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Did the dioritic intrusions of the Vredefort Dome in South Africa form during the Bushveld event?

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The Vredefort dome (VD), South Africa, is seen as part of one of the largest (with a 300 km diameter) and oldest (2.023 Ga [5]) meteorite structures in the world. Due to the meteorite impact event the Earth's crust was turned on-edge which led to the exposure of deep seated rocks after millions of years of erosion. The inner part of the dome consists mainly of granitic basement with various ultramafic to mafic intrusions. The outer rim of the dome consists of sedimentary and igneous rocks. Most of these sedimentary, extrusive and intrusive rocks can be related to lithostratigraphic units of the South African geology: Dominion, and Ventersdorp Supergroups. Two intrusive suites, tholeiitic and alkaline dioritic, are presumed [1][7] to be of the age of the 2054 Ga [6] Rustenburg Layered Suite (RLS) of the Bushveld Igneous Complex (BIC), and are probably related to the same magmatic event. Previous work done by Bisschoff [1], Stepto [6], Coetzee *et al*. [5] place the tholeiitic suite in the same time slot as the BIC based on field relationships between known Witwatersrand rocks and pseudotachylite formed due to the meteorite impact. The dating of some of the members of the dioritic suite (Roodekraal Complex and Lindeques drift intrusion) are also of Bushveld age (2.055 Ga, [2]).

In this study the Koedoesfontein Complex (KFC) and Winddam intrusion (WDI) are compared to the Rietfontein Complex (RFC), all part of the dioritic suite. De Waal *et al*. [3] postulate that the RFC is part of a high titanium suite (HITIS). The aim is to illustrate whether the three intrusions (RFC, KFC and WDI) are indeed part of the HITIS by reporting on their petrography, geochemistry and petrology. RFC were found to consist of repetitive modal layering of olivine, clinopyroxene, plagioclase and magnetite; the rock types of KFC vary from olivine clinopyroxenite to diorite; WDI is mainly an olivine clinopyroxenite with conspicuous late-magmatic crystallization of hornblende. The overall chemistry of these dioritic intrusions is intermediate, and the origin will be illustrated by means of geochemical modelling.

References:

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