# Evidence of a Catastrophic Event

Rocks in a small area near Jordan have something in common with the moon. In 1969, Apollo 11 astronauts collected samples that contained a titanium-rich mineral called Armalcolite. The mineral has since been found in a few places on Earth, including in the igneous rocks at Smoky Butte eight miles west of here. The magma that produced the igneous rock was hot enough to bake and harden the layers of sedimentary rock it intruded. The igneous rock and baked sediments are more resistant to erosion, resulting in formation of the butte.

The Fort Union Formation and the underlying Hell Creek Formation which is exposed to the south and west of Jordan, record important world-wide events that contributed to the extinction of the dinosaurs. About 75 million years ago the shallow sea that extended from the Arctic to the Gulf of Mexico, receded from this area. The western shoreline of the sea migrated eastward as mountains rose to the west, creating the coastal-plain dinosaur habitat of the Hell Creek Formation. Dinosaur fossils found in the formation include *Triceratops*, hadrosaurs called *Edmontosaurus*, the fierce *Tyrannosaurus rex*, and many others.

The top of the Hell Creek Formation includes a layer containing unusual amounts of iridium, an element more abundant in meteorites and asteroids than in terrestrial rocks. Quartz grains in this layer have a distinctive pattern of fractures that could only have come from tremendous shock waves, the kind that a major impact to the earth can produce. Dinosaur fossils are found below this layer in the Hell Creek Formation, but not above it in the Fort Union Formation. Some scientists think that the dinosaur extinction may have been caused by a large extraterrestrial object that crashed into what is now the Yucatan Peninsula of Mexico. The impact engulfed the earth in a massive shroud of dust and debris that blackened the skies, produced widespread fires, and perhaps increased volcanic activity.

*Asteroid and Tylosaur, illustration by Doug Henderson.*

*Smoky Butte is located on private property and is not accessible to the public. Photograph by Kristi Hager.*

*Buzz Aldrin on the Moon, NASA Collection.*

## Geo-Facts:

- The Fort Union Formation covers most of eastern Montana and was deposited not long after the dinosaur extinction, about 65 million years ago. It consists mostly of thick deposits of sand, silt, and clay that cemented and compacted into sandstone, siltstone, and mudstone.
- The asteroid that struck the earth about 65 million years ago was about six miles in diameter or about the size of the island of Manhattan.
- Armalcolite is named for astronauts Neil Armstrong, Buzz ALdrin, and Mike Collins.

## Geo-Activity:

- Geologists use layers of rock as a way to go back in time and look for clues from fossils and rocks about what the earth was like in the past. The layers of rock tell a story about how the earth formed and contain evidence of past events that shaped the planet. Imagine what happened here 65 million years ago after the asteroid or meteorite struck the earth. What kinds of things would you look for in the rocks that would provide evidence of that event?