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EARLY ARCHEAN SPHERULE BEDS OF POSSIBLE IMPACT ORIGIN FROM BARBERTON, SOUTH AFRICA: A DETAILED MINERALOGICAL AND GEOCHEMICAL STUDY. Christian Koeberl¹, Wolf Uwe Reimold², and Rudolf H. Boer², ¹Institute of Geochemistry, University of Vienna, Dr.-Karl-Lueger-Ring 1, A-1010 Vienna, Austria, ²Economic Geology Research Unit, University of the Witwatersrand, P.O. Wits, Johannesburg 2050, South Africa.

The Barberton Greenstone belt is a 3.5- to 3.2-Ga-old formation situated in the Swaziland Supergroup near Barberton, northeast Transvaal, South Africa. The belt includes a lower, predominantly volcanic sequence, and an upper sedimentary sequence (e.g., the Fig Tree Group). Within this upper sedimentary sequence, Lowe and Byerly [1] identified a series of different beds of spherules with diameters of around 0.5–2 mm. Lowe and Byerly [1] and Lowe et al. [2] have interpreted these spherules to be condensates of rock vapor produced by large meteorite impacts in the early Archean. This interesting hypothesis is based mainly on the structure of the spherules, which is reported to be similar to quench structures, and on the discovery of Ir anomalies of up to several hundred ppb in some of the spherule beds [2]. Although Lowe et al. [2] reported the abundances of the platinum group elements (PGEs) to be of roughly chondritic proportions, a more detailed study by Kyte et al. [3] showed that the PGEs are fractionated relative to the chondritic abundances. They interpreted this to be due to later hydrothermal alterations.

The study of impacts early in the history of the Earth is of great importance and interest; we feel that therefore a more detailed investigation of the Barberton spherule beds is warranted, especially because no detailed mineralogical study of the spherules (and of all secondary mineralizations such as abundant sulfide mineralization) and no detailed geochemical stratigraphy (including, e.g., the rare earth elements) is available so far. The host phase of the Ir (and PGE) anomaly is also unknown.

We have collected a series of samples from drill cores from the Mt. Morgan and Princeton sections near Barberton, as well as samples taken from underground exposures in the Sheba and Agnes mines. These samples seem much better preserved than the surface samples described by Lowe and Byerly [1] and Lowe et al. [2]. Over a scale of just under 30 cm, several well-defined spherule beds are visible, interspaced with shales and/or layers of banded iron formation. Some spherules have clearly been deposited on top of a sedimentary unit because the shale layer shows indentions from the overlying spherules. Although fresher than the surface samples (e.g., spherule bed S-2), there is abundant evidence for extensive alteration, presumably by hydrothermal processes. In some sections of the cores sulfide mineralization is common.

For our mineralogical and petrographical studies we have prepared detailed thin sections of all core and underground samples (as well as some surface samples from the S-2 layer for comparison). For geochemical work, layers with thicknesses in the order of 1–5 mm were separated from selected core and underground samples. The chemical analyses are being performed using neutron activation analysis in order to obtain data for about 35 trace elements in each sample. Major elements are being determined by XRF and plasma spectrometry. To clarify the history of the sulfide mineralization, sulfur isotopic compositions are being determined. We hope to be able to identify the host phase of the platinum metal anomaly by separating spherules and matrix. At the time of the conference we will report on the first geochemical and mineralogical results and their bearing on the impact hypothesis.

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References: [1] Lowe D. R. and Byerly G. R. (1986) *Geology*, 14, 83–86. [2] Lowe D. R. (1989) *Science*, 245, 959–962. [3] Kyte F. T. et al. (1992) *GCA*, 56, in press.

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U-Pb ISOTOPIC RESULTS FOR SINGLE SHOCKED AND POLYCRYSTALLINE ZIRCONS RECORD 550–65.5-Ma AGES FOR A K-T TARGET SITE AND 2700–1850-Ma AGES FOR THE SUDBURY IMPACT EVENT. T. E. Krogh¹, S. L. Kamo¹, and B. F. Bohor², ¹Jack Satterly Geochronology Department, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, M5S 2C6, Canada, ²U.S. Geological Survey, Box 26046, MS 972, Denver CO 80225, USA.

The refractory mineral zircon develops distinct morphological features during shock metamorphism and retains these features under conditions that would anneal them in other minerals. In addition, weakly shocked zircon grains give primary ages for the impact site, while highly reconstituted (polycrystalline) single grains give ages that approach the age of the impact event. Data for a series of originally coeval grains will define a mixing line that gives both of these ages providing that no subsequent geological disturbances have overprinted the isotopic systematics. In this study, we have shown that the three zircon grain types described by Bohor (this session), from both K-T distal ejecta (Fireball layer, Raton Basin, Colorado) and the Onaping Formation, represent a progressive increase in impact-related morphological change that coincides with a progressive increase in isotopic resetting in zircons from the ejecta and basement rocks. Unshocked grains are least affected by isotopic resetting while polycrystalline grains are most affected.

U-Pb isotopic results for 12 of 14 single zircon grains from the Fireball layer (Fig. 1) plot on or close to a line recording a primary age of 550 ± 10 Ma and a secondary age of 65.5 ± 3 Ma. Data for the least and most shocked grains plot closest to the primary and secondary ages respectively. The two other grains each give ages between 300 and 350 Ma. This implies that the target ejecta was

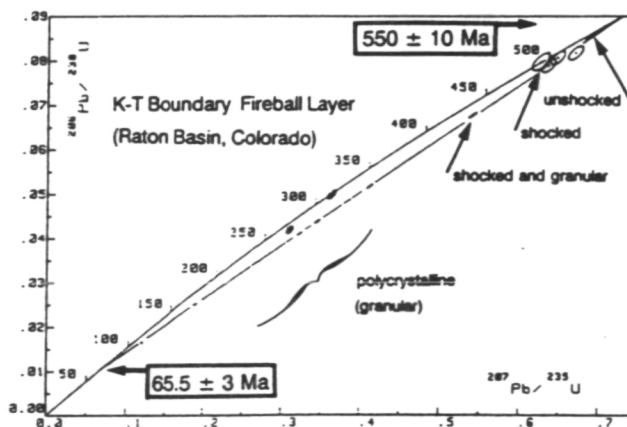


Fig. 1. U-Pb data for single zircons from the K-T boundary fireball layer, Raton Basin, Colorado.