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AN IDENTITY CRISIS SOLVED BY U-PB DATING: THE CASE OF THE CEDERBERG DYKE SWARM, WESTERN AND NORTHERN CAPES, SOUTH AFRICA

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Introduction

The geologic evolution of South Africa during the Mesozoic was heavily imprinted with dyke swarms and sill networks representing the plumbing systems of the 183 Ma Karoo-Ferrar Large Igneous Province ("Karoo LIP") and the c. 50 Myr younger Parana-Etendeka LIP (134 Ma). These LIPs are thought to be the products of mantle plume heads that were, at the time of their formation, under present-day extreme NE South Africa (Karoo) and the central Namibian coast (Parana-Etendeka). Each of these two magmatic provinces are associated in time with the breakup of the supercontinent Pangaea (White and McKenzie, 1989).

The Cederberg dyke swarm predominantly consists of two parallel, NW-striking mafic dykes in western South Africa that are separated by ~50 km (Figs. 1 & 2). The NW-trend of these dykes extends towards the plume centre of the 134 Ma Parana-Etendeka LIP and therefore could represent the plumbing system of the Parana-Etendeka LIP (Fig. 2). However, the eastern extent of the Cederberg dykes extends into the Karoo Basin, thereby clouding certainty over their origin; they could alternatively represent a western extent of the 183 Ma Karoo LIP in the Namaqualand and Cederberg region. The purpose of this study is to test our hypothesis that the Cederberg dykes represent the plumbing system of the 134 Ma Parana-Etendeka LIP and to do so by applying high-precision U-Pb age determinations on baddeleyite.

Results

Sample 18CK003 was collected from a dolerite dyke that measures ~90 m in width and strikes 305° (towards the NW). The dyke is exposed as a roadcut along R363, 26 km southwest from Nuwerus in the Western Cape (coordinates 31.356°S, 18.235°E; Figure 1). Baddeleyite extraction of sample 18CK003 was successful. U-Pb TIMS dating gave a $^{206}Pb/^{238}U$ age of 131.4±4.5 Ma MSWD of 0.1; Fig. 3), based on two concordant fractions.

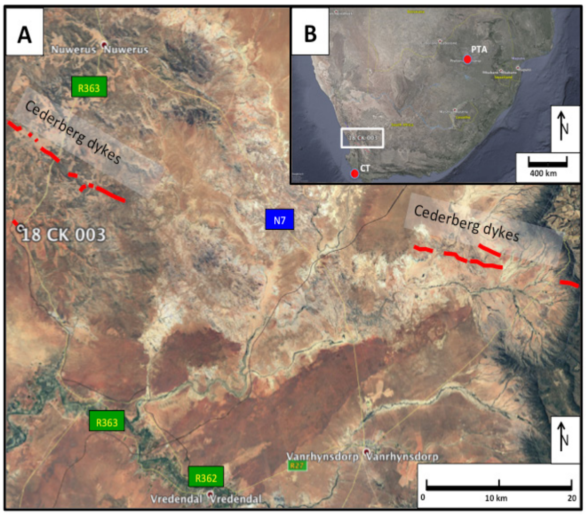

Figure 1. Google Earth® map showing (A) the location of where sample 18CK003 was collected. Thin red, NW-trending lines represent mapped dykes of the Cederberg dyke swarm in the vicinity of the sample collection site. (B) Inset map showing the location of sample 18CK003 (white box) relative to South Africa. Key to abbreviations: CT = Cape Town and PTA = Pretoria.

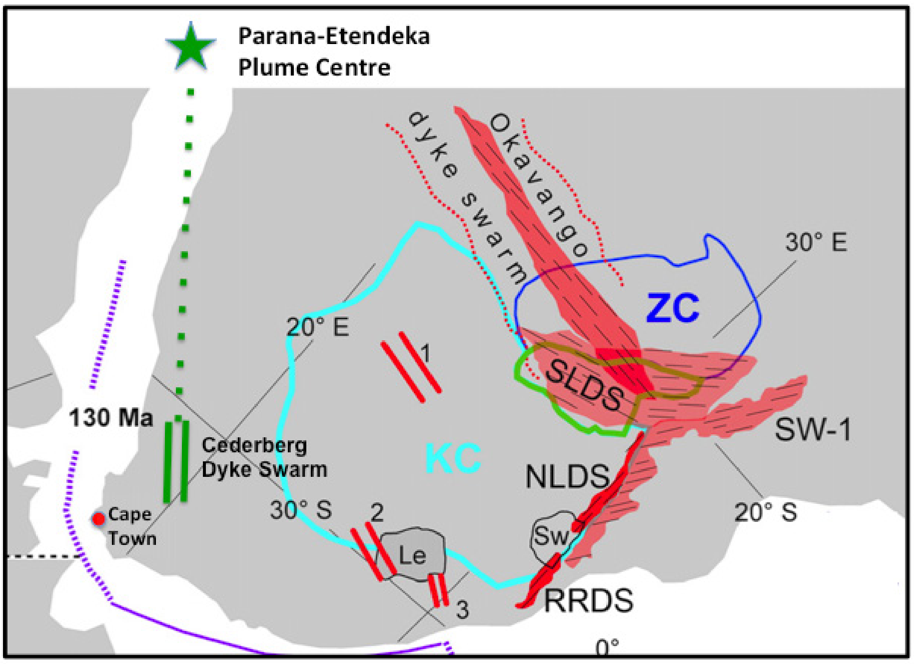

Figure 2: Distribution of dykes (in red) of the 183 Karoo LIP (after Hastie et al. 2014) and the Cederberg dyke swarm (in green after Figs. 7 and 8 in Ernst and Buchan 1997). Note that based on their trend, the Cederberg dyke swarm is proposed to be linked to the 134 Ma Parana-Etendeka LIP. Key to select abbreviations and designations: NLDS = Northern Lebombo dyke swarm; RRDS = Rooi Rand dyke swarm; SLDS = Save-Limpopo dyke swarm; KC = Kaapvaal Craton; ZC = Zimbabwe Craton; 1 = Southern Botswana dyke swarm; 2 = Southern Lesotho dyke swarm.

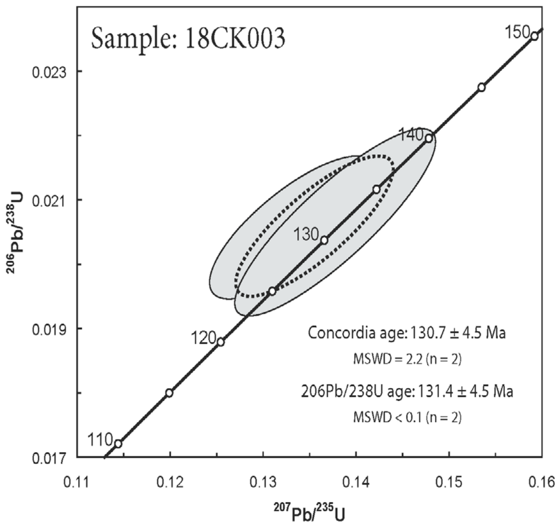

Figure 3: U-Pb concordia diagram of Sample 18CK003

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