EVIDENCE FOR AN IMPACT ORIGIN OF THE AMBAR LAKE STRUCTURE: A SMALLER COMPANION CRATER TO THE LONAR IMPACT CRATER, MAHARASHTRA, INDIA.

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The Lonar Crater (19°58'N, 76°31'E) is a 1.83 km-diameter impact structure situated on 65 Ma basalts of the Deccan Traps, in northern Maharashtra, India [1,2]. In their paper [2] describing the Lonar Crater, Fredriksson et al. (1973) noted a small c. 300 m-diameter depression about 700 m due north of the north rim of the main Lonar Crater, and suggested that it may be a second impact crater. The small depression, which is occupied by the perennial Ambar Lake, is partly illustrated in the vertical aerial photograph accompanying their article [2].

The Ambar Lake structure was investigated by the author on the 13th February, 1999. The country rocks around this structure are the same as those around the Lonar crater, and consist of grey, microporphyritic, plagioclase-phyric massive and amygdaloidal basalts of the Deccan Traps. The structure is roughly oval shaped, with its outermost limits having major and minor axes of approximately 340 m and 275 m respectively. There is a raised rim, about 6 m high, surrounding the central depression that is occupied by Ambar Lake, which lies at an elevation about 5 m below the general surface surrounding the structure. The estimated rim-to-rim major and minor axes are about 290 m and 250 m respectively. The major axis is oriented along an approximate strike of 120°/300°.

The rim is breached in three places, where streams arising in the surrounding flat basaltic plains have cut narrow channels draining into the central lake. The largest of these channels, to the north, has built out a small delta which protrudes tongue-like into the lake. The crater rim, exposed in cross-section on the channel flanks, is composed of allochthonous basaltic breccias, in which a size gradation is apparent, with the larger breccia fragments, up to 0.5 m long, predominating in the lower part. There are discontinuous exposures, mainly in the form of loose basaltic blocks, along the inner flanks of the rim, and in erosional gullies. There are no exposures on the lake shores, which consist of brown sands and mud, derived from basalt, which have been washed into the crater by the ephemeral streams that must be active during the monsoon season.

Numerous shatter cones, or conical shatter cone segments, were found in basaltic breccia fragments from the crater rim, as well in basaltic blocks exposed on the inner flanks of the rim or strewn along the shoreline of Ambar Lake. One loose piece of suevite, consisting of black frothy scoriaceous vitreous meltrock, containing angular fragments of basalt and chalcedony, and broken xenocrysts of plagioclase and pyroxene, was found on the northwestern inner flanks of the crater. The raised rim consisting of a thick layer of allochthonous breccia, the abundant shattercone segments, and the suevite, are interpreted to be macroscopic evidence of shock processes resulting from a meteorite impact, which generated the crater. The very close proximity of the Ambar Lake structure to the Lonar Crater, and its relatively large size, indicates that the two craters may have formed by near-simultaneous double impacts of fragments of the same bolide, and appears to preclude the possibility that the Ambar Lake structure is a secondary crater formed by ejecta thrown out on ballistic trajectories from the larger Lonar crater. Assuming a link between the two craters implies that the Ambar Lake structure was formed at the same time as the Lonar Crater, for which an age estimate of 52,000 ± 6,000 years [3] has been made, based on thermo-luminescence (TL) studies of impact glasses. The small size and young age of the Ambar Lake impact crater makes it quite probable that meteoritic debris from the impacting small bolide fragment would have survived, and a systematic search for such meteorites is likely to be successful.

References: [1] Nayak, V. K. (1972). *EPSL*, *14*, 1-6. [2] Fredriksson, K. et al. (1973). *Science*, *180*, 862-864. [3] Sengupta, D. (1996). Abstr., 30th IGC, Beijing, China, **3**, p. 511.