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Geochronological, Geochemical and Paleomagnetic Clues for Existence of a ~2.1Ga Dyke Generation in the Mashishing Area, South Africa

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Dyke swarms are widespread throughout the Kaapvaal Craton (KC) in South Africa and have been documented in some detail. Up to date, only the ~2.9 Ga SE-trending and the ~2.7 to ~2.66 Ga radiating dyke arrays are recognized to predate the well known ~ 2.05 Ga Bushveld magmatic event. The knowledgebase on NE-trending dyke swarms in the northeast of KC was recently expanded by Olsson et al. (2016) who reported new U-Pb ages of 1875-1835 Ma, and associated geochemical results to define the so-called Black Hills Dyke Swarm (BHDS). On the other hand, there is no published data for the nearby NE-trending dykes that cut the younger than 2.22 Ga sedimentary formations of the Pretoria Group in the Mashishing area. We conducted a sampling of 10 Mashishing dykes (sites LDA to LDJ), and despite the study area being affected by weathering, preliminary results are reported here. A U-Pb age of ~1.88 Ga from one baddeleyite fraction at site LDH as well as geochemistry is compatible with Olsson et al. (2016)'s data, and suggests a link to the 1875-1835 Ma BHDS. More importantly, however, $^{40}Ar/^{39}Ar$ results of a primary amphibole mineral provided by dyke LDB clearly indicate older plateau values, and a minimal age of intrusion estimated at ~2.1 Ga. Our $^{40}Ar/^{39}Ar$ date, together with geochemistry suggests the existence of a previously unidentified pre-Bushveld dyke generation in the eastern KC. Demagnetization tests consisting of low alternating field pretreatment up to 10 mT, followed by stepwise heating from 100°C to 560-580°C were achieved on more than 80 oriented dyke cores to yield very complex results that are quite difficult to interpret. Thermomagnetic analysis indicates that the ferromagnetic carriers of the studied samples are pyrrhotite and magnetite (Curie temperature is ~350° C and ~580° C respectively). Characteristic remanences locked-in as instantaneous record (snapshot) during cooling of individual dykes may be affected by magnetic overprints, and generally deviate from expected directions. Further work is needed to refine our results.

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References

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