COLORADO SCHOOL OF MINES

GEOLOGY MUSEUM

LESSONS FROM THE MINES GEOLOGY TRAIL

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For more than 100 years the classic geology of the Golden area has been used to educate students about the earth's systems. The Mines Geology Trail crosses some of the rocks which record a unique period in the history of Colorado—the time when mountains rose out of the Cretaceous seaway 69 to 66 million years ago. Stops along the Trail to study the rocks teach us invaluable lessons in earth history.

Start the Trail at the Museum (Stop 1), and walk 200 feet south along Maple St. Turn west and go 600 feet on Campus Drive to Stop 2. Follow the signs from Stops 2 to 5 to see dinosaur tracks, logs and leaf imprints, economic products, the Rock Garden, and the geology of the Golden area.

STOP 1. GEOLOGY MUSEUM

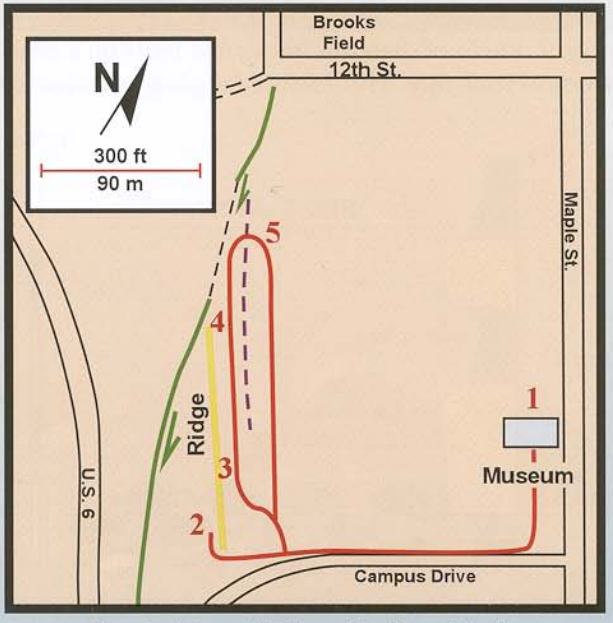

Fig. 1. Map of Mines Geology Trail.

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Computer graphics by Linda G. Martin.

STOP 2. FOSSIL LOCALITY

This steep sandstone face has dinosaur tracks and trampled trails (the bulges), and leaf fragments of plants and palm trees (Figs. 2 and 3).

Could the dinosaurs have walked up such a steep slope? No!! The track impressions were made in a horizontal mud layer that were filled in as sand casts, and later tilted to steep dip by uplift of the Front Range.

A column of sandstone and clay layers, exposed at Stops 2 and 3, is drawn in Fig. 3.

Lesson: The dipping beds were once horizontal!

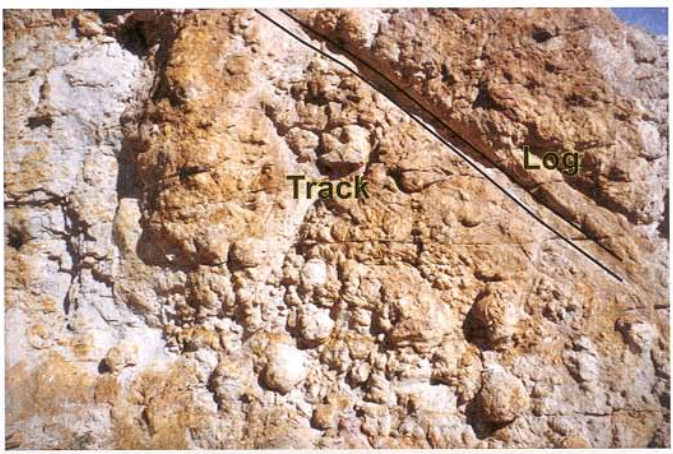


Fig. 2. Photo of dinosaur tracks and trails on a near vertical rock face with 25-foot long log as reference.

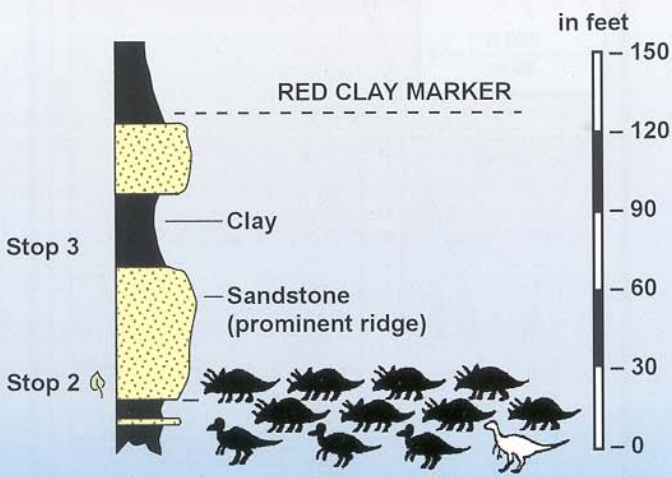


Fig. 3. Estimated number of ceratopsian (Triceratops), theropod (ostrich-like) and hadrosaur (duckbill) track-ways on base of sandstone (from Lockley and Hunt, 1995). Each silhouette equals one individual.

STOP 3. MINED CLAY AND ENVIRONMENTS

The red and gray claystone and sandstone at this stop are typical of those mined by the Parfet family starting in 1877, to make bricks and tiles for building construction (Fig. 3). Coal was mined from a 6- to 8-foot thick seam along 12th St. about 800 feet to the north. The mine was flooded accidentally in 1889 at a depth of 700 feet, and the 10 trapped miners were never rescued (Fig. 5).

Can you find the 12-foot long log in the rocks that is broken by small faults and fractures?

What were the environments where the dinosaurs lived 68 million years ago? Using the fossils and the rock types to reconstruct the habitat, they lived on land and left tracks on the margin of a river channel (Fig. 4). A food supply was available from swamps, and fresh water came from small channels that broke through the levee on the margin of the main channel.

Lesson: Fossils and coal are used to interpret the ancient environments in which rocks were deposited and how economic products formed.

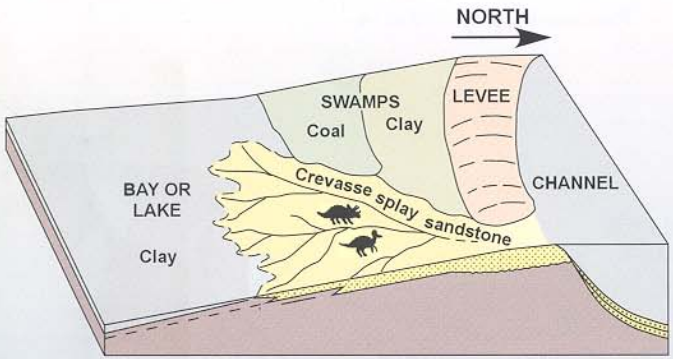


Fig. 4. Ancient landscape of dinosaurs.

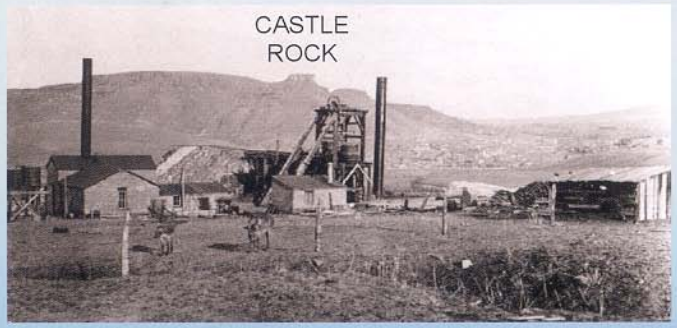


Fig. 5. Photo of White Ash Coal Mine buildings located along 12th St. (abandoned long ago).

STOP 4. END OF RIDGE

As you walk north to Stop 4, the prominent sandstone ridge ends abruptly because it is cut off by the Clay Pits Fault. The resistant sandstone of the Laramie Formation is placed in fault contact with non-resistant marine shale of the Pierre Formation (Fig. 6), now largely covered by the parking lot surface. The fault trace curves around the west side of the ridge.

Lesson: Beds extend laterally until they reach a fault or pinch out.

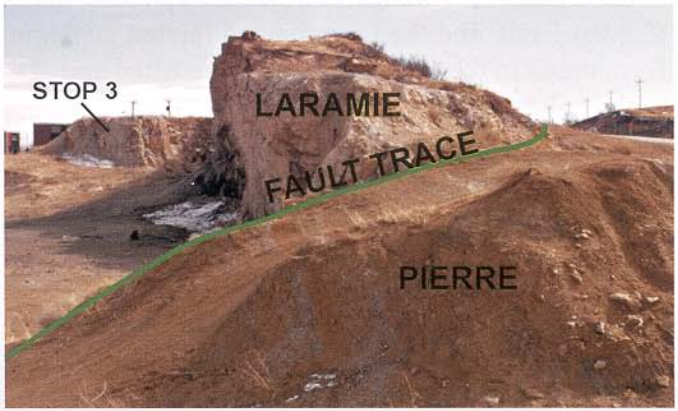
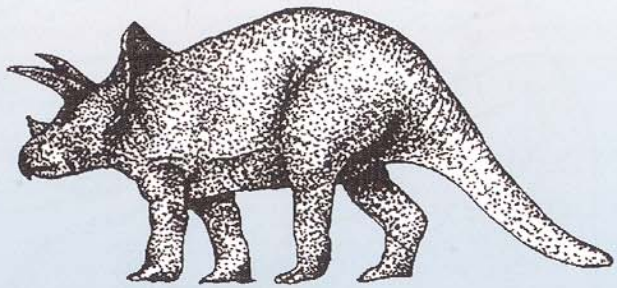


Fig. 9. Photo of Clay Pits Fault looking south.



Triceratops

STOP 5. OVERVIEW OF GOLDEN AREA AND ROCK GARDEN

From this overview of the Golden area, many important geologic features can be observed that are located on Fig. 7 by the letters A, B, C, and D. The mountains and valleys are caused by the erosion of different rock types as the land surface was lowered through time.

A—Looking north, the weathering nature of the 3 main classes of rocks shapes the terrain. Hard metamorphic rocks hold up the Front Range to the west; hard igneous rocks (lava flows) of the Denver Basin cap the Table Mountains to the east; and the intervening valley is formed in softer sedimentary rocks.

B—The Front Range was pushed up along the Golden Fault, and the Laramie and related geologic formations in the CSM clay pits were tilted and also faulted about 64 million years ago.

C—The disappearance of the dinosaurs is thought to have been caused by an asteroid impact in Mexico about 65 million years ago. South Table Mountain is one of the first areas where dinosaur bones were identified within the Cretaceous (K) Period, whereas overlying mammal bones were identified within the Tertiary (T) Period (Brown, 1943). This K/T boundary was found about 180 feet below the lava flow cap rock that is dated as 64 million years ago (Fig. 7).

ROCK GARDEN

D—In the Rock Garden, rock samples typical of the geologic formations in the north Golden area are aligned according to their age: the oldest Precambrian rocks are to the west; the Paleozoic and Mesozoic are in the middle; and the Cenozoic lava flows of the Table Mountains are to the east. Each formation has a distinct rock type(s) and is given a name taken from the geographic locality where it was first described.

Lesson: The Golden area illustrates many geologic features that are typical of uplift mountains observed throughout the world.

RETRACE TRAIL TO THE MUSEUM

References:
Weimer, R.J., 1966, Colo. Geological Survey Bulletin 51.
Brown, 1943, Geol. Soc. of America Bulletin, v. 54, p. 65.
Lockley, M.G., and Hunt, A.P., 1995, Journal of Vertebrate Paleontology, p. 592-614.

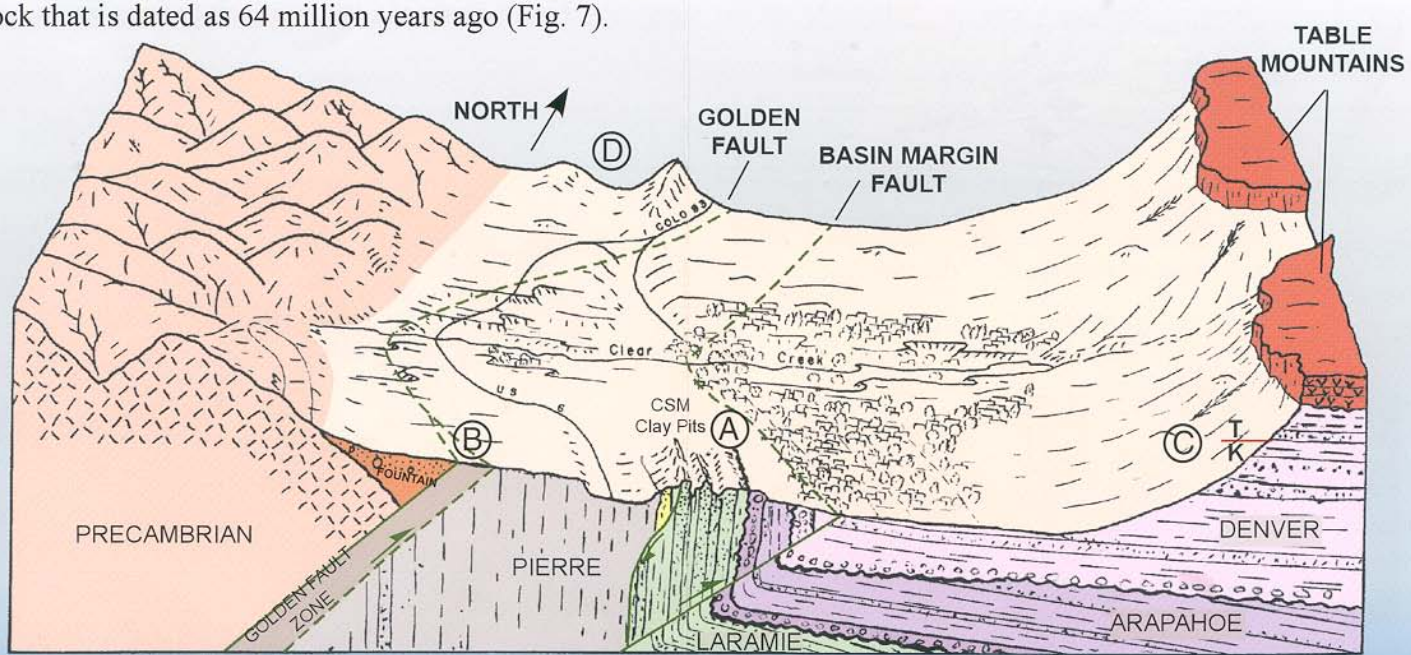


Fig. 7. Sketch and cross section of Golden Area formations and faults (after F. E. Moore).