

THE ASH SHUTBAH CIRCULAR FEATURE – A SUSPECTED METEORITE IMPACT SITE IN SAUDI ARABIA. M. Schmieder¹, E. Buchner¹, B. A. Hofmann² and E. Gnos³, ¹Institut für Planetologie, Universität Stuttgart, Herdweg 51, D-70174 Stuttgart, Germany, martin.schmieder@geologie.uni-stuttgart.de, ²Naturhistorisches Museum Bern, Bernastrasse 15, CH-3005 Bern, Switzerland, ³Natural History Museum, Route de Malagnou 1, CP 6434, CH-1211 Geneva 6, Switzerland.

Introduction: Although Saudi Arabia covers an arid area of more than two million square kilometers, the small ~300-year-old Wabar meteorite craters (three craters 11 m, 64 m, and 116 m in diameter, respectively; crater field at 21°30' N, 50°28' E) in the Rub' Al-Khali desert, southeastern Saudi Arabia, struck by a IIIA iron, are the only impact structures so far confirmed in this large country [1-4]. Remote sensing and field studies suggested some additional circular features of possible impact origin in Saudi Arabia, e.g., the ~5 km in diameter Jabal Rayah 'astrobleme' [2;5] (also known as Al Madafi [6;7]; centered at 28°39' N, 37°12' E) in Devonian sandstones near the city of Tabuk in northeastern Saudi Arabia and the ~17 km Wadi Na'am structure (centered at 19°08' N, 44°00' E) in Precambrian crystalline rocks of the Arabian Shield in the southwestern part of the country [8]; however, none of these two promising structures could be confirmed as of impact origin by the detection of unequivocal shock metamorphic features to date. This study adds another odd circular feature to the list of suspected meteorite impact sites in Saudi Arabia.

The Ash Shutbah Circular Feature: A singular circular feature ~2.5 km in diameter, centered at 21°37' N, 45°39' E, is clearly apparent on multispectral Landsat-7 Enhanced Thematic Mapper Plus (ETM+) satellite images (scene of path 166, row 45, acquired on February 20, 2005; Fig. 1). The circular feature is located ~50 km SW of the town of Al Haddar in southern central Saudi Arabia and close to the upper end of the wadi Ash Shutbah on the escarpment of the Tuwaiq Mountain (Jebel Tuwaiq) sedimentary plateau (Fig. 2), at a topographic height of ~960-970 m above sea level. Accordingly, the circular feature is referred to as the Ash Shutbah feature below. The Ash Shutbah feature is hosted by the Middle to Late Jurassic marine sedimentary rocks of the Tuwaiq Mountain Formation, which is part of a thick (partially hydrocarbon-bearing)

Mesozoic sedimentary sequence [9-11], and which constrains the maximum stratigraphic age of the feature. Shuttle Radar Topographic Mission (SRTM) data revealed almost no topographic expression of the Ash Shutbah feature (Fig. 2).

Discussion and Results: Without ground-truthing, the origin of the Ash Shutbah feature remains speculative. A magmatic or sedimentary origin (e.g., as an eroded magmatic intrusion or a sedimentary salt/gypsum diapir) of this singular circular feature could be considered in the sedimentary succession of the Tuwaiq Mountain (see also [12;13]). However, in particular, the Ash Shutbah feature bears a notable resemblance to the eroded ~2 km in diameter BP impact structure (centered at 25°19' N, 24°19' E; Fig. 3A) in the Nubian Sandstone of southeastern Libya [14] as regards the size and shape of both structures. Furthermore, the appearance of annular features of the Ash Shutbah structure on satellite images is similar to those observed in the central part of the eroded ~5 km Shiyli (Chiyli) Dome impact structure (centered at 49°11' N, 57°50' E; Fig. 3B) in Cretaceous-Paleogene sedimentary rocks of western Kazakhstan [15]. The weak topographic expression of the Ash Shutbah feature, in analogy, points to a stronger influence of erosion. The outcrop of darker rock units at the center and within an annular feature of the Ash Shutbah feature, compared to the surrounding rocks, might suggest the uplift of underlying sedimentary strata that also outcrop west of the Tuwaiq Mountain escarpment (compare Fig. 1). These observations would be compatible with structural phenomena known from terrestrial impact structures. With respect to a possible impact origin of the Ash Shutbah feature, field work and a focused search for shatter cones and other traces of shock metamorphism [16] should be envisaged. Like other suspected impact structures that occur in petroleum domains, the Ash Shutbah circular feature might also be of economic interest [6;8].

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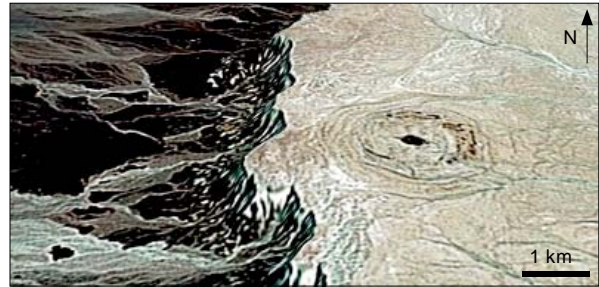


Fig. 1: Oblique view of the Ash Shutbah circular feature near the escarpment of the Tuwaiq Mountain (Landsat-7 ETM+ image draped over SRTM data; 3-fold vertical exaggeration).

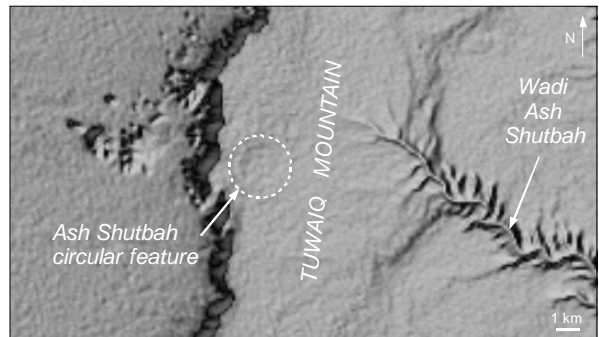


Fig. 2: Shaded relief scene of the Ash Shutbah circular feature (circle) on the Tuwaiq Mountain; note the escarpment west of the feature and the wadi Ash Shutbah in the east (SRTM data; 10-fold vertical exaggeration).

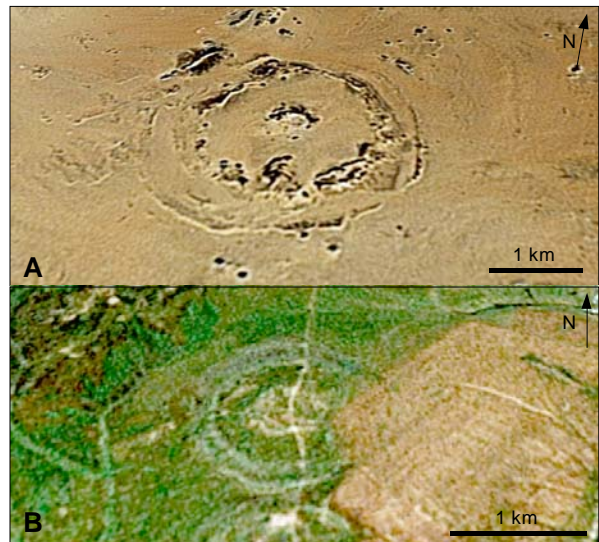


Fig. 3: Landsat-7 satellite image scene of two confirmed terrestrial impact structures (oblique views); A: BP impact structure, Libya [14]; B: Shiyli Dome, Kazakhstan [15].