



Jordanian Geologists Association



AUASS



University of Jordan

THE FIRST ARAB IMPACT CRATERING AND ASTROGEOLOGY CONFERENCE



**NOVEMBER 9-11, 2009
AMMAN-JORDAN**

ABSTRACT VOLUME

METEORITE IMPACT CRATERS IN THE ARAB WORLD: AN OVERVIEW. M.C. Chabou,
Department of Earth Sciences, Ferhat Abbas University, Setif, Algeria. (charaf.chabou@hotmail.com)

Introduction: Meteorite impacts on Earth are now recognized as an important geological process and have produced several geological structures that are of particular economic interest [1]. The aim of this paper is to review and update our knowledge on the meteorite impact craters in the Arab world (Table 1) and to discuss some problems concerning the discovery of new impact structures in the region.

Confirmed impact craters: There are 176 confirmed impact structures on Earth [2] and only ten are currently known in the Arab world, most of them located in the Sahara [3,4,5,6]: Amguid (Algeria), Aouellouel (Mauritania), BP (Libya), Oasis (Libya), Ouarkiz (Algeria), Jebel el Waqf as Suwwan (Jordan), Talemzane (Algeria), Tenoumer (Mauritania), Tin Bider (Algeria) and Wabar (Saudi Arabia). This number is very small considering: (i) the large area of the region, mainly composed of good surfaces for the preservation of impact craters (arid deserts, cratonic areas), (ii) estimates of cratering rates on Earth [7], and (iii) the number of impact craters known in other regions where there have been active programmes to study impact structures (eg. North America, Australia, Europe) [2]. This indicates that a number of impact craters remains to be discovered in this vast area.

Possible impact craters: In recent years, possible new impact structures, located in Libya and Egypt, were reported in the literature based on remote sensing studies, analysis of satellite images and on fieldwork investigations (for Arkenu and Gilf Kebir structures): Ibn-Batutah [8], Jebel Hadid [9] and the two Arkenu [10] structures in Libya, the so-called Kebira crater that straddles the border between Egypt and Libya [11], and the Gilf Kebir crater field located in the Western Egyptian Desert, where more than 1300 small crater-like features were reported by [12,13]. However, these discoveries must be taken with caution, as the only criteria that are generally accepted for assigning an impact origin for a terrestrial crater structure are the occurrence of shock-metamorphic effects in the target rocks, the occurrence of shatter cones, and detection of traces of a meteoritic projectile. So, these circular structures

need field studies. Particular attention should be paid during fieldwork investigations and petrographic study of the target rocks, as some alleged shock metamorphic features reported in the literature were proven wrong when they were submitted to scrutiny (eg. shatter cones can be easily confused with cone-in-cone structures or wind abrasion features, especially in desert regions, and some reports of planar deformation features in quartz were shown to be, in fact, not planar) [14]. More recently, detailed studies of the Arkenu double craters and the Gilf Kebir crater field have shown no evidence supporting an impact origin of these structures [15,16] despite the early reports by [10,12] of the presence of shatter cones and planar deformation features in quartz. Other possible and discredited impact structures cited in scientific works during the last thirty years and located in the Arab world are listed in Table 1. Among these craters, the best candidate for a meteorite impact origin is the Temimichat Ghallaman located in Mauritania [3,17].

References: [1] Grieve, R.A.F. (2005). *GSL Special Publications*, 248, 1-29. [2] Earth Impact Database, 2009 <http://www.unb.ca/passc/ImpactDatabase/>, (Accessed: September 2009). [3] Koeberl, C. (1994). *J. Afr. Earth Sci.*, 18, 263-295. [4] Salameh, E. (2008). *Meteoritics & Planet. Sci.*, 43, 1681-1690. [5] Wynn, J.C. and Shoemaker, E.M. (1998). *Scientific American*, 279, 36-45. [6] Prescott, J.R. et al. (2004). *J. Geophys. Res.*, 109, E01008, doi:10.1029/2003JE002136. [7] Grady, M.M. et al. (1998). *GSL Special Publications*, 140, 280 p. [8] Ghoneim, E.M. (2009). *Geomorphology*, 103, 341-350. [9] Schmieder, M. et al. (2009). *Marine and Petroleum Geology*, 26, 310-318. [10] Pailou, P. et al. (2003). *C.R. Geoscience*, 335, 1059-1069. [11] El Baz, F. and Ghoneim, E.M. (2007). *International Journal of Remote Sensing*, 28, 451-458. [12] Pailou, P. et al. (2004). *C.R. Geoscience*, 336, 1491-1500. [13] Pailou, P. et al. (2006). *J. Afr. Earth Sci.*, 46, 281-299. [14] Reimold, W.U. (2007). *Meteoritics & Planet. Sci.*, 42, 1467-1472. [15] Orti, L. et al. (2008). *Meteoritics & Planet. Sci.*, 43, 1629-1639. [16] Di Martino, M. et al. (2008). *Large Meteorite Im-*

pacts and Planetary Evolution IV, Abstr. # 3012. [17] Rossi, A.P. et al. (2003). *LPS XXXIV*. Abstr. # 1882. [18] Garvin, J.B. and Blodget, H.W. (1986). *Meteoritics*, 21, 366-367. [19] Grieve, R.A.F., et al. (1988). *LPI Technical Report 88-03*, 75-82. [20] McHone, J.F. and Dietz, R.S. (1988). *Meteoritics*, 23, 288-289. [21] McHone, J.F. and Greeley, R. (1997). *LPSC XXVIII*. Abstr. # 1149. [22] Underwood, J.R. (1994). *Large meteorite impacts and planetary evolution. GSA Spec Paper*, 293, 259-263. [23] Rossi, A.P. (2002). *LPS XXXIII*. Abstr. # 1309.

[24] Levell, B. et al. (2002). *GeoArabia*, 7, 721-730. [25] Blom, R.G. et al. (1998). *LPS XXIX*. Abstr. # 1559. [26] Master, S. and Woldai, T. (2007). *Comet/Asteroid Impacts and Human Society (I)*, Springer, 89-103. [27] Di Achille, G. (2005). *LPS XXXVI*. Abstr. # 1606. [28] El Baz, F. (1981). *Science*, 213, 439-440. [29] Barakat, A. (1994). *Annals Of Geological Survey of Egypt*, XXIV, 167-177. [30] Hofmann, B.A., et al. (2003). *Meteoritics & Planet. Sci.*, 38(Suppl.), Abstr. # 5096.

Table 1: List of confirmed, possible and discredited impact craters in the Arab world. * Buried crater

| Name | Country | Latitude | Longitude | Diameter (km) | Age (Ma) | Ref. |
|--------------------------------------|--------------------|----------|-----------|---------------|-----------|---------------|
| Confirmed impact structures | | | | | | |
| Amguid | Algeria | 26°05' N | 04°23' E | 0.45 | ≤ 0.1 | [3] |
| Aouelloul | Mauritania | 20°15' N | 12°41' W | 0.36 | 3.1 ± 0.3 | [3] |
| B.P. Structure | Libya | 25°19' N | 24°20' E | 2.8 | < 120 | [3] |
| Jebel Waqf as Suwwan | Jordan | 31°03' N | 36°48' E | 5.5 | ≤ 30 | [4] |
| Oasis | Libya | 24°35' N | 24°24' E | 11.5 | < 120 | [3] |
| Ouarkziz | Algeria | 29°00' N | 07°33' W | 3.5 | < 70 | [3] |
| Talemzane | Algeria | 33°19' N | 04°02' E | 1.75 | < 3 | [3] |
| Tenoumer | Mauritania | 22°55' N | 10°24' W | 1.9 | 2.5 ± 0.5 | [3] |
| Tin Bider | Algeria | 27°36' N | 05°07' E | 6 | < 70 | [3] |
| Wabar | Saudi Arabia | 21°30' N | 50°28' E | 0.12 | 0.00029 | [5,6] |
| Possible impact structures | | | | | | |
| Al-Madafi | Saudi Arabia | 28°40' N | 37°11' E | 6 | < 360 | [18,19,20] |
| Al Umchaimin | Iraq | 32°36' N | 39°25' E | 2.75 | | [20,21,22] |
| El-Mirba | Iraq/Jordan border | 32°42' N | 38°52' E | 10 | | [20,21] |
| El Mrayer | Mauritania | 22°43' N | 07°19' W | 3 | | [23] |
| Gogui | Mauritania | 15°33' N | 11°18' W | 0.5 | | [23] |
| Ibn-Batutah | Libya | 21°34' N | 20°50' E | 2.5 | < 144 | [8] |
| Jebel Hadid | Libya | 20°52' N | 22°42' E | 4.7 | < 144 | [9] |
| Kebira | Libya | 24°40' N | 24°58' E | 31 | | [11] |
| Murshid* | Oman | 18°10' N | 54°55' W | 2.5 | ~ 100 | [24] |
| Temimichat Ghallaman | Mauritania | 24°15' N | 09°39' W | 0.75 | | [3,17] |
| Thamud | Yemen | 18°09' N | 50°04' E | 0.77 | < 0.006 | [25] |
| Umm al Binni Structure | Iraq | 31°08' N | 47°04' E | 3.4 | ~ 0.002 ? | [26] |
| Wasita | Yemen | 14°54' N | 44°12' E | 14 | | [20] |
| Unnamed | Sudan | 17°55' N | 37°55' E | 6 | | [27] |
| Discredited impact structures | | | | | | |
| Arkenu 1,2 | Libya | 22°04' N | 23°44' E | 10, 6.8 | < 140 | [10,16] |
| El Baz | Egypt | 24°12' N | 26°24' E | 4 | | [28,29] |
| Gilf Kebir field | Egypt | 23°10' N | 26°50' E | 0.1-2 | | [12,13,15] |
| Habhab structure | Oman | 23°40' N | 27°35' E | | | |
| | | 19°55' N | 56°58' E | 6 | | [19,20,21,30] |