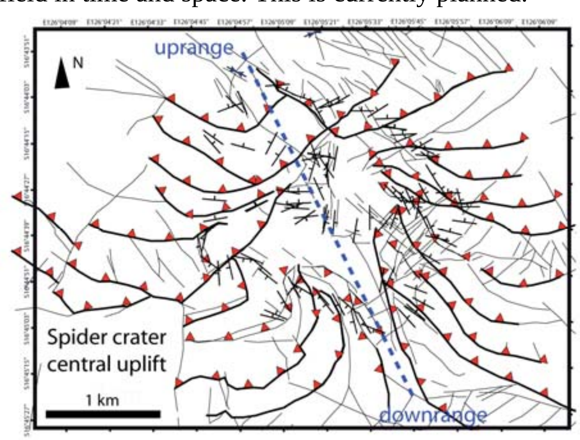
THE CENTRAL UPLIFT OF SPIDER CRATER, WESTERN AUSTRALIA. T. Kenkmann[1] and M. H. Poelchau[1], [1]Institute of Earth and Environmental Sciences, Albert-Ludwigs Universität Freiburg, Albertstraße 23-B, 79104 Freiburg, Germany, Thomas.kenkmann@geologie.uni-freiburg.de.

Introduction: The Spider impact crater, Australia (13 x 11 km Ø, N16°44'27'', E126°05'21'') named after the peculiar appearance of its central uplift, is situated on the Kimberley-Plateau in Western Australia. J. E. Harms was the first who recognized the structure around 1960, but twenty years later a cryptovolcanic origin was still favored [1]. Shoemaker and Shoemaker [2, 3] mapped the site in 1984-85. McHone [4, 5] and Abels [6, 7] investigated the structure by means of remote sensing analyses. While most authors favored an oblique impact from N to NW to explain the northerly dipping thrust stacks [2, 3], Abels [6, 7] argued that pre-impact topography and the (very) gently dipping limbs of the broad Mt. Barnett syncline might account for the asymmetric structure.

We undertook a field survey of the central uplift at Spider in 2007. The nearest infrastructure is the Gibb River Road and the Mount Barnett Roadhouse. Access to the structure is restricted as it is part of the Mount Barnett pastoral lease under declared Aboriginal homeland. We present micro- and macrostructural field data along with a simple kinematic model that explains the structure of the central uplift.

Microstructures: Twelve samples were analyzed for petrography and shock metamorphism using optical microscopy, four from the central dome, six from the thrust systems and two from outside the crater (Pentecost sandstone). The samples of the core region are strongly deformed to monomictly brecciated Warton Sandstone (1.7 Ga), the oldest unit at Spider. This pure quartzitic sandstone shows some planar deformation features (PDFs) and very abundant planar fractures (PFs), many of them contain feather features (FFs) [8]. Shock effects propagate from quartz grains into the surrounding quartz cements suggesting that the rocks were completely lithified and of low porosity when the impact occurred. Shatter cones are ubiquitously present in the central dome. Pentecost sandstone samples from the surrounding thrusts show a quartz arenite with clayey and Fe-rich seams surrounding the quartz grains. The deformation varies from weakly deformed to shocked. The shocked samples show abundant transgranular fractures, PFs, FFs, and a few PDFs. Shatter cones occur only in the vicinity of the central dome. Between the thrusts occur narrow zones of monomict and polymict lithic breccias. They contain a fine-grained lithic matrix (5-10 µm) in which angular fragments of quartz, chert, siltstone (50-100 µm) are embedded.

Macrostructures and kinematic model: The central uplift consists of two imbricate thrust stacks that surround the core of the structure, indicating N-S shortening with a preferred material transport top to southerly direction (Fig. 1). Dipping of beds within the imbricate stacks ranges between 20-80° (40° mean dip) and shows no systematic change from N to S. The traces of each thrust are bent and their strike gradually shifts from N to S. To explain the change in orientation of the thrust slices from up range to downrange a very simple approach of vector summation in a horizontal plane might be helpful: An idealized flow field during crater collapse at a vertical incidence is represented by purely radial convergent flow lines. This flow field is combined with a flow field consisting of parallel flow lines of outward decreasing magnitude that are pointing from up range to downrange. The latter trajectory field is expected when a tangentially impacting projectile transfers momentum to a target. Simple vector addition of the two flow fields results in curved trajectories whose orientations are perpendicular to the strike of the thrusts. The imbricate stacks initiated up-range and migrated down-range simultaneously with the uplift of the central core. Three-dimensional numerical modeling is necessary to fully resolve the trajectory field in time and space. This is currently planned.



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