CONNOLLY BASIN, WESTERN AUSTRALIA: TOTAL MAGNETIC FIELD SURVEY. J. B. Plescia, E. M. Shoemaker, and C. S. Shoemaker, U. S. Geological Survey, 2255 N. Gemini Drive, Flagstaff AZ 86001, jplescia@usgs.gov

Introduction: Connolly Basin is an impact structure in the Gibson Desert of Western Australia (23° 33' S; 124° 45' E). The structure is ~9 km in diameter, surrounded by a topographic rim 25-30 m high, and contains a small playa. A central uplift ~1 km across has a minimal topographic expression of ~5 m and scattered exposures of bedrock. The geology of the structure is described in an accompanying abstract [1] and in several previous abstracts [2-3]. A reconnaissance total magnetic field survey was made to establish the nature of any magnetic anomaly associated with the structure.

Data Collection: Total magnetic field data were collected along two orthogonal profiles crossing approximately at the center of the structure; one north-south, the other east-west. The position of the profiles was the same as that for a gravity [4, 5] and seismic reflection survey. Magnetic field measurements were made using a Model G816 Geometrics Portable Proton Magnetometer. Station spacing was ~176 m and profile lengths were 11.3 km. Corrections for drift were made by reoccupying stations during the survey. Drift between station reoccupations during individual survey sessions amounted to a few nano-Teslas (nT). The base station was assigned a value of 54200 nT and individual survey sessions were adjusted such that the base station had this value.

Results: Figures 1 and 2 show the resulting total field profiles along the two traverses. The south to north profile shows a northward decrease in field strength with a gradient of ~10-15 nT km^{-1}. Several spikes are apparent in the profile which are confined to single stations. These are not spurious noise signals as reoccupation of the station indicated the same field levels. The west to east profile is essentially flat with only a few, low-amplitude small single-station anomalies.

These data show that there are no detectable anomalies associated with the rim, interior or central uplift of the Connolly impact basin. At a few isolated stations, anomalies of several thousand nT were observed. As these were restricted to single points they probably result from buried man-made objects, although the actual source remains unknown. The profiles were run along the route of seismic surveys and materials may have become buried at a shallow depth. They do not, however, represent significant geologic anomalies. As this was a ground survey, even low-amplitude, short-wavelength anomalies associated with the structural components of the basin should have been recognized.

The magnetic signature of impact craters is often complex. The dominant magnetic anomaly is a low [6] that is often best expressed over simple craters. Pilkington and Grieve [6] present data on magnetic anomalies for 37 structures ranging in diameter from ~1 to 200 km. Some display magnetic lows, some a central magnetic anomaly associated with the central uplift, and some display no anomaly. The presence of a gravity anomaly and/or a structural central uplift do not imply that a magnetic anomaly will be present. They suggest a broad correlation with structures having D<10 km having magnetic lows, and central high-amplitude anomalies associated with larger structures. The magnetic signature is often the result of remanent rather than induced magnetizations.

Plado et al. [7] have examined the effects of erosion on both gravity and magnetic anomalies. As erosion progresses and exposes deeper levels through an impact structure the magnitude of the magnetic anomaly decreases. Connolly Basin is relatively fresh and still retains a topographic rim, hence erosion has been minimal. The absence of an anomaly can not be attributed to erosion.

The absence of anomalies associated with the various morphologic elements of Connolly Basin indicate that the various rock types exposed at the surface or buried at shallow depth do not have significant differences in either their susceptibility or remanence. Geologic mapping indicates that the bedrock units exposed within the structure are sandstones and siltstones with an overlying blanket of Quaternary sands and Tertiary lateritic soils. The similarity of these materials suggests that they would have similar magnetic properties and thus might not produce an anomaly. The only unusual lithology is a breccia layer that lines the basin interior. Breccia and melt rock often acquire a thermal or chemical remanence after the impact event. However, brecciation can also destroy an anomaly by disrupting a preexisting remanance. The absence here suggests that either significant volumes of melt rock with an acquired thermal remanent magnetization are missing or that such a remanence was destroyed by subsequent weathering.

References: [1] Shoemaker E. M., et al., (2001) LPS XXXII, this volume. [2] Shoemaker E. and Shoemaker C. (1985) *Meteoritics, 20*, 754-756. [3] Shoemaker E. M. and Shoemaker C. S. (1989) *LPS XX 1008-1009*. [4] Shoemaker E. M. et al. (1989) *LPS XX 1010-1011*. [5] Plescia J. B. (1993) *Eos, Transactions, American Geophysical Union,.74*, 387. [6] Pilkington, M. and Grieve R. A. F. (1992) *Rev. Geophys., 30,* 161-181. [7] Plado J. et al. (1999) Geol. Soc. Amer. Special Paper 339, 229-239.

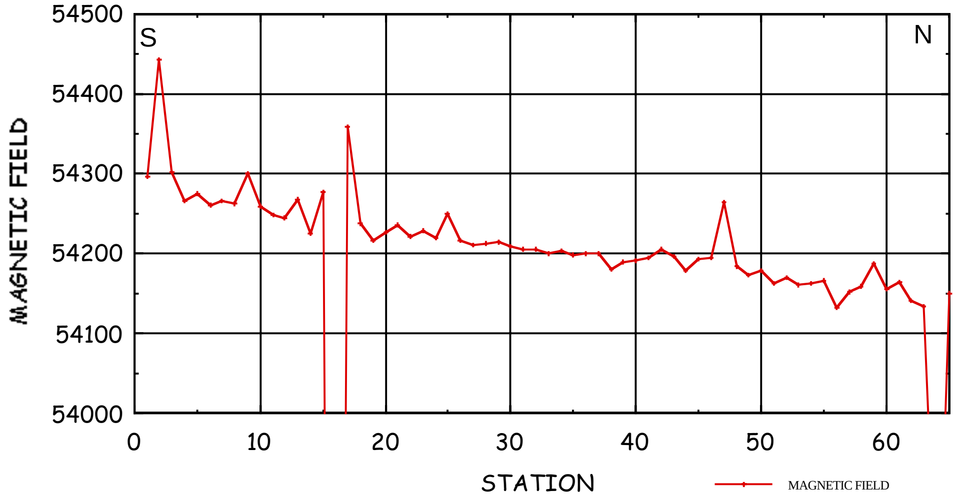

Figure 1. South to north total magnetic field profile. Profile length 11.3 km.

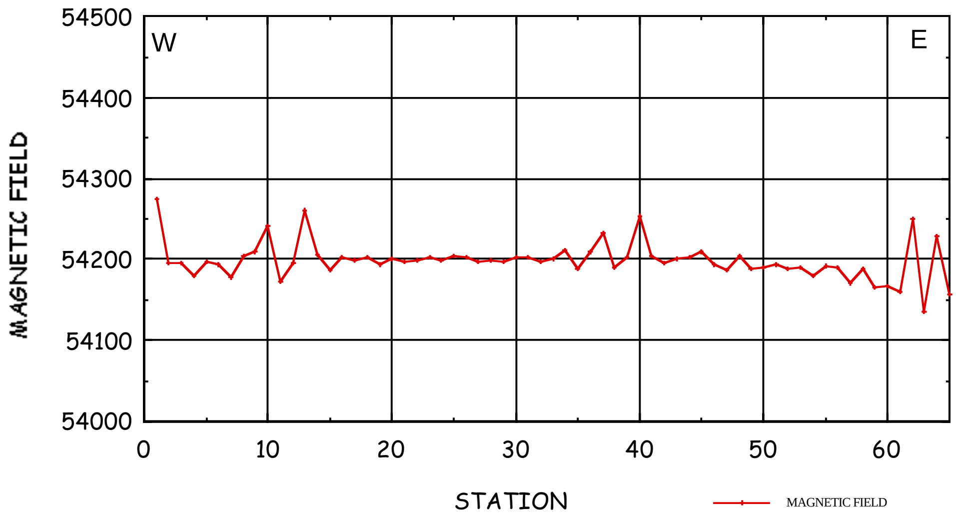

Figure 2. West to east total magnetic field profile. Profile length is 11.3 km.