Large Igneous Provinces (LIP) and the subcontinental lithosphere of the Kaapvaal craton (South Africa) from the Mesoarchean to the present

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The Kaapvaal Craton, along with the Pilbara Craton (Western Australia), are the only two areas on Earth with a record of relatively pristine 3.6–2.5 Ga crust. Yet, such crust continuously evolved up to our days by numerous episodes of erosion, sedimentation, and magmatic additions. This study focuses on the geochemical evolution and geodynamic situation of all the LIPS (from the ~ 3.07 Ga Dominion Supergroup to the ~ 0.18 Ga Karoo LIP) and smaller sized units, and the information they can provide on the subcontinental lithosphere mantle (SCLM). We mainly focused on the interpretation of literature and newly acquired data for high field-strength-elements, because of their immobility during low temperature alteration processes. All the LIPs and other mafic bodies present trace elements patterns that are (1) remarkably uniform, and (2) clearly distinct for all units. Nevertheless, some similarities remain in all Precambrian units, marked by clear negative Nb, Ta, Ti, and P anomalies. Such results suggest a subduction-related magmatism. However, for most of the units, the tectonic setting has been interpreted to be more similar to a within-plate than a subduction-related setting. In addition, some units also show negatives Pb and Sr anomalies, which are not typical of arc-related magma. Crustal contamination can also explain the Nb-Ta negative anomaly, but some units have isotopic signatures (such as high εNd) that rule out significant such contamination. In the end, such signatures might be either explained by early fractionation of high-pressure rutile in the source, or can be interpreted as evidence of crustal contamination of asthenospheric melts in a continental within-plate setting. Above all, such results are in agreement with a stable SCLM below the craton through time.