

ON THE PROBLEMS OF THE IDENTIFICATION OF NEW IMPACT STRUCTURES IN THE ARAB WORLD. M. C. Chabou. Department of Earth Sciences, Ferhat Abbas University, Setif, Algeria. charaf.chabou@hotmail.com.

Introduction : There are currently 182 impact structures on Earth [1] and in the early 2010 only 10 were known in the Arab world, all of them located in the Sahara [2]. This number is very small considering the large area of the region, mainly composed of good surfaces for the preservation of impact craters (arid deserts, cratonic areas). In July 2010, Folco et al. (2010) [3] reported the discovery in southern Egypt of a new well-preserved impact crater named Kamil crater that was added to the list of confirmed impact structures in the Arab region. This finding indicates that there is probably other impact structures that have not yet been discovered in this vast area. Here we present an update of the inventory of confirmed and possible impact craters in the Arab world (Table 1) and a discussion of some problems concerning the recognition and the identification of a new impact structures in the area.

An updated inventory of confirmed and possible impact structures in the Arab world : To date, 11 meteorite impact structures have been identified in the Arab world. In addition to the 10 impact structures known in 2009 ([4] and references therein), the newly discovered Kamil is a small impact crater 45 m in diameter with an ejecta ray structure that highlight the exceptional freshness of the structure, with an estimation age < 5 k.y. [5]. A meteorite impact origin for the Kamil crater was based on morphological observations, shock metamorphism, and preservation of an iron meteorite impactor [6]. Several other circular features located in the Arab world have been proposed as possible impact craters [4]. Beside the 14 circular structures compiled in [4], three additional structures (As Shutbah [7,8], Jaraminah and Tmisan [9]) have been recently identified of possible impact origin. Gnos et al. (2011) [8] investigated the 2.5 km Al Shutbah crater in Saudi Arabia and concluded that this structure is a complex meteorite impact crater, although the evidence cited by these authors - the presence of folded beds and a "possible" shatter cone - do not provide definitive proof of an impact origin.

The problems of the recognition and identification of new impact structures in the Arab world : 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 discovery of preserved meteorite fragments or detection of traces of a meteoritic projectile [10]. Consequently, field

investigations, including collection and analyses of rock samples are required. Unfortunately, in many countries of the Arab region, these field works are impossible due to political instability, civil wars and the presence of landmines. For example, most of possible impact structures cited in Table 1 that need field investigations are located in such countries (Iraq, Sudan, Yemen and Libya). Another aspect in the problems of the recognition of impact craters is the misidentification of shock metamorphic features (eg. shatter cones can be easily confused with cone-in-cone structures or wind abrasion features, especially in desert regions that characterize the Arab countries, and some reports of planar deformation features in quartz were shown to be, in fact, not planar) [11]. Recently, detailed studies of the Arkenu double craters (Libya) and the Gilf Kebir crater field (Egypt) have shown no evidence supporting an impact origin of these structures [12,13] despite the early reports by [14,15] of the presence of shatter cones and planar deformation features (PDF) in quartz. Finally, it should be noted that the geological community in the Arab countries is rarely initiated in the study of impact craters, with the result that there is a lack of research programs and funding in the fields of impact cratering.

Conclusion : The record of impact structures in the Arab region is still incomplete considering the great size of the territory and the number of impact craters known in other regions where there have been active programmes to study impact structures. It should be important not only to promote impact crater studies in the Arab world, but also insist about the diagnostic criteria for the recognition and identification of impact structures.

References: [1] Ferrière L. (2011) (<http://www.meteorimpactonearth.com/>) (Accessed: September 2011). [2] Reimold W. U. (2010) *Meteoritics & Planet. Sci.*, 45, 157-160. [3] Folco L. et al. (2010) *Science*, 329, 804. [4] Chabou M. C. (2009) *Abstract, the First Arab Impact Cratering and Astrogeology Conference (AICAC)*, 7-8. [5] Folco L. et al. (2011) *Geology*, 39, 179-182. [6] Folco L. et al. (2011) *Meteoritics & Planet. Sci.*, 46, 1179-1196. [7] Schmeider M. et al. (2009) *Abstract, the First AICAC*, 84-85. [8] Gnos E. et al. (2011) *Meteoritics & Planet. Sci.*, 46, Supplement., A79. [9] Dunford A. and Koeberl C. (2009) *Abstract, the First AICAC*, 18-20. [10] French B. M. and Koeberl C. (2010) *Earth Sci. Rev.*, 98, 123-170. [11] Reimold, W. U. (2007).

Meteoritics & Planet. Sci., 42, 1467-1472. [12] Orti L. et al. (2008). *Meteoritics & Planet. Sci.*, 43, 1629-1639. [13] Di Martino M. et al. (2008). *Large Meteorite Impacts and Planetary Evolution IV*, Abstr.

3012. [14] Paillou P. et al. (2003). *C.R. Geoscience*, 335, 1059-1069. [15] Paillou, P. et al. (2004). *C.R. Geoscience*, 336, 1491-1500.

Name	Country	Latitude	Longitude	Diameter (km)	Age (Ma)	Ref.
Confirmed impact structures						
Amguid	Algeria	26°05' N	04°23' E	0.45	≤ 0.1	[4]
Aouelloul	Mauritania	20°15' N	12°41' W	0.36	3.1 ± 0.3	[4]
B.P. Structure	Libya	25°19' N	24°20' E	2.8	< 120	[4]
Jebel Waqf as Suwwan	Jordan	31°03' N	36°48' E	5.5	≤ 30	[4]
Kamil	Egypt	22°01' N	26°05' E	0.045		[3,5,6]
Oasis	Libya	24°35' N	24°24' E	11.5	< 120	[4]
Ouarkiziz	Algeria	29°00' N	07°33' W	3.5	< 70	[4]
Talemzane	Algeria	33°19' N	04°02' E	1.75	< 3	[4]
Tenoumer	Mauritania	22°55' N	10°24' W	1.9	2.5 ± 0.5	[4]
Tin Bider	Algeria	27°36' N	05°07' E	6	< 70	[4]
Wabar	Saudi Arabia	21°30' N	50°28' E	0.12	0.00029	[4]
Possible impact structures						
Al-Madafi	Saudi Arabia	28°40' N	37°11' E	6	< 360	[4]
Al Umchaimin	Iraq	32°36' N	39°25' E	2.75		[4]
Ash Shutbah	Saudi Arabia	21°37' N	45°39' E	2.5		[7,8]
El Mrayer	Mauritania	22°43' N	07°19' W	3		[4]
Gogui	Mauritania	15°33' N	11°18' W	0.5	< 144	[4]
Ibn-Batutah	Libya	21°34' N	20°50' E	2.5	< 144	[4]
Jaraminah	Libya	26°32' N	10°35' E	2.2		[9]
Jebel Hadid	Libya	20°52' N	22°42' E	4.7		[4]
Kebira	Libya	24°40' N	24°58' E	31	~ 100	[4]
Murshid*	Oman	18°10' N	54°55' W	2.5		[4]
Temimichat Ghallaman	Mauritania	24°15' N	09°39' W	0.75	< 0.006	[4]
Thamud	Yemen	18°09' N	50°04' E	0.77	~ 0.002 ?	[4]
Tmisan	Libya	27°25' N	13°24' E	3.2		[9]
Umm al Binni Structure	Iraq	31°08' N	47°04' E	3.4		[4]
Wadi el Murbah	Iraq/Jordan border	32°44' N	39°00' E	7.5		[4]
Wasita	Yemen	14°54' N	44°12' E	14		[4]
Wadi Na'am	Saudi Arabia	19°08' N	44°00' E	17	Precambrian	[4]
Unnamed	Sudan	17°55' N	37°55' E	6		[4]

Table 1: An updated inventory of confirmed and possible impact structures in the Arab world. * Buried crater