

ARE THERE TWO TYPES OF VREDEFORT GRANOPHYRE?

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Introduction: *Vredefort Granophyre*, the Vredefort impact melt rock, has been regarded as a homogeneous lithology, with only local occurrence of a more mafic phase due to assimilation of mafic wall rock [1, 2]. However, [3] described 2 locations of allegedly zoned Granophyre in the NW of the Vredefort dome, composed of clast-poor mafic marginal and clast-rich felsic central portions. They proposed “assimilation of host rock at the base of the superheated impact melt sheet and differentiation of the sheet and emplacement of the dike in a two-stage scenario” [2, p.179].

Methods: To test this allegation backed up by poor chemical analyses only, we studied this dike with special attention to lithozonation, variations in texture, clast populations, wall rock compositions, and chemical/isotopic compositions of Granophyre phases and country rocks. A 1:10,000 field mapping was carried out on farms Kopjeskraal/Eldorado/Rensburgsdrift. Some 50 Granophyre and country rock samples were collected and comprehensively studied petrographically. Some 31 samples of conventional (“normal”) Granophyre (NG), the slightly more mafic phase (MP), epidiorite, Dominion Group Lava (DGL), and granite were analyzed by XRF spectrometry, ICP-MS, and ICP-AES for major and trace element abundances. Samples from all these lithologies were analysed for Rb-Sr, Sm-Nd, Re-Os, and U-Pb isotope systematics.

Results: A continuous zonation of the dike in this area was indeed found, but it comprises clast-rich and clast-poor portions with a reverse arrangement from that by [2]. Comparison between the clast-poor, slightly more mafic central part (MP) and clast-rich (NG) margins showed: (1) a coarser grained texture with less granophyric matrix content, (2) occurrence of schlieren of MP material in central MP, and (3) comparatively more modal Ca-rich pyroxene in MP and schlieren. The transition between the two Granophyre phases in terms of chemistry and mineralogy appears transitional. The dike margins are characterized by comparatively enhanced abundance of felsic clasts. Mafic clasts are overall but only visible at the microscopic scale in both phases. Clast populations of NG and MP do not correlate with local wall rock type. The MP is enriched in Fe₂O₃, CaO and V and depleted in SiO₂, Cr, Zr and Ba, with regard to NG. Based on the currently available chemical and isotopic data, participation of an epidiorite component in the formation of the MP is more likely than one of DGL.

At the conference the chemical and isotopic systematics will be used to analyze an emplacement scenario for this unique dike.

References: [1] Therriault A. M. et al. 1997. *S. Afr. J. Geol.* 100: 115-122. [2] Reimold W. U. & Gibson R. L. 2006. *Chemie der Erde* 66: 1-35. [3] Lieger D. & Riller U. 2012. *Icarus* 219: 168-180.