BARRINGER METEORITE CRATER

An aerial view of Barringer Meteorite Crater, Arizona, one of the Earth's youngest impact craters and one which has played major roles both in basic cratering research and as a training site for each of the Apollo astronaut crews. Field studies by E. M. Shoemaker indicate that Barringer Meteorite Crater formed some 25,000 years ago, shortly before man began permanently to inhabit the southern regions of the Colorado Plateau. Recent studies of the event indicate that an iron mass(es), traveling in excess of 11 km/second, impacted flat-lying sedimentary rocks, initiating a complex set of cratering processes and releasing some 10-20 megatons (10^{23} ergs) of kinetic energy. The result was the formation of a large bowl-shaped crater, approximately 1.1 km across and over 200 m deep, surrounded by an extensive ejecta blanket.

The nature and extent of structural deformation remained unknown until D. M. Barringer initiated a systematic exploration in the early 1900's to mine the iron meteorite. His deep drilling and excavations never located the impacting body which, unknown to him, had totally fragmented. His subsurface data, however, played a major role in Shoemaker's identification of the classic elements formed in such an impact crater, including a thick breccia lens, a fallout layer, uplifted and deformed rim strata, an ejecta blanket, and a partial sedimentary fill of talus, playa and lake beds. Vertical shafts excavated as deep as 67 m below the crater floor penetrated 30 m of fill, 10 m of fallout, and terminated in highly shocked and fused Coconino Sandstone. The white mounds seen in the floor consist of rock debris from the shafts and contain high pressure forms of quartz, coesite and traces of stishovite.

Structural deformation in the rim of the crater consists principally of highly faulted and folded strata that have been uplifted so that they now dip away from the crater. Structural uplift, locally as great as 50 m along the upper crater walls, produced steep cliffs which expose complete sections of the Moenkopi Sandstone, 10 m thick, and the underlying Kaibab Dolomite, approximately 90 m thick. Talus on lower walls largely conceals the underlying uplifted deformed section of Coconino Sandstone.

Field studies by D. J. Roddy, combined with data from over 160 holes drilled in the rim by the U.S. Geological Survey, show that approximately 175 x 10^6 metric tons of rock were ejected during the cratering event to form a coherent ejecta blanket with a well-ordered inversion of strata. The light-colored, hummocky terrain surrounding the crater is underlain largely by Coconino and Kaibab ejecta, locally as thick as 25 m near the rim crest. The outer edge of the ejecta blanket once extended over 2 km from the center of the crater, but erosion has reduced the range to about 1.5 km with an estimated 15% to 25% of the ejecta eroded since the time of impact. White areas on the southwest rim (left side) are abandoned silica pits in Coconino Sandstone which form the upper part of the overturned ejecta near the rim. Detailed studies by D. M Barringer, H.H. Nininger, and E.M. Shoemaker have shown that iron fragments from the impacting body are widely but sparsely distributed on the ejecta blanket and surrounding plain, and in the crater walls, inner rim, breccia lens, and fallout layer.

The San Francisco Peaks and their associated volcanic field form the skyline 70 km to the northwest. Sunset Crater, one of the larger cinder cones in the field, has erupted as recently as about 1250 AD and locally scattered fine ash from air fallout over the Barringer Meteorite Crater area. Canyon Diablo, from which the numerous meteorite fragments at Barringer Meteorite Crater acquired their name, can be seen in its winding course a few kilometers northwest of the crater. Buildings on north rim are Barringer Museum and quarters. Barringer Meteorite Crater as seen today averages 1186 m in diameter and 167 m in depth measured at rim crest, which rises about 50 m above surrounding plain. The crater now exhibits a squarish outline, but retains the classic bowl-shpe so common to impact craters observed on other terrestrial planets and the moon. Photo by D. Roddy and K. Zeller, U.S. Geological Survey.