CARBONATE-RICH IMPACT-MELT FROM MOROKWENG IMPACT STRUCTURE, SOUTH AFRICA.

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Introduction: The Morokweng impact crater (centered 26°20′S, 23°32′E) in the North West Province of South Africa was formed at 145±2 Ma ago by an impact of a LL-6 chondrite [1]. The target rocks of this impact crater mostly include Archaean granitoids, mafic gneisses, greenstones, mafic to acid lavas, and ultramafic cumulate rocks along with the overlying Proterozoic and Phanerozoic (Karoo) cover rocks. More specifically, the Proterozoic supracrustals include extensive dolomitic carbonates and BIF of the Griqualand West Supergroup [2]. The preserved thickness of the impact-melt probably exceeds ~870 m [1] and was interpreted to have formed dominantly from the granitic target along with significant mafic igneous rocks and minor quartzite [3]. In the present abstract, we report our preliminary observation on cores provided by the De Beers company from boreholes drilled ~15 Km SW of the Morokweng town (26°15′30″S, 23°41′30″E), an area blanketed by sand and calcrete of the Cenozoic Kalahari Group [2]. The study of these cores suggests the presence, at least locally, of a carbonates-rich impact-melt component in the Morokweng crater.

Sample descriptions and analytical procedure: In the present study, we have investigated a set of a dozen core samples 70 mm in diameter and up to 8 cm in length. The cores are representative of extensive breccia intersected in boreholes drilled in the early 1990s by the De Beers Company at the site of a magnetic anomaly within the Archaean basement rocks (Dr. C. Smith, personal communication). The clasts in the breccia predominantly consist of granite (generally intensely fractured and discoloured) and sulphide-bearing amphibolite. Occasionally, very fine grained clasts, dark grey or red colour, were also noted. The chemical analyses for the present study were done at PLANEX, Physical Research Laboratory, Ahmedabad, India, with a Cameca Sx 100 electron microprobe equipped with wavelength dispersive spectrometer (WDS) with large crystals (LPET and LLiF) under the following analytical conditions: 15 keV accelerating voltage, 20 nA sample current, ≤1 μm bean with PAP correction.

Petrography: A core sample marked 834/2 (depth unspecified) from the De Beers bore hole has been investigated for the present study. Under the microscope, the rock consists of angular fragments of granitoid of two main sizes (fewer large clasts scattered among smaller ones) within a very fine grained, red-coloured matrix, not clearly resolvable under an optical microscope.

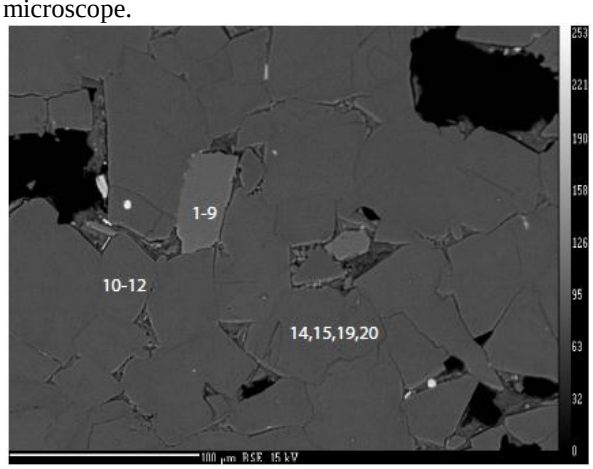

Fig. 1. BSE image of finer grained, red-coloured matrix from De Beers borehole core marked 834/2 (see text; numbers define analytical spots).

BSE image of the finer fraction of the rock sample is shown in figure 1. It mostly consists of subhedral prismatic grains of rectangular shapes, which are in contact with each other showing cumulate-type texture.

Analytical data: Analyses 1-9 were carried out on a prismatic grain with corroded boundary, which was found to be a potash feldspar xenocryst. The rest of the analyses (10-12, 14, 15, 19, 20) established that the matrix material was mainly a dolomitic melt with significant proportions of MgO (~17-23 wt %) and CaO (~36-38 wt %). Our further analyses on other spots of the thin section further confirmed that most of the red matrix consists of euhedral to subhedral dolomite crystals < 100μm in maximum size.

Discussion: Our preliminary investigation on the De Bears borehole suggests that the matrix of the impact breccia consists of dolomitic melt. This suggests the involvement of significant volumes of Griqualand West carbonates as a target rock, at least locally, during the excavation of the Morokweng crater. Given the presence of a melt in the breccia and of common PDFs in the granite clasts (M Andreoli, unpublished data) we conclude that the De Beers boreholes cores intersected a volume of suevite, a rock type previously misinterpreted as Dwyka Group diamictite [3].

References: [1] Maier W. D. et al. (2006) *Nature, 441*, 203-206. [2] Andreoli M. A. G. et al. (1999) *GSA Spec. Paper, 339*, 91–108. [3] Koeberl C. and Reimold W. U. (2003) *GCA, 67*, 1837-1862.