FINDING THE CRATER

THE DAY
THE MESOZOIC DIED
The asteroid impact left behind different types of evidence

- Drs. Alvarez, Smit, and colleagues proposed that a 10-km asteroid struck Earth 66 million years ago.

- The impact would have left behind a massive crater and a lot of other physical evidence.
The evidence is found in 66-million-year-old rock layers.

Signs of the impact can be found at the boundary between the Cretaceous and Tertiary periods (the K-T boundary)—the time of the asteroid impact.
The K-T boundary is rich in iridium

- Iridium is an element rare in Earth’s crust but relatively abundant in asteroids and comets.
- The K-T asteroid was vaporized on impact; fine particles of iridium traveled high into the atmosphere and were then distributed all over Earth.
Deposits at the K-T boundary hold other clues

Many K-T event deposits worldwide contain pieces of melted or crushed rocks that were blasted from the impact site, which are called *ejecta*.
Ejecta include spherules and tektites

- When the asteroid struck, some of the rock in Earth’s surrounding crust melted as it was ejected from the impact site.

- As these melted rock particles fell back to Earth and cooled, they formed glass-like objects called spherules and tektites.
Spherules are found in K-T sites worldwide

- **Spherules** are glassy spheres that range in size from less than 0.1 mm up to 2 mm.

- Spherules are found both close to and far from the asteroid impact site.
Tektites are closer to the impact site

- Tektites are 2 to 3 cm in size, are made entirely of glass, and have more irregular shapes than spherules.

- Tektites are typically found in K-T boundary deposits close to the asteroid impact site.
Some spherules contain nickel-rich spinels

- Nickel-rich spinels are a type of mineral formed by fusion and oxidation of asteroid material as the asteroid passed through Earth’s atmosphere.

- Nickel-rich spinels are found in K-T deposits worldwide.
Ejecta debris also includes shocked quartz

The extremely high pressure of an asteroid impact caused quartz grains at the impact site to shatter and fracture internally as they were blasted into the air.
The size of shocked quartz grains reveals distance from impact site

- Shocked quartz grains bigger than 0.5 mm are abundant in K-T deposits closer to the impact.

- Smaller grains (less than 100 microns in size) are found at other locations, and they are not as abundant.
Broken-up rock is found close to the impact site

- K-T event deposits very close to the impact site may contain large chunks of broken-up rock, called breccia.
- Breccia represents Earth crust that was crushed by the asteroid impact.
Tsunami deposits are also found close to the impact

- Some K-T event deposits also contain large rocks and boulders mixed with the ejecta.
- The rocks were carried there by giant waves generated by the force of the impact.
Deposit thickness varies depending on distance from the impact.

In general, K-T boundary locations closer to the impact site have thicker deposits than sites further away.
Evaluating the evidence

K-T event deposits are found at sites all over the world—at varying distances from the crater. Sites can be classified as:

<table>
<thead>
<tr>
<th>Close:</th>
<th>Intermediate:</th>
<th>Distant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposit thickness greater than 10 cm.</td>
<td>Deposit thickness 1 to 10 cm.</td>
<td>Deposit thickness less than 1 cm.</td>
</tr>
<tr>
<td>May contain breccia.</td>
<td>Does not contain breccia.</td>
<td>Does not contain breccia.</td>
</tr>
<tr>
<td>May contain spherules, tektites, large and small shocked quartz grains, Ni-rich spinels, and iridium.</td>
<td>May contain spherules, tektites, large and small shocked quartz grains, Ni-rich spinels, and iridium.</td>
<td>May contain spherules, small shocked quartz grains, Ni-rich spinels, and iridium.</td>
</tr>
</tbody>
</table>
Today’s activity...

- Today you will evaluate K-T event deposits at 10 different K-T sites.
- You will map each site and determine whether it is close to, an intermediate distance from, or distant from the impact site.
- You will then propose the general location for the impact crater.
- Write down the iridium concentration for each site, if available.
Credits

Developed by: Scott Wahlstrom, Wachusett Regional School District; Laura Bonetta, HHMI; Mark Nielsen, HHMI

Scientific review by: Jan Smit, VU University Amsterdam; PhilippeClaeys, VUB Brussels; Peter Schulte, Erlangen-Nürnberg University


Photos: Photos courtesy of PhilippeClaeys, VUB Brussels; Jan Smit, VU University Amsterdam; Frank Kyte, University of California, Los Angeles; Bruce Simonson, Oberlin College; United States Geological Survey (USGS); image of iridium courtesy of image-of-elements.com/iridium.php.