# JEBEL WAQF AS SUWWAN, JORDAN: RESULTS OF A FIELD CAMPAIGN 2015.

T. Kenkmann[1], S. Sturm[1], T. Krüger[1], E. Salameh[2], K. Konsul[3], [1] Institute of Earth and Environmental Sciences-Geology, Albert-Ludwigs-Universität Freiburg Germany; [2]Depart. of Geology, University of Jordan; [3]Arab Union for Astronomy and Space Sciences (AUASS), Jordan; thomas.kenkmann@geologie.uni-freiburg.de

**Introduction:** Jebel Waqf as Suwwan is a complex impact crater in Jordan (N31°02.9'E36° 48.4') that was discovered by Elias Salameh in 2006 [1, 2]. Previously a crypovolcanic origin had been assumed for this structure [3]. The impact origin has been confirmed based on abundant occurrences of shatter cones [1], rare PDFs [2, 4], PFs and FFs [5]. The crater has been formed in a horizontally layered sedimentary target. The roughly circular structure has (i) a well exposed central uplift of ~1000 m diameter and ~350 m structural uplift, which provides a section through large parts of the sedimentary target, (ii) an annular trough with a wadi drainage system, and (iii) a morphologically elevated rim area of ~5.5 km diameter. Sedimentary rocks exposed in the crater comprise of Albian to Eocene strata. The structure is eroded and no allochthonous crater fill breccias are preserved. Based on the regional geology erosion between 300 and 420 m was estimated indicating an age between latest Eocene and late Oligocene [6].

Gravimetric data show a positive anomaly of 2 mgal suggesting an excess mass below the central uplift [6]. Gravimetric modeling also shows a ring high of denser rocks, possibly Paleozoic basement, surrounding the central uplift at a central distance of ca 2.2 km. This may support a contrast of soft suprastructure over a harder basement multilayer that shows buckling, as has been suggested before by hydrocode modeling [6, 7]. Two reflection seismic profiles are available in NS and EW direction [6] and provide insights to the deeper crater structure. Reflectors in the crater are often incoherent or chaotic. However SW of the central uplift [6] could demonstrate the presence of a radial transpression ridge. Along the crater rim Paleozoic reflectors allow to determine off-sets. Uplift in the N and E rims is about twice that in the S and W rims. The Paleozoic basement in the footwall of the boundary fault shows up-bending and outward thrusting. The asymmetry indicates an oblique impact from the SW [6]. This is in accordance to an earlier proposal [5] that was based on the structure of the central uplift.

Here we present results of a field campaign conducted in spring 2015. We are presenting an updated detailed geological map of the entire structure (Fig.1).

**Geology:** *Central uplift:* The oldest rocks are Albian sandstones that are exposed in the core of the central uplift (Kurnub sst.). Varigated limestones, marly limestones, and competent limestone beds of Cenomanian and Turonian age are disintegrated into 20-150 m sized, internally bent and folded blocks. Together with Kurnub sst. they build up the central part of the central uplift. Marls of Guddran/Wadi Sir Fm. (Coniac/Santonian) are rarely exposed and behave incompetent. The collar of the central uplift is formed by massive chert and phosphorite of Maastrichtian to Santonian age (Alhisa/Amman Fm.). In the more massive SW part of the collar normal layering dominates, whereas overturning is the rule in the NE part. In the SW sector chevron-type folds display outward plunging fold axes whereas in the NE sector fold axes of anticlinal synforms (overturned anticlines) plunge towards the center. This overall asymmetry indicates a strong NE vergency of the central uplift dome and indicates top-to-NE shearing of the entire central uplift that in turn suggests an impact from the SW [5].

*Annular trough:* The annular trough is built up by nodule-rich marly limestones and chert and by chalk and marls of the Muwaqqar Fm. (Paleocene/Eocene). Wadi deposits restrict a detailed analysis of this area except for a morphologically visible intermediate ring (Fig.1) that does not correspond to the ring-like gravity high. In the up-range sector (SW) strata strike preferentially perpendicular to the impact trajectory. In the downrange sector chevron-style folding with radial as well as concentric strike are recorded. Cross-range sectors show complex signals.

*Crater rim:* The crater has a polygonal outline. The crater rim normal fault is exposed outside of the morphologically elevated rim ridges, which represent the outermost terraces. The apparent crater diameter is ~6.1 km. Concentric strike predominates in the outer terraces with preferred outward dip due to antithetic rotations. In the downrange sector, however, inward dip dominates. Strata dips are very gentle in the cross-range sectors and become very steep up-range. The southern crater rim is superbly exposed. The rim fault is highly localized, commonly dips towards the center (outward dip also occurs), and was activated as a normal fault. Fault gouge and fault breccias, as well as Riedel shears are present, but datable pseudotachylites could not be found.

**References**: [1] Salameh, E. et al. (2006), Z. Dtsch. Ges. Geowiss., 157, 319-325. [2] Salameh, E. et al. (2008) MAPS, v. 43, No.10. [3] Heimbach, W., 1969: Beih. Geol. Jb.,81,149-160. [4] Schmieder, M. et al. (2011) M&PS 46, 574-586. [5] Kenkmann, T. et. (2010) GSA-SP 465: 471-487. [6] Heinrichs, T. et al. (2014): Int. J. Earth Sci. 103, 233-252. [7] Wünnemann et al.(2011) 42nd LPSC,#1700.

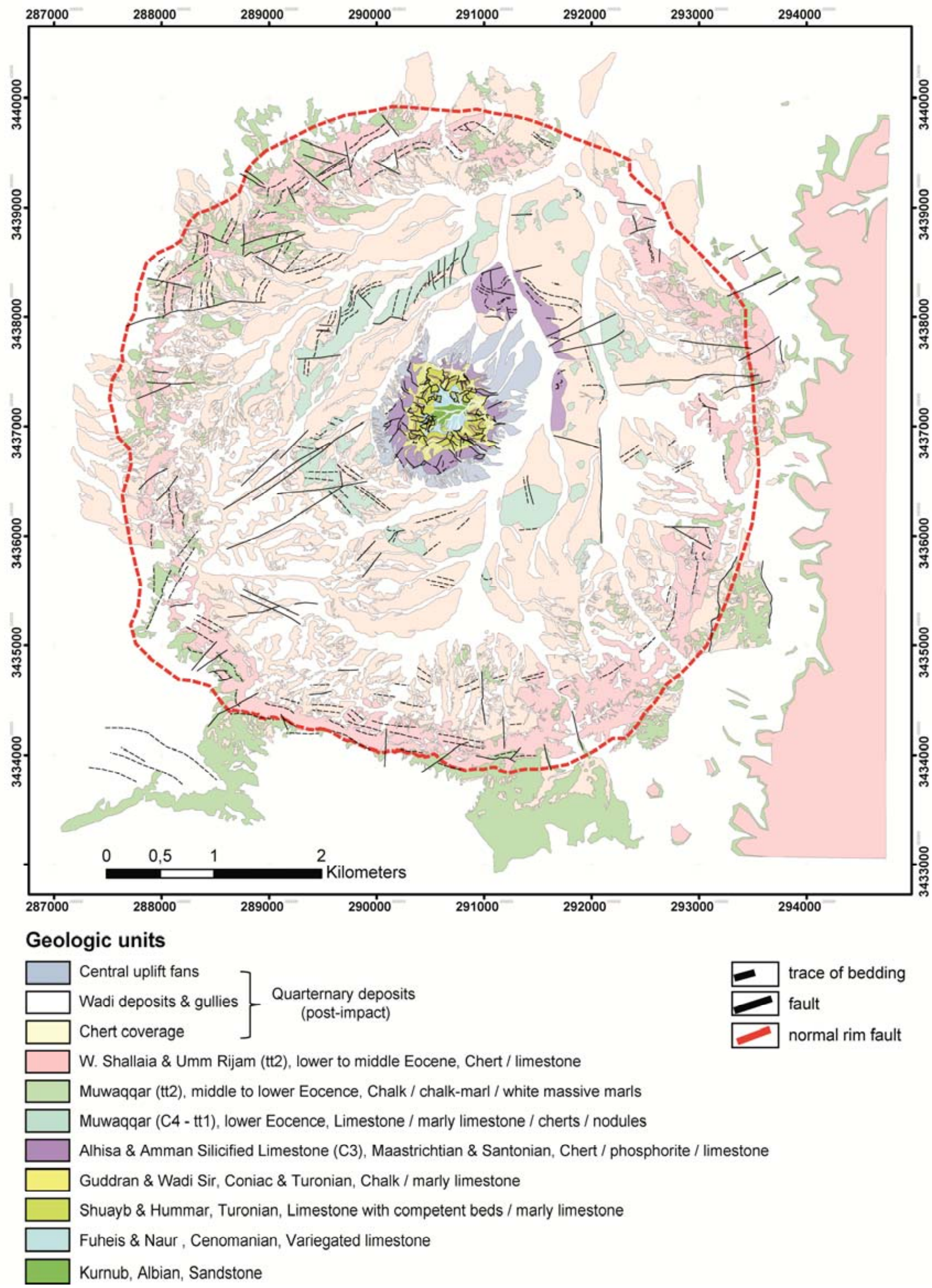


Fig. 1. Updated geological map of Jebel Waqf as Suwwan impact crater, Jordan