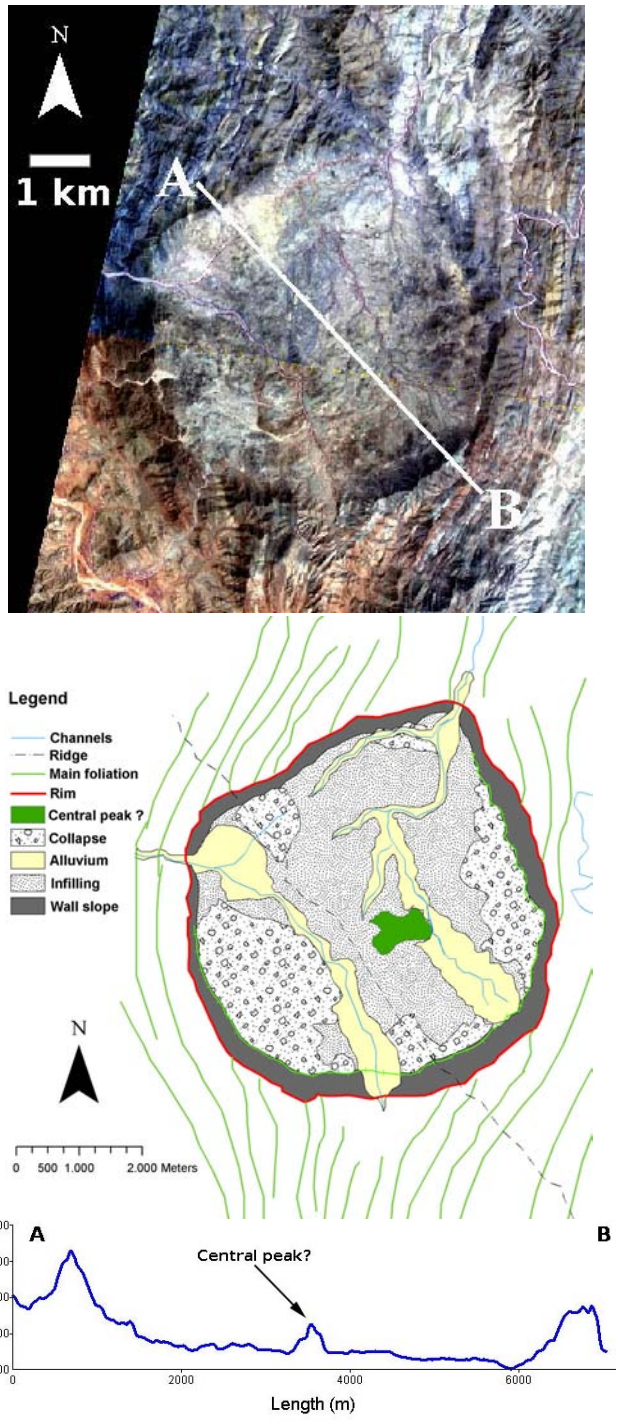
A NEW CANDIDATE IMPACT SITE IN NORTHEASTERN SUDAN DETECTED FROM REMOTE SENSING. G. Di Achille, IRSPS, International Research School of Planetary Sciences, Viale Pindaro 42, 65127 Pescara, Italy, gadiachi@irsps.unich.it

Introduction: A new possible impact structure has been observed, in the northeastern Sudan (37°55'E, 17°57'N), close to the border with the Eritrea and the Red Sea. In this study are presented the evidence for the impact hypothesis, as derived from remotely sensed data, accurately compiled by GIS analysis. The formation of this feature is uncertain and the impact related origin will remain hypothetical without a field work and direct investigations. Only with a careful geological-geophysical survey it is possible to verify the impact hypothesis, nevertheless many of the typical impact-related morphological features are present and may hint at this possibility.

Data: The impact-related origin of the structure has been investigated using ASTER, Landsat 7 (2000, MrSid), ERS-SAR and CORONA KH-4B (declassified) imagery, draped on the ASTER-derived and SRTM (Shuttle Radar Topography Mission) topography at 15 m/pixel and 90 m/pixel respectively. The CORONA stereo-pairs images (acquired on 05/27/1972) were been scanned from negative film at 3600 dpi, obtaining a final resolution of ~4 m/pixel. The scanned images were used in comparison with latest satellite imagery, in order to evaluate the erosional rate in the area and (exploiting their stereo capabilities) to realize an high resolution anaglyph.

Study area: The structure is located on the southern Sudanese Red Sea Hills mostly composed of volcano-sedimentary rocks of the Neo-Proterozoic Nubian Shield [1, 2, 3]. It shows a nearly circular outline and sharply interrupts the N-S trending regional foliation, belonging to the Baraka Suture, that distinguishes the metamorphic basement rocks in this area [2, 3, 4]. The rounded feature, approximately 5.5-6 km in diameter, is shown as including a circular mass of sediments and two large collapsed area along the eastern and western portions of the inner rim. The floor of the structure is incised by two main channels that breach the rim in the northern and western part respectively. The westernmost channel has deeply

Fig. 1 - ASTER mosaic of the structure, geomorphological sketch map and topographic profile from SRTM data.



incised the floor of the crater and with its stronger erosional activity likely produced the general asymmetric morphology of the structure and the western internal trough. This channel was also structurally controlled by the NW-SE trending topographic ridge that crosscuts the structure. The maximum floor-rim height is about 350 m and, from the topographic profile AB, is also visible a central elevated area (see Fig.1), raising of ~75 m from the surrounding terrains. The presumed remnant of the central peak has been also observed from an unsupervised spectral mapping based on the six ASTER SWIR (short wavelength infrared) bands.

Discussion: The bowl-shaped appearance combined with the presence of the elevated central portion (possible central peak remnant?) [5], the large lateral collapsed areas (materials from the post-impact crater wall collapse?) [5], the sharp truncation of the regional structural lineaments and its deflection, and the overall geomorphological-topographic aspect are indicated as possible evidence for an impact origin of this structure. The slightly elongated outline of the structure might indicate an oblique impact from North direction and this eventuality could also take account for the higher elevation of the southern rim relative to the northern portion.

The observable deflection of the N-S striking regional foliation close to the crater's rim is more pronounced in the lateral part respect to the northern and southern regions and it should be explained with the disturbance effects produced by the radial forces spreading perpendicularly to the impact shock waves. Therefore the former lineations might have been distorted and uplifted simulating an outward contortion of the foliation more evident on the preferentially oriented lateral rocks.

The crosscutting ridge could be interpreted as a remnant of the pre-existing topography or as result of post-impact tectonic activity related to the regional stress field. In the latter case the rim should appear dislocated along the ridge, but from the available data no evidence of rim deformation were been found. In any case the ridge controlled the western major channel's development, confining its erosional/depositional activity in the western crater floor.

The well preserved rim, as well as the circular expression and central uplift could suggest an intermediate erosional level for the supposed complex impact structure. Due to the local geological settings (volcano-sedimentary rocks) the evidence could more conservatively fit with a volcanic-related hypothesis (domes, maar, collapsed caldera).

However, several intrusive domes (granitic, granodioritic) [2] are present in the area and were been compared with the proposed crater (see Fig.2). The main differences are represented by their larger size (>10 km), the different erosional style (e.g. the presence of typical mutually intersecting fractures and joint networks), by the absence of well defined circular shape and raised rims and, overall, by the topography that is usually inverted respect to the candidate impact site. Moreover the relatively large size of the structure is against the maar supposition, since they usually range between 100 m and 3 km diameter and present peculiar aspect ratios (maar are usually wide relative to rim height).

Conclusions: Using remote sensing analysis, geomorphological and topographic evidence had been inferred to propose the impact hypothesis for the above discussed structure. Its origin will remain uncertain without field work and rock sampling. Only the detection of shock-metamorphic effects (e.g. PDFs, shutter cones), unique geochemical signatures, impact-produced breccias, melt rocks, meteorites or a meteoritic signature can confirm this hypothesis. A scientific exploration is going to be realized on the Fall 2005.

References: [1] Unesco (1990) International Geological Map of Africa, 1:5.000.000, Unesco, Paris. [2] Kenea N. H. (1997) *Berl. Geowiss. Abh. D-14*. [3] Sultan M. et al. (1992) *Geology, 20,* 295-298. [4] Abdelsalam Mohamed G. (2003) *Precambrian Research, 123,* 203–221. [5] Melosh H. J. (1996), Impact cratering, *Oxford Univ. Press*.

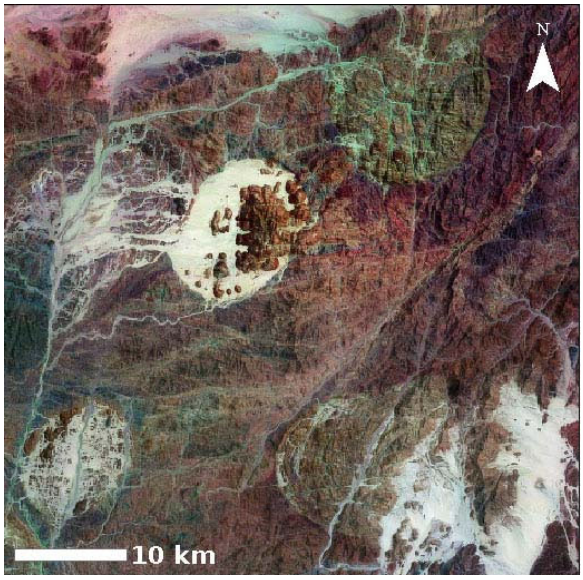


Fig. 2 - Landasat view of the granitic domes in the area.