THE SINAMWENDA STRUCTURE - A SMALL NEW METEORITE IMPACT CRATER IN TRIASSIC (UPPER KAROO) SANDSTONES OF WESTERN ZIMBABWE. **S.Master[1a#*], D.J.Robertson[2], C.W.Stowe[3], K.L.Walsh[4], W.U.Reimold[1a], & D.Brandt[1b].** [1a]EGRU, [1b]Dept. of Geology, Univ. Witwatersrand, Wits 2050, Johannesburg, South Africa. [2]Dept. of Physics, Univ. of Zimbabwe, P.O.Box MP 167, Harare, Zimbabwe. [3]Dept. of Geological Sciences, Univ. of Cape Town, Rondebosch 7700, South Africa. [4]Dept. of Geology, P.O.Box MP 167, Univ. of Zimbabwe, Harare, Zimbabwe. # Previous Address: ERSI, Harare, Zimbabwe. * Corresponding Author.

The Sinamwenda Structure is a small 200m-diameter circular crater situated near the shores of Lake Kariba at 17°11'42" S, 27°47'30" E, about 4.8 km SSW of the Sinamwenda Research Station in western Zimbabwe [Fig.1]. The crater is located in an area underlain by Middle Triassic sandstones and grits of the Escarpment Grit Formation (K^6) of the upper Karoo Supergroup. The crateriform morphology, together with the presence of overturned bedding, abundant multiply-striated joint surfaces (MSJS), and enhanced microdeformation of crater rim samples in comparison with samples outside the crater, coupled with the complete absence of any igneous rocks or magnetic anomalies, strongly suggest a meteorite impact origin for the Sinamwenda Structure.

The Sinamwenda Structure was first spotted on aerial photographs [Fig. 2] by one of our group (CWS), who together with his students, visited the structure in 1970, and commenced mapping it with chain and compass. The partially-mapped structure was abandoned when the party of geologists was chased away by an aggressive herd of elephants. The origin of the structure was not resolved, and the partial map was not published. The Sinamwenda structure was not visited again until September 1994, when another group consisting of two geologists (SM, KLW) and a geophysicist (DJR) carried out a N-S magnetometer traverse across it, and collected samples for further investigation.

The unbreached crater rim is elevated a few metres above the level surface of the surrounding sandstones [Fig.3]. There are no outcrops in the centre of the structure, which appears to be filled in with younger sediments, possibly aeolian sands of the Cenozoic Kalahari Group. In 1970, CWS found steeply-dipping or overturned outcrops of sandstone of the Escarpment Grit Formation (K^6) [1] which was overlain by stratigraphically underlying shales of the Upper Madumabisa Mudstone Formation (K^{5e}) in the NW rim of the structure. During the 1994 investigation, numerous sets of joints containing variably-oriented parallel striations, were found in outcrops on the northern and eastern rim of the structure [Fig.4]. Such joints, which are interpreted to be shock-produced features similar to the "Multiply-Striated Joint Surfaces" (MSJS) of the Vredefort Structure [2] (also a prominent deformation phenomenon in the Sudbury impact structure, where these joints, just like in Vredefort, are also related to the formation of shatter cones), were not found in the flat-lying sandstones and grits surrounding the Sinamwenda structure. The magnetometer traverse across the structure (along line A-B, Fig.3) showed absolutely no magnetic anomaly, with a maximum of 2 gammas variation in the magnetic field. This completely rules out the possibility that the structure could be due to a volcanic plug, as was found for the Thuli and Save craters in S and SE Zimbabwe [3]. This finding is further supported by the total absence of any intrusive or volcanic rocks in or around the crater. Initial petrographic analysis of sandstones from the crater rim and from sampling sites outside of the crater structure did not reveal characteristic shock-induced microdeformation (such as PDFs). However, the crater samples are more strongly deformed than samples from the crater environs: most crystals in crater rim sandstones are strongly fractured and commonly display intricate patterns of deformation bands. In addition, several crater rim samples display cataclasis in the form of pockets of cataclastic breccia or more linear zones of brecciation. Because of its circular crateriform appearance, the presence of overturned bedding, the evidence for shock in the form of MSJS, and the absence of any intrusive rocks or magnetic anomalies, the Sinamwenda Structure is considered to be most probably of meteorite impact origin. This would make it the second known impact structure in Zimbabwe, after the Highbury Structure [4], and the 16th impact crater in Africa (cf [5]).

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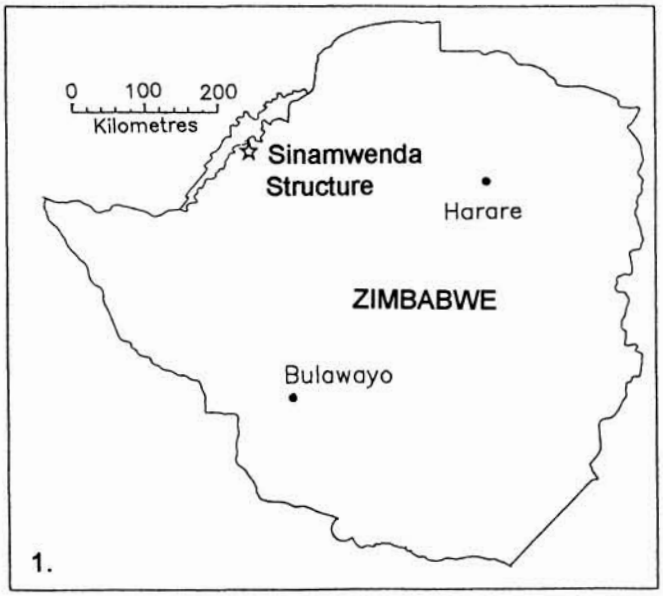
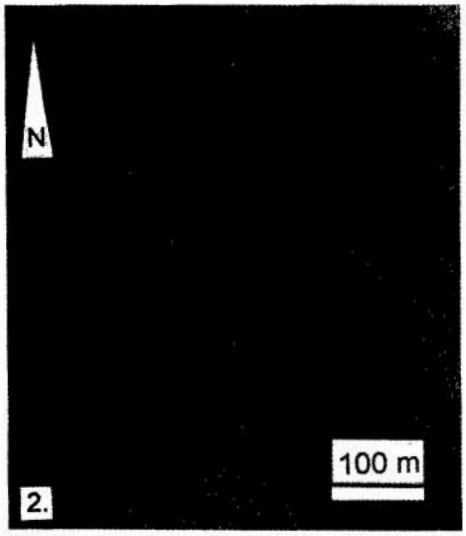
THE SINAMWENDA STRUCTURE, ZIMBABWE S.Master et al.





Figures:

1. Locality map of Sinamwenda Structure, W. Zimbabwe.
2. Vertical aerial photograph of the Sinamwenda Structure. Rim to rim diameter is about 200 metres.
3. Oblique aerial photograph of the Sinamwenda Structure, looking SW. A-B = Line of magnetic traverse.
4. Multiply-Striated Joint Surfaces (MSJS) in coarse-grained sandstone, north rim of Sinamwenda Structure.