# THE CENTRAL UPLIFT OF GOSSES BLUFF, NORTHERN TERRITORY, AUSTRALIA

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**Introduction:** Gosses Bluff impact structure has one of the best exposed central uplifts of all craters on Earth. Here we present first results of new structural and lithological mapping of this uplift. The general objective of the field survey is the restoration of its kinematic evolution. The project also aims to further refine the methodology by which impact direction can be determined from the structure of its central uplift [1,2] and to assess the intensity of shock deformation in the up-range, down-range and cross-range sectors of an oblique impact event. Data were gathered from 332 field stations and for mapping purpose we also used the base map of ArcGIS 10.1 by ESRI.

**Geological Outline:** Gosses Bluff, located about 150 km west of Alice Springs, is situated on a broad, flat–floored, E-W trending syncline south of the West Macdonnell Ranges. The crater was formed ~142 Ma ago within rocks of Ordovician to Devonian age [3]. The crater rim has been removed by erosion and has no morphological expression. The bluff is a collar of steep hills ~4.5 km across which reaches ~180 m above the surrounding plain. This collar and its inner morphological depression form the central uplift. Gosses Bluff was identified as an impact crater in 1966 [4-5] and extensive geological, geochronological, and geophysical analyses have been carried out since then [6-9].

**Results:** Most strata in the central uplift show very steep dips and are strongly fractured and shock-deformed. Nevertheless the stratigraphic sequence is roughly intact, insofar as the oldest strata occur in the center and are surrounded by successively younger units. The oldest exposed lithologies, that can be found within the central depression, are of Ordovician age (Stairway Sandstone and Stokes Siltstone). Overlying these units is the Late Ordovician Carmichael Sandstone that forms the lower slopes of the inner collar. The Lower and Upper Mereenie Sandstones (LMS, UMS) of Late Ordovician to Early Devonian age are responsible for the prominent topography of the collar. The white, thickly bedded sandstones of the LMS form the steep cliffs of the inner collar. The Devonian Parke siltstone (DPS) forms the outer slopes of the collar. The collar has a somewhat triangular shape with the western half resembling the eastern half. The symmetry axis trends NNE-SSW and marks the trajectory of the oblique impact (Fig. 1). In the northern, up-range sector, tilted blocks form a stack of steeply north dipping to upright ENE-WSW trending slices that are thrust on top of each other. The northernmost edge is marked by a radial anticline. Slices are separated by E-W striking faults that mostly correspond to local valley incisions. Faults are marked by massive breccia occurrences. In contrast, in the down-range sector the inner thrust slices are radially oriented with respect to the center (Fig. 1). The cross-range sectors contain obliquely oriented, upturned thrust slices, thus acting transitionally between the E-W faults of the up-range sector and the radially oriented faults of the down-range sector. This pattern shows similarities to the Spider [2] and Waqf as Suwwan [10] impact structures. Towards the outer collar in the down-range direction, strata are generally overturned and dip in a northerly direction. Fault breccia and localized pseutotachylite veinlets are present. Vertical to overturned strata are overlain by allochthonous blocks of comparatively flat-lying LMS and megabreccia that were transpressionally squeezed upwards and outwards from the radially-oriented fault systems of the down-range sector. These blocks also cover steeply dipping to overturned beds of UMS and DPS. The occurrence of these nappe-like rocks suggests that the summit area of the collar is close to the crater floor.

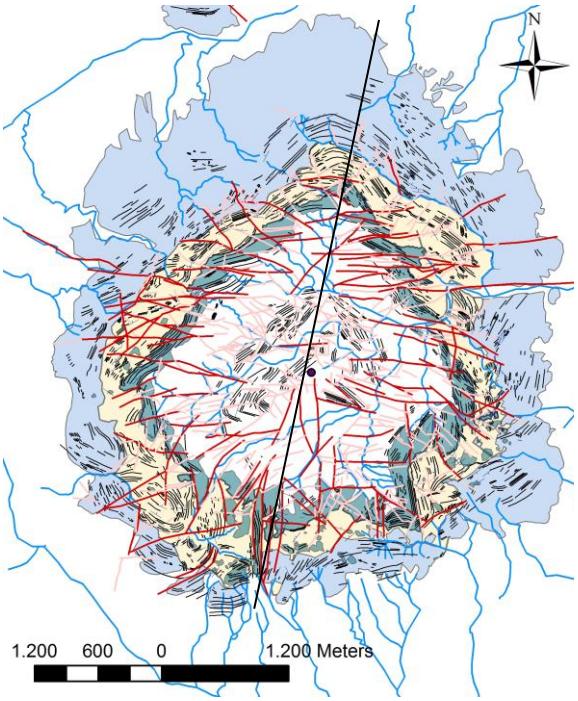


**Fig. 1**. *Central uplift of Gosses Bluff. Red and pale red: faults, black lines: strata strike, Lower Mereenie SSt.: blue, Upper Mereenie sst.: yellow, Parke siltst. pale blue*

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