMVF comprise strongly SiO_2-undersaturated basanites to mildly alkaline basalts. The occurrence of basanite is confined to eastern (South Edmonson) or southern coastal (Cape Washington) area with a very minor volume of about ~3 km^3, whereas the mildly alkaline basalt to evolved trachytic volcanics dominate (more than 400 km^3 of volume, Wöner et al., 1989) in Mt. Melbourne stratovolcano (~180 km^3 of volume) and surrounding volcanic field (~250 km^3 of volume). Radiogenic isotope compositional ranges of less evolved alkali basalts ($^{206}Pb/^{204}Pb$ = 19.101–19.719, $^{87}Sr/^{86}Sr$ = 0.70297–0.70399, $^{143}Nd/^{144}Nd$ = 0.51284–0.51295) and basanites ($^{206}Pb/^{204}Pb$ = 19.318–19.712, $^{87}Sr/^{86}Sr$ = 0.70293–0.70306, $^{143}Nd/^{144}Nd$ = 0.51292–0.51295) are very similar suggesting a common mantle source with HIMU-like characteristics. Incompatible trace element modeling suggests that melting took place in the spinel garnet transition zone with a residual K-bearing phase (amphibole or phlogopite). The basanitic magmas (La_N/Yb_N = 17-21) are derived from small degrees (1-2%) of partial melting, whereas alkaline basalts (La_N/Yb_N = 11-15) are the result of higher melting degrees (3-5%) at a common mantle source region. Differentiation of primary alkali basaltic melts produced trachyybasaltic to trachytic lavas which are considered to be affected from an assimilation process, possibly with lower–to mid-crustal material.