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THE BOXHOLE METEORITE CRATER, NORTHERN TERRITORY, AUSTRALIA; E.M. Shoemaker, D.J. Roddy, C.S. Shoemaker, and J.K. Roddy, U.S. Geological Survey, Flagstaff, Arizona 86001

The Boxhole meteorite crater, which lies about 170 km northeast of Alice Springs, Northern Territory, was first described by C.T. Madigan [1], who also described its associated iron meteorites [2]. The crater was briefly examined by D.J. Milton [3], who suggested that the Boxhole and Henbury meteorites might be paired falls and that the 13 Henbury craters, which lie about 120 km southwest of Alice Springs, might be contemporaneous with Boxhole. In 1987, we carried out a detailed investigation of Boxhole crater to examine cratering processes, determine the direction of impact, and test Milton's hypothesis.

Boxhole crater, about 170 m in diameter at the rim crest, lies on the south flank of an east-west ridge underlain by weathered, steeply dipping metamorphic rocks of Early Proterozoic age (Fig. 1). Units of quartzofeldspathic gneiss, muscovite-quartz-feldspar schist, and brown-weathering schist and quartzite, and a unit consisting largely of vein and replacement quartz were mapped at the crater (Fig. 2). Precrater colluvium mantles the flank of the main ridge and is exposed on the rim of the crater. On the south crater rim, this colluvium is locally overlain by precrater red sandy alluvium, some of which occupies channels cut into the colluvium. Both the bedrock and the precrater surficial deposits have been uplifted and deformed along the walls and in the rim of the crater.

Ejecta derived from the bedrock units and from the precrater surficial deposits have been laid down in inverted sequence on the crater rim. The ejecta blanket is thickest along the south rim crest and is entirely absent on the north rim. Extensive ejecta can be traced more than 300 m south of the crater [4]. This extreme asymmetry in the ejecta distribution provides the most direct evidence available of the direction of impact. We infer that the meteorite was traveling from north to south and that it probably impacted at a relatively low elevation angle.

The ejecta blanket is overlapped by postcrater alluvium as much as 0.5 m thick; beyond the rim of the crater the ejecta deposits are only locally exposed [4]. Postcrater surficial materials, including colluvium, alluvium, and playa deposits, occur on the floor and lower walls of the crater; patches of thin postcrater colluvium are also present on the north crater rim and on the flank of the main east-west ridge to the north. Thicknesses of the postcrater deposits appear to be consistent with a crater age of 5,400 ± 1500 years BP derived from the terrestrial age of the meteorite [5].

Meteorites have been intensively collected at Boxhole crater over the last 50 years, but the initial distribution pattern of the meteorites can still be deduced from shale-ball (oxidized meteorite) fragments that have been left by the collectors. The fragments that we observed near the crater were almost exclusively on its north rim and on the main ridge farther north, where the ejecta blanket is absent. We found only two shale-ball fragments on the south crater wall just downslope from the base of the ejecta blanket. No shale-ball fragments or meteorites were found resting on the ejecta. This distribution indicates that the meteorites landed immediately before the ejecta were laid down and were buried beneath the ejecta blanket on the east, south, and west parts of the crater rim. Madigan also found meteorites about 140 m east of the crater [2]. The overall ejecta distribution is best explained by a shower of meteorites produced by aerodynamic fragmentation of the main body.

The inferred north to south direction of impact of the Boxhole meteorite is much different than that inferred for the Henbury meteorites (southwest to northeast), and we conclude that they were not paired falls. From comparison of the thickness of postcrater surficial deposits at the Boxhole and Henbury craters, we suspect that Boxhole is the older.

References: [1] Madigan, C.T., 1937, Roy. Soc. South Australia Trans. and Proc., v. 61, p. 187-190. [2] Madigan, C.T., 1940, Mineralog. Mag., v. 25, p. 481-483. [3] Milton, D.J., 1968, U.S. Geol. Survey Prof. Paper 599-C. [4] Roddy, D.J., Shoemaker, E.M., Shoemaker, C.S., and Roddy, J.R., this volume. [5] Kohman, T.P., and Goel, P.S., in Radioactive dating: Internat. Atomic Energy Agency, Vienna, p. 395-411.

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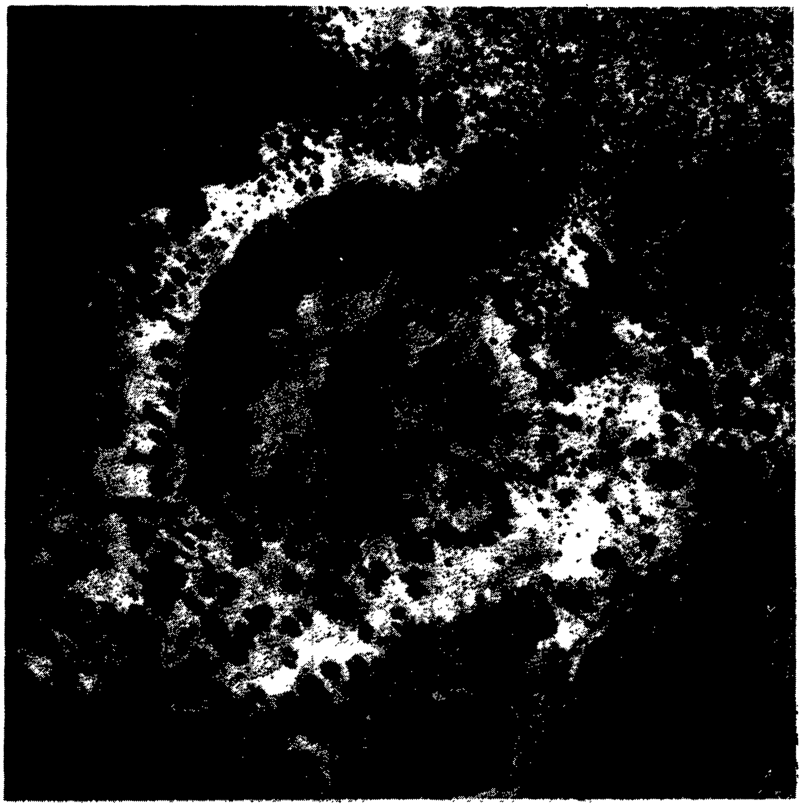

Fig. 1. Vertical aerial view of Boxhole crater, Northern Territory, Australia (photograph by authors, 1987). Inferred direction of impact shown by dashed line with arrow. Scales of Figures 1 and 2 are the same.

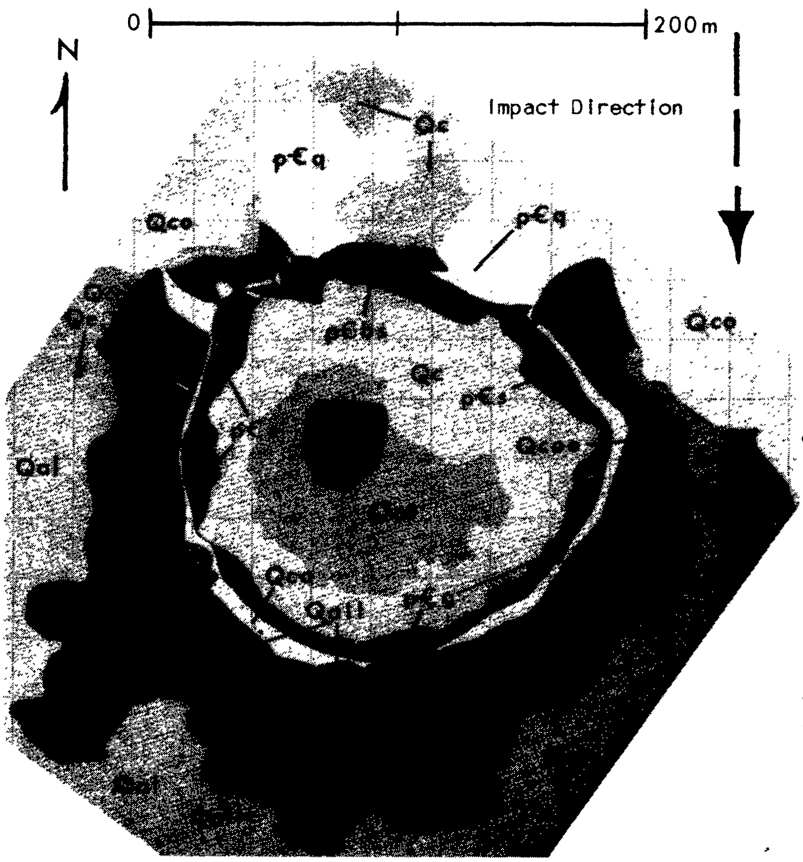


Fig. 2. Geologic map of Boxhole crater.

Explanation

Quaternary

Postcrater Units
- Qp playa deposits
- Qc colluvium
- Qal alluvium

Crater Ejecta Deposits
- Qalle alluvium ejecta
- Qcoe colluvium ejecta
- Qse schist ejecta
- Qge gneiss ejecta
- Qe ejecta, undivided

Precrater Units
- Qco colluvium
- Qall alluvium

Precambrian
- pЄq vein & replacement quartz
- pЄbs brown-weathering schist & quartzite
- pЄs muscovite schist
- pЄg quartzofeldspathic gneiss

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