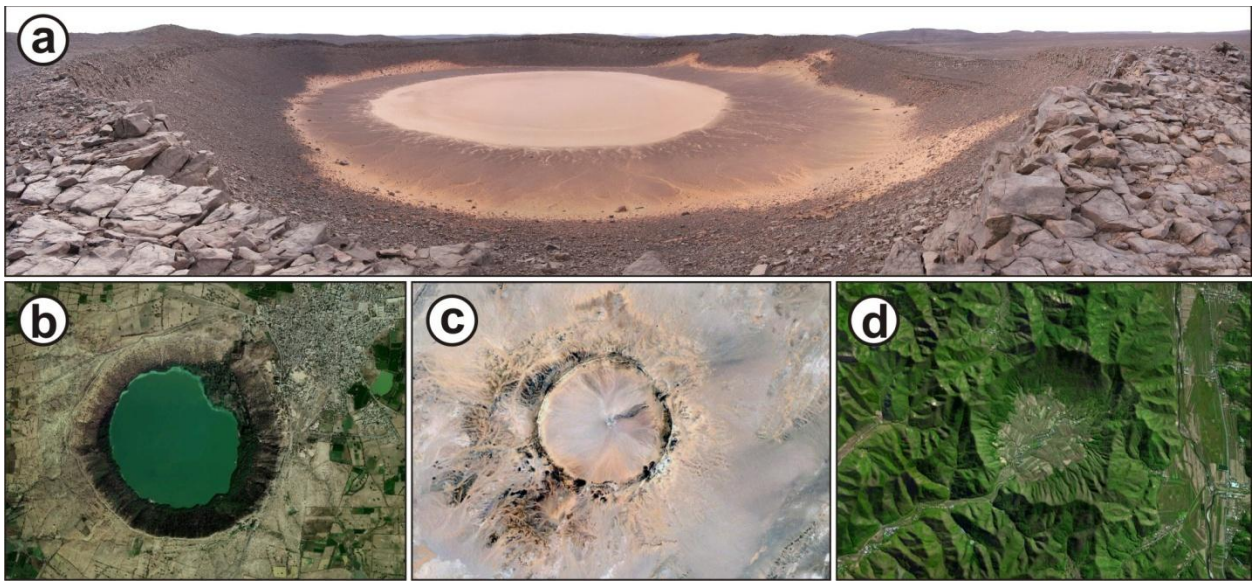
Quaternary meteorite impact craters and products: An overview

Ludovic FERRIÈRE[1]
[1]Natural History Museum, Burgring 7, A-1010 Vienna, Austria
Email ludovic.ferriere@nhm-wien.ac.at
Website www.MeteorImpactOnEarth.com

Currently, 182 impact craters are definitively recognized on Earth, including ~30 that are Quaternary in age (i.e., less than 2,588 million years old), but many other impact structures that must exist have not yet been discovered and/or confirmed.
A requirement for the recognition and confirmation of meteorite impact structures is the presence of specific impact-related phenomena, such as shock metamorphic indicators, either megascopic (e.g., shatter cones) or microscopic (e.g., planar deformation features in minerals), high-pressure polymorphs (e.g., coesite and stishovite) and/or siderophile element (e.g., iridium) or isotopic (osmium) anomalies in specific geological settings. In some rare cases, especially in the case of relatively small and young craters, the occurrence of meteorite(s) within or in proximity to a circular or elliptical structure can also be used as an evidence for an impact origin.
Most of the Quaternary meteorite impact craters are relatively small, simple craters, less than 2-4 km in diameter. Only two of them are larger than 10 km in diameter (all the other being less than 5 km in diameter), the Bosumtwi and Zhamanshin craters, 10,5 and 14 km in diameter, respectively.
The youngest of the Quaternary meteorite impact craters is the Carancas crater (Peru), 14 m in diameter, that was formed very recently, on the 15th of September 2007.

Fig. 1: Examples of Quaternary impact craters; a) Amguid, b) Lonar, c) Tenoumer, and d) Xiuyan.



In some rare cases, only the "ejected products" (or ejecta deposits) are known; one good example is the Australasian tektites that are found in Indochina, southern China, the Philippines, Malaysia, Indonesia, and Australia. These tektites (i.e., special type of impact glasses) were formed ~0.8 Ma ago; The source crater is still unknown.
Finally, a large number of more or less circular structures are presently considered to be of uncertain origin, and a few possible ejecta deposits/layers are known, however their recognition and confirmation as

impact related will need to be supported by evidence of unambiguous shock deformation and/or traces of extraterrestrial matter.

The "Younger Dryas impact hypothesis" is one of these; It is a recent theory that suggests that a cometary or meteoritic body exploded over North America 12,900 years ago, causing the Younger Dryas climate episode, extinction of Pleistocene megafauna, demise of the Clovis archaeological culture, etc. but not any recognized impact markers have been found so far.

All the confirmed Quaternary meteorite impact craters, as well as the possible/probable young meteorite impact structures and possible ejecta deposits/layers will be discussed, including the Bukit Bunuh crater.

Table 1: Confirmed meteorite impact structures/craters that are Quaternary in age (ordered by age).

Structure/crater name	Location	Age (million years)
Carancas	Peru	0.000004
Sikhote Alin	Russia	0.000063
Wabar	Saudi Arabia	0.00014
Haviland	USA	< 0.001
Sobolev	Russia	< 0.001
Whitecourt	Canada	<0.0011
Campo Del Cielo	Argentina	< 0.004
Kaalijärv	Estonia	0.004 ± 0.001
Henbury	Australia	0.0042 ± 0.0019
Kamil	Egypt	< 0.005
Boxhole	Australia	0.0054 ± 0.0015
Ilumetsä	Estonia	~ 0.0066
Macha	Russia	< 0.007
Morasko	Poland	< 0.01
Tenoumer	Mauritania	0.0214 ± 0.0097
Meteor Crater (Barringer)	USA	0.049 ± 0.003
Odessa	USA	< 0.05
Lonar	India	0.052 ± 0.006
Xiuyan	China	> 0.05
Amguid	Algeria	< 0.1
Rio Cuarto	Argentina	< 0.1
Tswaing	South Africa	0.220 ± 0.052
Kalkkop	South Africa	0.250 ± 0.050
Dalgaranga	Australia	~ 0.27
Wolfe Creek	Australia	< 0.3
Zhamanshin	Kazakhstan	0.9 ± 0.1
Veevers	Australia	< 1
Monturaqui	Chile	< 1
Bosumtwi	Ghana	1.07
New Quebec	Canada	1.4 ± 0.1
Talemzane	Algeria	< 3