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Age and isotopic marks of K-rich Manning Massif trachybasalts: an evidence for Lambert-Amery rift-system initiation (East Antarctica)

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Volcanic rocks from the Manning Massif, which is situated in the western flank of the Paleozoic-Late Mesozoic Lambert Rift (East Antarctica), belong to a rare type of alkaline magmatism within the Precambrian East Antarctic Craton. K-rich olivine trachybasalts compose some flows resting upon a surface of Precambrian granulite terrain, each flow of 2.5-7 m in thickness and total section not less than 30 m. Each flow sequence comprises of glassy chilled base with vitroporphyritic texture, fine-plated vesicular basalt with interstitial texture, massive fine-grained basalt with porphyritic microlitic texture, amigdaloidal aphanitic basalt with poikilophytic texture, and vesicular mandelstone of slag crust with vitroporphyritic texture [Andronikov et al., 1998]. Rb-Sr and K-Ar isotopic age of this eruption was estimated as 40-50 Ma and the main reason for this Cenozoic continental volcanism was supposed the post-rift tectonic activity [Andronikov et al., 1998]. But the isotopic characteristics of these trachybasalts are very similar to those obtained for the part of spinel lherzolite and spinel-garnet lherzolite xenoliths from the Mesozoic alkaline picrite of the adjacent Jetty Peninsula region. That could be evidence of the trachybasalt mantle source in long-lived enriched upper mantle beneath the region, either under the lowermost levels of spinel lherzolite facies or on the highest levels of garnet lherzolite facies conditions.

To reveal tectonic position of these enigmatic volcanics, we have studied 16 samples from different parts of basaltic flows for U-Pb geochronology and Pb-Sr-Nd-Os isotopic characteristics. U-Pb SIMS SHRIMP-II analysis was performed for 68 apatite grains from 5 samples. All obtained data-points are approximated by discordia line (MSWD=1.6) on Tera-Wasserburg diagram, corresponding to the age of 346±46 Ma. Common Pb isotope composition of these apatites differs from the model by increased $^{206}Pb/^{204}Pb$ (19.8) and $^{207}Pb/^{204}Pb$ (18.3) that means the source of contamination was an ancient material ($>$ 2.4 Ga) and/or with high μ (26.5). The initial isotope characteristics of the studied basalts are the same for different individual flows: ε_{Nd}=-3.4±0.4; $^{87}Sr/^{86}Sri$=0.7061±0.0003, $^{206}Pb/^{204}Pbi$=18.421±0.001; $^{207}Pb/^{204}Pbi$=15.667±0.001; $^{208}Pb/^{204}Pbi$=39.845±0.001; $^{187}Os/^{186}Osi$ = 0.2012±0.0004 and reflect minimal influence of host-rock contamination during or after melts crystallization and correspond to enriched mantle source signatures akin to plume-like.

Thus the Manning Massif K-rich basalts correlate with the time of formation of the Late-Paleozoic coal-bearing sediments of the Lambert Glacier Rift and basic dykes of Jetty Peninsula [Mikhalsky, Sheraton, 1993] and can be interpreted to mark the earliest, Lower Carboniferous stage of the rifting. This event corresponds to the initial intracontinental stretching in the Eastern Gondwana wich was previously detected only in Perth Basin of western Australia.

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References:

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