Historical Notes on the Odessa Meteorite Crater

BRANDON BARRINGER

Philadelphia, Pa.

Abstract. This is a history of the identification of the crater by the late Daniel Moreau Barringer, Jr., in 1926, and subsequent exploration. The findings at Odessa and at Barringer Crater are compared and problems posed.

At the dinner of the 28th Meeting of the Meteoritical Society at Odessa, Texas, on October 24, 1965, I gave a short account of my family's connection with the nearby meteorite crater. It has since been suggested that this be published, with comments, as part of the history of meteoritics.

In May, 1926, my late brother, D. Moreau Barringer, Jr., a past President of the Meteoritical Society, read a letter to the Engineering and Mining Journal-Press by A. B. Bibbins (1926). It described the finding in 1921 of an iron meteorite, so identified by G. B. Merrill (1922) near a "blow-out" in the vicinity of Odessa. The editor had captioned the letter "A Small Meteor Crater in Texas," though Bibbins had not made that suggestion. Naturally, we were all intensely interested. Under date of June 7, my brother wrote Bibbins, who gave him further information, and I checked with an Odessa bank, which confirmed the existence of the crater.

At this time, G. M. Colvocoresses, President of the Humboldt Smelter, offered my brother a job examining Arizona mines. Reau accepted and decided to go there by way of Odessa. The idea was that he would investigate the crater and, if he decided that it was caused by an impact, try to acquire the site. We prepared a code by which he could give us his findings privately. This was fortunate, as, when he wired after his examination, several people were looking over his shoulder, and the telegraph operator said disgustedly, "You're in no hurry to get this off surely. It just says where you're going."

Reau wired from Texarkana for hotel reservations in Odessa. He arrived by the Santa Fe at night and when the train pulled out it took

with it every light in town. He guessed that the biggest silhouette was the hotel, walked there and in. Striking a match, he found a candle on the desk and under it a note--"Mr. Barringer from Texarkana, your room is number nine." This story seems worth telling to indicate how relatively primitive a place Odessa was only forty years ago.

Next day, June 24, 1926, he went to the crater and stumbled over a piece of iron shale which he knew would hardly have been used to "salt" the property. I quote from a letter to father from him, written that night, which reflects his excitement at identifying the world's second meteorite crater. C. D., of course, stands for Canyon Diablo, and M. C. for our Meteor Crater.

"Dear Father:

"Knowing your anxiety which my telegram will occasion, I hasten to send you this scrawl. Can't get anything better.

"It is a meteor crater, beyond a shadow of a doubt.

"It's oblong, and of very irregular outline; say 450 × 600 feet. The rim is very distinct but irregular in height. Highest about 16-18' above floor of crater--maybe 5' above plain. Formation visible; massive limestone, but there must be sandstone below. Dips almost impossible to observe, but seem to be as indicated. Outcrops small.

"Iron shale, sample enclosed, not by any means abundant. I found maybe 2 pounds of little pieces, all slightly magnetic, two at least perfect little shale-balls, $\frac{1}{2}$" × 1" in diameter. Several bigger pieces cannot be told from C. D. stuff. One of them is about 3" long and 2" wide and thick. Of course most of the pieces were much bigger than the samples I am sending.

"An hour's search found four tiny irons; three are little flat flakes, $\frac{1}{2}$" in diameter, and one is long, irregular: ---- , about about $\frac{3}{4}$" thick and $2\frac{1}{4}$" long. Am keeping this and the other samples and sending 1 little one.

"Shale more plentiful along W. side, iron on N. where Bibbins' piece was found. This means nothing, I think.

"Could not stay long enough to get any idea of direction of approach but did stay long enough to find out it will be darned hard. The irregularities of the rim may come to mean something later on, but I haven't yet settled down enough to study them. Trying not to appear in the least excited before these cow-men is a job, to say the least. Two of them drove me out gratis. As we came up to the rim, I knew what it was, although my sober judgment, if any, made me suspend sentence, even to myself, for an hour. I hadn't gone ten feet from the car when I found a piece of shale, either.

"The whole thing is so absurdly like M. C. that it doesn't seem possible. Same flat plain, sagebrush, bunch of grass and mesquite in the bottom, cherty limestone boulders thrown out (without symmetry, dammit) even (though I can't be sure of this) pulverized sandgrains. There are two areas of sand, at low places in the rim. The sand is brown and very fine, but my glass doesn't show any cracks or broken pieces. Biggest boulder which I am sure is ejected can't weigh over a couple of tons. Limestone fragments, which may be ejected, found 100 yards away. No shale found over 30 yards or so from edge.

"I have it up with a real estate dealer, who went out with us. If it's RR land, may have to buy $\frac{1}{2}$ sec., at $6 or $7 the acre. If so, you better see it first. If not, I have met the owner, who seems O.K. Will know this evening, and wire or write you fully from El Paso. Anyway you better see it. McKinney, to whom Bib referred, is the real estate man. We can't quite find whose land it's on.

"How was my telegram?
Very = have found iron.
Well = it is a met. crater.
Making plans = ditto
To arrive Prescott = to get option;
5 days = 500' in diameter.

"Love and congratulations
'Reau."

On June 25th, my father wrote of the mass which made Meteor Crater it "may easily have been a travelling companion".

The owner, the Texas and Pacific Land Trust, fortunately for us, wouldn't sell, because oil and gas had just been discovered there. Carrying one crater through the depression proved enough of a job. Moreau promptly wrote a paper for the Philadelphia Academy of Natural Sciences (Barringer 1928). However, we didn't think the identification of the world's second meteorite crater by a son of the man who had identified the first would exactly help to raise money to explore ours. It seemed "too much of a good thing". Publication was therefore withheld for two years. Meanwhile E. H. Sellards (1927) published a paper giving impact as one of several possible origins.

In 1941, I visited the crater, met Glen L. Evans and saw the work he and Sellards were doing for the Texas Memorial Museum. The 70-foot crater was beautifully exposed and looked exactly like our diagrams of the interior of our crater, with meteorites all along the contact between the "fill" and the material not ejected and the six-ton mass that made it exposed at a depth of 17 feet. Walking down

FIGURE 1—Odessa Meteorite Crater, photo by Otto Roach (1938?). Courtesy of American Museum of Natural History.

into it and feeling that mass was really an extraordinary experience (Sellards 1940, 1941; Sellards and Barnes 1940, 1943; Sellards and Evans 1941; Evans 1941).

Under a lease from the owners, the Texas and Pacific Land Trust, to the Ector County Commissioners, the crater was shamefully neglected, at one time being actually used as a dump. To Evans belongs the credit for stopping this, with little or no actual authority to do so.

In 1958, my brother Richard secured permission of all parties to attempt to locate the mass that made the main crater, as the one that made Crater No. 2 had been located. Evans agreed to supervise, without charge, the drilling done at Barringer Crater Company expense. Eighty-six air drill holes were sunk 105 - 200 feet into the undisturbed strata, in 1958 and 1960. They were so arranged that any mass 25 or more feet in diameter would have been encountered. Nothing was found, except numerous very small meteoritic fragments

in the "fill", primarily near its bottom. The results were reported at the 1961 Washington Cratering symposium (Evans 1961). The six tons of meteoritic shale from Crater No. 2 were excavated and sent to the Texas Memorial Museum.

In 1963, Thomas Rodman became interested, formed the Odessa Meteoritical Society, and had it buy the surface rights. A Chamber of Commerce campaign made it possible to clean and sign the area and build a little Museum. A curator is employed, and admissions make the enterprise self-supporting. During the site visit of the Meteoritical Society on October 24, 1965, it was designated a Registered Natural Landmark. The work of Rodman and his associates in thus really saving the Crater and making it available to meteoriticists and the general public is deserving of great praise.

The exhaustive exploration of these two Odessa craters raises some as yet unsolved problems. Obviously, the masses that made them separated late in their flight through the atmosphere, as their rims are within 100 feet of each other near the southern nose of the 2-mile by 1-mile strewn field of meteorites from the fall (Evans 1961, D-2). Evans calls the object which made No. 2 "a compact cluster of masses" and a "large concentration of meteorites" (ibid, D-4). That is how they looked to me in situ. The two objects must have struck at virtually the same speed, as otherwise they would have been farther separated. Yet, the smaller did not explode—the larger apparently did.

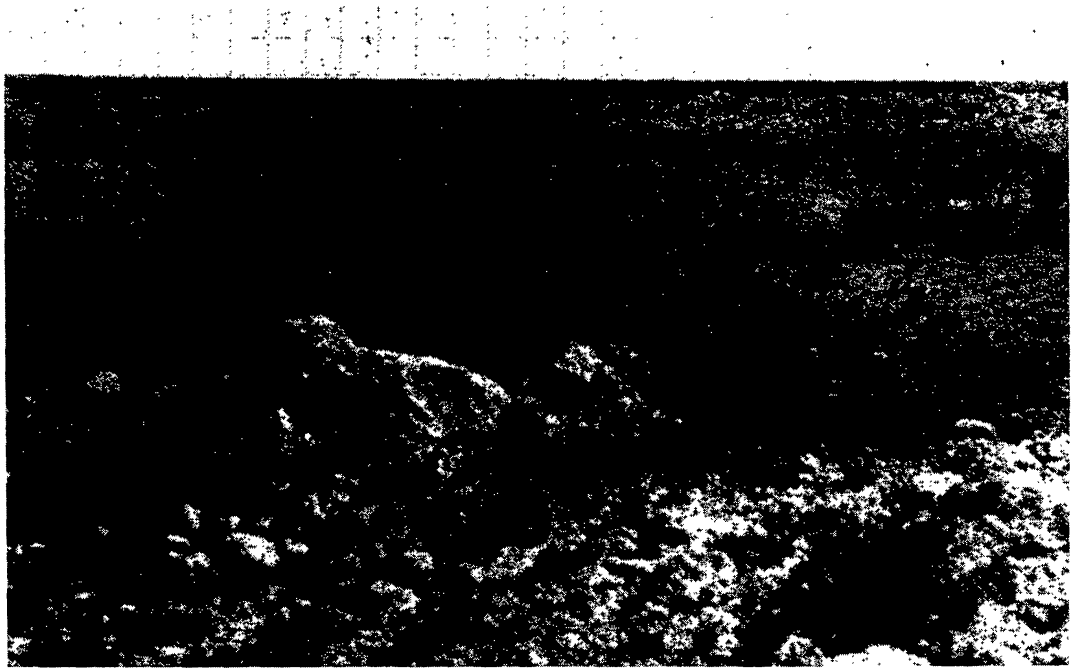

FIGURE 2—Odessa Crater seen from rim.

Furthermore, in support of my father's guess that they may have been travelling companions of the mass which made the Barringer Crater, there are the following facts:

(1) As Shoemaker and Eggleton (1961, A-5) and others have pointed out, the meteorites "are essentially identical".

(2) "The craters are of the same age". Actually, Shoemaker puts the age of Barringer from the geology at about 20,000 years, and Evans gives 25,000 years for Odessa (ibid., D). Goel (1962), from a study of the Carbon 14 content, finds 11,000 plus or minus 4,000 years for Odessa, which could well mean 19,000 or more, if the actual error is twice the probable.

(3) They both came from the north, or slightly west of north. For Odessa, this is shown by the shape of the strewn field, the location of the craters in it, the fact that the mass in Crater No. 2 was found slightly to the south and east of the center, and the more gradual slope of the original crater to the north and west (Evans 1961, D-11 cross section). For Barringer, it is shown by the bilateral symmetry, including the fact that the brown sandstone, the lowest strata ejected, is found only on the south rim, which also has the largest amount of ejecta (Barringer, 1909).

However, it seems unlikely that they were formed by the decomposition of a single natural satellite, as that would have meant that Barringer, by far the larger piece, fell out of the orbit first. Odessa, the smaller, fell, not 22.5° to the east, as would have been the case if each fell at succeeding perihelions of a single orbit, but only about 9°.

Curiously enough, the recently discovered Monturaqui (Chile) Meteorite Crater and the possibly associated Atacama meteorites lie 14° west of the smaller Campo del Cielo craters, which may be associated with it (Sanchez and Cassidy, 1966). It is possible that, in each case, a smaller body was following in interplanetary space the larger from which it had been somehow separated, or that they were moving in parallel orbits.

The greatest puzzle, however, lies in the fact that the exhaustive drilling of Odessa indicates that the original crater had the shape of a bowl, the sides of which apparently had not been penetrated by the meteorites. This is what one would expect from a true explosion crater, though no other evidences of explosion, such as coesite, glass, shocked rock, or resolidified droplets have been found. In Barringer, on the other hand, we find these evidences of explosion, but, from the rather scanty drilling evidence, a trough, rather than a bowl, with meteorites being found at increasing depths, as one goes south, as is shown by the following tabulation:

	23 Drill Holes in center of Crater	Drill Hole A	Drill Hole No. 1
Highest depth found	450'	400'	603'
Lowest depth found	680'	625'	849'

The depths in the above table have been corrected to the distance below the collar of the central shaft; i.e., Drill Hole A, which is located 850' south 17° west of the central shaft, started 50' higher, so that amount was deducted. The hole stuck in "many meteorites." Similarly, Drill Hole No. 1, sunk by the U. S. Smelting, Refining and Mining Company from the top of the south rim, is 1,100' south 55° east of Drill Hole A and 527' above the shaft collar. It encountered meteorites from 1,130' to 1,376' (603' to 849', after correction), where it stuck in a lot of them. Therefore, we know that the bottom of the meteorite zone is below the "lowest depth found" in these two holes, but probably not below 680' in the center of the crater, as the 14 of the 23 drill holes there which struck meteorites did not encounter any below that depth (Barringer 1909, p. 15). Barringer Crater buried meteorites nicked and sometimes stopped the drills. The fragments in Odessa No. 1 were far too small to do either (see Footnote).

If there is an "explosion bowl" in the Barringer Crater, large numbers of meteorites clearly lie outside of it, and even at a level below its bottom! This is apparently not the case in Odessa No. 1. Both craters are like the smaller Kaalijan craters in containing large quantities of finely subdivided meteorites above the bottom of the original crater. Krinov calls the latter impact craters, as distinguished from the largest one, which he terms an explosively formed "meteoritic crater" in which no meteoric material has been found (Krinov 1966, p. 41).

We have been unable to develop a theory which would explain these apparently contradictory facts. Further exploration of Barringer Crater might throw light on the problem.

Excerpts from logs of Drill Holes 1, A, and B. Privately printed. Available on request from Barringer Crater Company, 2106 Girard Trust Building, Philadelphia, Pa. 19102.

REFERENCES

Barringer, D. M. 1909, Meteor Crater (formerly called Coon Mountain or Coon Butte) in northern central Arizona. Delivered before National Academy of Science Nov. 16, 1909, published privately, 15, 16.

Barringer, D. M., Jr., 1928, A new meteor crater, Proc. Acad. Natural Sciences, Philadelphia, 80, 307-311.

Bibbins, A. B. 1926, Letter to Engineering and Mining Journal-Press, 3, 932.

Evans, G. L. 1941, Ector County unit, in final report covering the period from March 4, 1939, to Sept. 30, 1941, for the state-wide paleontologic-mineralogic survey in Texas, Austin, Texas Univ. Bur. Econ. Geology, 30-34.

Evans, G. L. 1961, Investigations at the Odessa meteor craters, Proc. Geophysical Lab./Lawrence Radiation Lab. Cratering Symposium, Washington, D. C., March 28-29, 1961: Univ. California, Livermore, Lawrence Radiation Lab. Rept. UCRL-6438, Pt. 1, Paper D.

Goel, P. S. 1962, Doctoral Dissertation-U. S. A. E. C., Report No. NYO-8922, Department of Chemistry, Carnegie Institute of Technology, P. 126.

Krinov, E. L. 1966 "Giant Meteorites" Pergamon Press, Ltd.

Merrill, G. P. 1922, Meteoritic iron from Odessa, Ector Co., Texas, Am. Jour. Sci., 5th Series, 3, 335-337.

Sanchez, J., and Cassidy, W. 1966, A previously undescribed meteorite crater in Chile, Journal of Geophysical Research, 71, 4891.

Sellards, E. H. 1927, Unusual structural features in the plains region of Texas (abs.), Bull. Geol. Soc. America, 38, 149.

——— 1940, Odessa meteor crater (abs.), Bull. Geol. Soc. America, 51, 1944.

——— 1941, Odessa Meteor craters (abs.), Bull. Geol. Soc. America, 52, 2007.

Sellards, E. H. and Barnes, V. E. 1940, Meteor crater of Ector County, Texas, Geol. Soc. America 53rd Ann. Mtg. Excursions, 129-130.

——— 1943, Progress in excavating the Odessa, Texas, meteorite crater (abs.), Pop. Astron., 51, 224-225, reprinted in Soc. Research on Meteorites Contr., 3, 83.

Sellards, E. H. and Evans, G. L. 1941, Statement of progress of investigation at Odessa meteor craters, Austin, Texas Univ. Bur. Econ. Geology.

Shoemaker, E. M. and Eggleton, R. E. 1961, Terrestrial features of impact origin, Proc. Geophysical Lab./Laurence Radiation Lab. Cratering Symposium, Washington, D. C., March 28-29, 1961. Univ. California, Livermore, Laurence Radiation Lab. Rept. U C R L 6438 Paper A.