Asteroid Mississauga: A Teachers' Resource

Background info: What is an asteroid?

Think our solar system is just eight planets and a star? Think again. The place is littered with millions of chunks of rock and ice orbiting in a large, chaotic mess. Occasionally, one of these small objects collides with a larger one. Including, every once and a while, our own planet Earth.

That's one reason why we need to pay attention to these small things, but they are also interesting in their own right. Many remain unchanged since the solar system came together, older than our own planet. Others may be the leftovers of a failed planet or smashed-up moon. Still others are responsible for some spectacular celestial displays.

Whether a rocky asteroid, an icy comet or a tiny meteoroid, these micro neighbours of Earth have a lot to teach us.

The solar system's smaller citizens are organized into 3 categories: asteroids, comets and Asteroids are solid, rocky objects. Comets are similar in size, but contain a large amount of frozen gas and ices. Meteoroids are tiny and we only notice them when they collide with Earth and burn up in our atmosphere creating a meteor or shooting star.

Asteroids and comets are further categorized by their size and where they orbit.

- The Kuiper belt are comets orbiting beyond the orbit of Neptune.
- Trojan asteroids are caught in orbit near Jupiter.
- Apollo asteroids lead and follow Earth in its orbit around the Sun.

In 2004, David Levy found a small asteroid from his observatory in Arizona. As its discoverer, David Levy had the right to name it. Some Mississauga-based astronomers persuaded him to name it after Mississauga. So, in 2011, asteroid 2004 XY35 became Asteroid Mississauga!

We know a few things about Asteroid Mississauga. It is not very large and not very bright. It orbits once in just under 6 years between Mars and Jupiter and is not in an orbit that poses a threat to Earth. Asteroid Mississauga is one of more than a quarter of a million smaller objects now catalogued in our solar system.

Some asteroids and comets have been observed for hundreds of years, but many are still being discovered. It used to be every amateur astronomer's dream to find an asteroid or comet, and many still search for them, including Canadian David Levy.

With advances in technology, many asteroids are now discovered by automated telescope and satellites. These devices locate and track small objects that could come closer to our planet than we would like.

Asteroids and comets have collided with Earth in the past. In 2013, a piece of a comet weighing more than the Eiffel Tower collided with earth, entering our atmosphere over Chelyabinsk, Russia. It travelled at 19km/s, covering the distance from the CN Tower in Toronto to Port Credit in one second! The shockwave caused damage to the town and many injuries from smashed windows and shaken buildings.

Craters much larger than this leave pock marks all over our planet. You can see them quite easily from space in photos taken on the shuttle or space station. A catastrophic impact 65 million years ago not only created a massive crater, Chixchulub, off the coast of the Yucatan in Mexico, it also tossed tonnes and tonnes of the Earth's crust into the atmosphere, blocking the sunlight and lowering global temperatures. This created an unfavourable environment for the major dinosaurs of the Cretaceous period, many of which went extinct.

Lesson 1: Craters, Craters Everywhere!

As we send more and more cameras into orbit around our planet, we find more and more evidence of asteroid impacts. How do we find them? Impact craters share some features:

1. Impact craters are always round. An impacting object explodes and forces a large cloud of material out of the crater. It looks similar to what would happen if a bomb exploded.
2. Impact craters are often found in places where the Earth's surface is old. The Canadian Shield with rock that is billions of years old, has a lot of identified craters.
3. Impact craters can be connected with other geological phenomenon. One crater in eastern Canada created a unique landscape. Another left some interesting things behind in the ground.

What to do

Find the Earth Impact Database at:
www.passc.net/EarthImpactDatabase

Click on 'North America' at the top of the page for a map and a list of the craters in North America.

1. Looking at the map and without counting directly, estimate if there are more craters in Canada or the United States, if you think the numbers are about the same.

   _____
   _____
   _____

2. Think about what you know about the western United States and Canada (e.g. California, Washington State, Alaska and British Columbia) and guess where we do not see very many craters in these areas.

   _____
   _____
   _____

3. Locate the Barringer Crater from the list and click on it. In which US State is this crater located? Look at the photos of the crater. Describe it.

   _____
   _____
   _____

4. Go back to the list and locate a crater called Charlevoix. In which Canadian Province is this crater located? There are ground-based and satellite images of this crater. Can you identify the rim of the crater in the ground-based and satellite images of this crater?

   _____
   _____
   _____

5. Go back to the list and click on a crater called Sudbury. The space object that blasted out this crater was made of nickel and iron. Can you think of anything in Sudbury Ontario connected to one of these metals? (Hint: look for a famous landmark in Sudbury.)

   _____
   _____
   _____

Teacher's Guide Lesson 1: Craters, Craters Everywhere!

Ask students if they've ever seen a meteor streaking across the sky. Ask if they know what these are. (*Meteors are small bits of dust or rock that are hitting the Earth from space. They are moving so fast that they burn up in our atmosphere and do not often land on the ground. They are often confused with comets, but are often simply part of a comet that got left behind.)*

Ask students what might happen if a piece of rock large enough hit the Earth. Many will likely be familiar with the idea that the rock leaves a hole called a crater behind and that sometimes we can find pieces of that space-rock near the crater. These rocks are called meteorites.

Read through the 3 characteristics of craters with students. Then have them work through the 5 questions.

What to do

Find the Earth Impact Database at:
www.passc.net/EarthImpactDatabase

Click on 'North America' at the top of the page for a map and a list of the craters in North America.

1. *There are about the same number of impact craters discovered in the US as in Canada. Many in Canada's vast arctic would be covered and not visible.*

2. *The west coast of North America is geologically active. The actions of earthquakes and mountain building tends to erase evidence of impacts. Also, the bumpiness of the landscape makes them harder to identify.*

3. *Barringer Crater is in Arizona. It is very round. Some students may have visited it – it is a tourist attraction.*

4. *Charlevoix is in Quebec, near Baie St. Paul and not too far from Tadusac. Some may have been in the area. The rim and central uplifts are marked on the ground-based image. The central uplift is actually a well-known series of hills in the area called Les Eboulements. Charlevoix is also a geologically active area, in part, because of the impact site which is located on top of a point at which three geologic 'plates' join.*

5. *The Sudbury impact is thought to have delivered at least some of the nickel that is mined in the area to the ground. It may also have exposed existing nickel, making it easier to extract from the ground. The famous landmark is the Big Nickel.*

[More lessons coming soon! Please check back to earthshineastronomy.ca/programs often!]