

The Barringer crater

Key Assessment Task information sheet

1 The Barringer crater is in the desert in the USA. It is 175 metres deep and about a mile (1.6 km) across.

When the first scientists saw it, they thought it must have been formed by a volcano. But no volcanic rocks were found in the area.



2 By 1891, two possible explanations had been suggested:

- The crater was formed by an explosion of steam caused by a volcano underground.
- The crater was formed by the impact of a large meteorite from Space.

3 Grove K. Gilbert was the chief geologist for the US government. He visited the crater to consider which explanation was better.

There were lots of pieces of iron meteorites in the area. If the crater was caused by a meteorite, Gilbert thought that most of the meteorite would now be filling the bottom of the crater. So the volume of the hole would be smaller than the volume of rocks thrown out to make the rim of the crater. Gilbert estimated the volume of rim rocks and found that they would fit into the hole. So there seemed to be no room for a meteorite.

Gilbert also thought the iron would affect a magnetic compass needle, but he found no magnetic effects. He concluded that the steam explosion explanation was correct.

4 In 1902 Daniel Barringer, a successful mining engineer, heard about the crater and the pieces of iron meteorites. He thought that the crater was an impact crater and that a large iron meteorite would be buried in the centre. It could be mined for iron. He and a partner bought the mineral rights for the crater and began drilling in the centre of the crater but they did not find any iron.

5 In 1906 Daniel Barringer and his partner wrote scientific papers explaining that the crater was an impact crater. They published them in the *Proceedings of the Academy of Natural Sciences* in Philadelphia. Barringer gave presentations, including one to the National Academy of Sciences at Princeton.

These were some of the data they used to support the impact explanation:

- There are many meteorite pieces (rocks very different from Earth rocks) in the surrounding area.
- Around the crater are samples of rocks and minerals known to be created by a large pressure and temperature.
- In the rim, the rocks on top were oldest and those lower down were the newest – suggesting that they had all been thrown out in an explosion.

6 A geologist, George P. Merrill, was convinced by their explanation and he visited the crater. His investigations supported the impact crater theory. Grove K. Gilbert did not agree and did not take part in discussion. Daniel Barringer gave presentations, including one to the National Academy of Sciences at Princeton. Some scientists said they thought the impact crater idea was wrong. They thought that slow processes changed the surface of the Earth not sudden catastrophes. They were still not sure whether craters on the Moon were volcanic or impact craters and no other craters on Earth had been identified as impact craters. So there was no existing data for other craters to compare with the Barringer crater. Some scientists visited the crater and most of those scientists thought the impact crater explanation was correct.

7 Then George Merrill suggested that the iron meteorite had been vaporised in the explosion and that was why it had not been found. Daniel Barringer was unhappy with this explanation. He did not believe it and he continued drilling to find the iron. When he died in 1929 over \$600,000 had been spent. That was most of his money and that of the other investors.

8 Over the next 30 years many experienced scientists checked the data. The impact explanation was already accepted by most scientists when, in 1960, Eugene Shoemaker found rare minerals in the crater which cannot be formed by volcanoes. The only way to produce them is through an impact with an object like a meteorite, or by a nuclear explosion.