Earth Science Teacher Guide: **About Accretion**

(Formation of the Earth, Learning Segment 04)

As you move into exploring the formation of Earth with your students, you will be engaging with (indirectly, and sometimes directly) the process of ***accretion*.** It might be easy to remember this term almost literally – *a creation* of the rocky members of our (or any) solar system. You and the students will be exploring this fundamental part of the formation of our planet in a variety of ways through this Formation of Earth unit. We thought it could be helpful to provide just a little background here about the underpinnings of the process.

If you've never read information about the formation of the *solar system* (for example the first portion of the Hazen book), now would be a good time to do so, if only to understand where the "pieces" we'll be discussing originate from.

You'll notice that the most critical stage of the formation of Earth is the moment when dust-sized particles of rocky material are drawn to each and literally smack into one another. The details about how and why these tiny particles are drawn together are still not entirely understood, though clearly some tiny gravitational and electromagnetic forces play a part. Regardless, astrophysicists all agree that some kind of initial attraction had to have occurred, and that it led to slightly bigger and bigger pieces forming. As the pieces grew in size, they more easily attracted matter and continued growing. Similar to the idea of a tree originating from a small seed, our planet "grew" through this accretion process over the course of millions of years (here's where time scale makes a big difference!).

After the class has been introduced to Barringer Crater and considers where such a feature might have come from, you may be wondering where "meteors" fit into the story. As mentioned in the Earth Science Teacher Guide: About Meteors, meteors are simply another word for space rocks. So, by that logic, the pieces we're talking about here could also be termed "meteors" once they reach a bigger size (that particular threshold isn't too relevant here but you are welcome to look it up if you're interested).

In Learning Segment 04, you will start exploring the concept of accretion directly through a lab where students will simulate impact craters in flour using frozen flour balls. While this doesn't exactly recreate the planetary accretion process, it illustrates the process through the conservation of mass in the "space rock + growing planet" system. In this way conservation of mass provides a mechanism for planetary growth. (Ensuing segments give students a chance to unpack their ideas around actual conservation of mass and energy in these high-speed impacts.)

Helpful videos (for you, and perhaps eventually for students – just be sure to refrain from stealing "aha" moments):

https://www.khanacademy.org/science/cosmology-and-astronomy/stellar-life-topic/stellar-life-death-tutorial/v/accreting-mass-due-to-gravity-simulation

https://www.youtube.com/watch?v=A4OQ3W3vJ0I&ab_channel=ArindamKumarChatterjee

Sources:

https://en.wikipedia.org/wiki/Accretion_(astrophysics)

Hazen, R. M. (2013). Chapter 1: Birth. *The Story of Earth: The first 4.5 billion years, from stardust to living planet*. Penguin.