THE JURASSIC-CRETACEOUS BOUNDARY IMPACT EVENT: THE MOROKWENG IMPACT STRUCTURE, SOUTH AFRICA. Christian Koeberl[1], Wolf Uwe Reimold[2], and Richard A. Armstrong[3]. [1]Institute of Geochemistry, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria. [2]Department of Geology, University of the Witwatersrand, Johannesburg 2050, South Africa. [3]Research School of Earth Sciences, Australian National University, Canberra, ACT 0200, Australia.

Considering that relatively few impact structures are known in Africa, it was of interest when preliminary geophysical, petrological, and geochemical investigations indicated that a large near-circular magnetic and gravity anomaly in the area around Morokweng, Northwest Province, South Africa (Fig. 1), may represent an impact structure [1,2]. The subsurface structure, centered at 23°32' E / 26°31' S, shows a well-defined circular magnetic anomaly, about 70 km in diameter. Refined processing of the gravity and aeromagnetic data indicated the presence of a much larger circular structure with a diameter of about 340 km [3]. Three drill cores were obtained from near the center of the structure [2,4] and showed the presence of melt rocks with high contents of siderophile elements. We found abundant opaque minerals in the Morokweng melt rock, including various types of magnetite, spinel (Cr-, Ni- rich), ilmenite and rutile (often intergrown), monazite, chalcocite, and trevorite. Zircon and baddeleyite (evidence for the high-temperature origin) are also common. Remnants of PDFs are present in various unannealed clasts. The impact melt rock samples are remarkably uniform in composition. High contents of the siderophile elements were measured in the melt rock samples: up to 440 ppm of Cr, 50 ppm of Co, 780 ppm of Ni, and 32 ppb of Ir, with relatively little variation (less than a factor of 2). After correction for the indigenous component, a near-chondritic abundance range remains. PGE contents show a flat, near-chondritic pattern [4], indicating the presence of about 2-5% of a chondritic component. To determine the age of this structure, zircons were extracted from a large melt rock sample. The zircons were analyzed for their U-Th-Pb isotopic compositions on the ion microprobe SHRIMP I at the Research School of Earth Sciences (RSES), ANU. Using standard statistical data analysis, a $^{206}Pb/^{238}U$ age of 146.2 ± 1.5 Ma is obtained [5]. In addition, an independent $^{208}Pb/^{232}Th$ age of 144.7 ± 1.9 Ma was calculated from this data set [5] (Fig. 2). This age is indistinguishable from the age of the Jurassic-Cretaceous (J-K) boundary, which is placed at the base of the Berriasian Stage at 145 Ma (cf. [5]). This result, which is supported by other recent measurements [6], indicates that large-scale impact events may have influenced the geological and biological evolution of the Earth to a larger degree than previously assumed.

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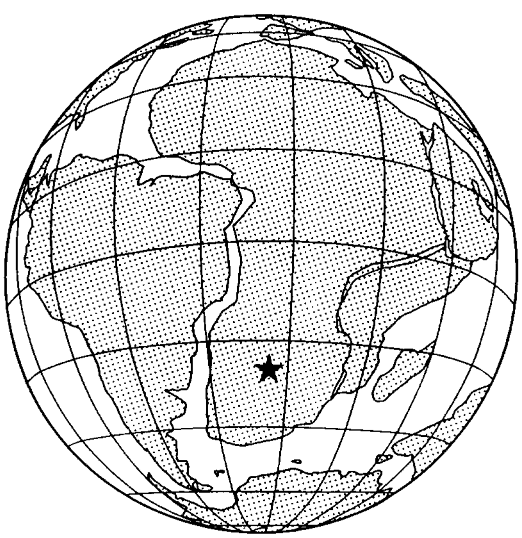

Fig. 1. The estimated position of the Morokweng impact structure in a schematic paleogeographic map (TME program, Sageware Corp.).

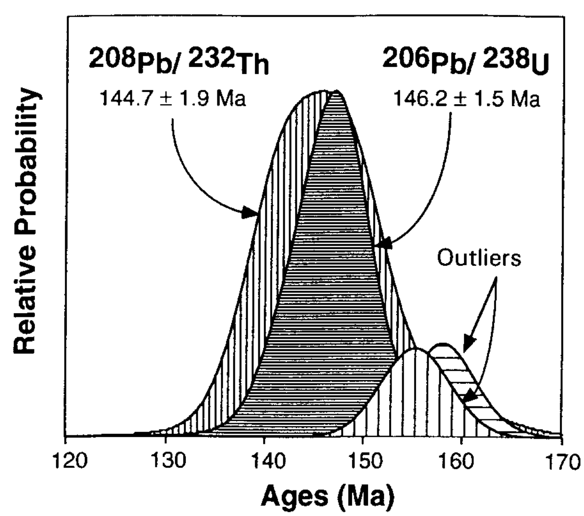

Fig. 2. Relative probability plots of age data for zircons from Morokweng impact melt rock. Errors shown are 95% confidence limit.