TIPPET RISE
ART CENTER

GEOLOGY & LANDSCAPE

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Y B R A
1936

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Summary

Tippet Rise sits uniquely in the Northern Rocky Mountains, at a junction between mountains and plains, where rocks spanning much of Earth's history are exposed. Vistas to the south provide a glimpse into the deepest geological time. The majestic Beartooth Mountains are composed of some of the oldest rocks on the planet. A transition zone along the edge of the Beartooth Mountains contains an early record of marine life on the planet in the upturned limestone palisade “fins”.

"Middle-aged" rocks of the Great Plains underlie Tippet Rise and record meandering streams that deposited sand and mud along the coastline of an ancient seaway, explosive volcanic eruptions that buried a forested landscape, and the extinction of dinosaurs by a global catastrophe. Most recently, Tippet Rise was partly covered by gravels eroded from the rising Beartooth Mountains by streams and mountain glaciers, and modern stream alluvium.

As you traverse Tippet Rise you can learn to read the geologic history like pages of a book. Enjoy the inspirational beauty of this unique natural setting!

Ice Age Gravel Deposit

Gravel deposits composed of pebbles that were eroded off of the Beartooth Mountains and transported down to the plains, dated as Pleistocene, the time of the Ice Age, blanket the surface in a few places at Tippet Rise. Additional young surficial deposits include river-floodplain terraces, small landslides and other gravity deposits.

The Hell Creek Formation

The northeast corner of the Tippet Rise property is underlain by one of the most prolific and well-known dinosaur-bearing formations in the world. The Hell Creek Formation of eastern Montana bears fossils of dinosaurs such as the *Tyrannosaurus, Triceratios, and Ankylosaurus*. Dinosaur fossils have not yet been found at Tippet Rise. This formation is capped by the K-Pg (formerly known as the K-T) impactite layer, which marks the Cretaceous–Paleogene extinction event that led to the final and catastrophic demise of the dinosaurs 66 million years ago.

The Sliderock Mountain Formation

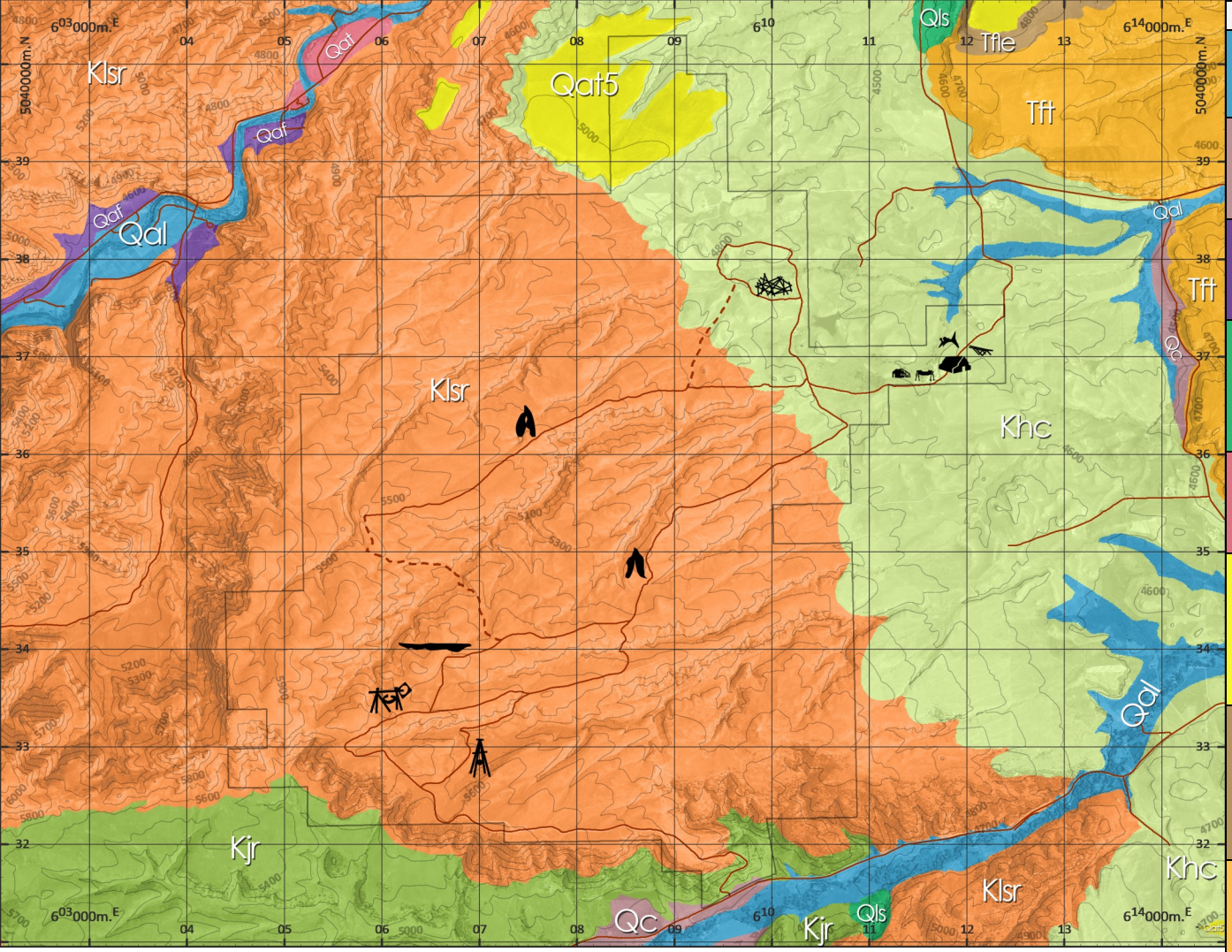
This formation contains volcanic breccias, lava flows, and volcaniclastic sediment that formed during eruptions of the Sliderock Mountain stratovolcano near Big Timber, Montana during the Late Cretaceous 78—75 million years ago. These volcanic deposits, akin to those in the modern Andes, formed when the oceanic Farallon Plate was subducting beneath North America. Sliderock Mountain and related geological features form a vast volcanic arc that has been modified by younger geological events. The resistant Sliderock Mountain layers put the “rise” in Tippet Rise.

The Judith River Formation

In the U.S., geological formations are named for places. Judith River was named by William Clark of Lewis and Clark fame in 1805. The Judith River Formation outcrops in the southwestern portion of Tippet Rise. This unit records deposition along the shoreline of a vast interior shallow seaway that stretched from the Gulf of Mexico to the Arctic. Some key dinosaur fossil finds have been made in the Judith River Formation in eastern Montana.

The Beartooth Mountains

The proximity to the Beartooth Mountains makes for spectacular vistas from Tippet Rise. The Beartooth Mountains are composed of Archean rocks (> 2.5 billion years old) that were pushed up during Laramide mountain building 75—55 million years ago. A distinctive transitional zone with upturned Paleozoic limestone ridges—the palisades— separate the Beartooth Mountain block from the Great Plains.



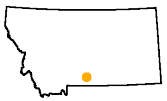
SCALE 1:45,000
CONTOUR INTERVAL 100 FEET

Kilometers

0 0.5 1 2 3 4

0 0.5 1 2 3 4

NORTH



Tippet Rise

Roads

Trails

Art

Coordinate System: WGS 1984 UTM Zone 12N | Projection: Transverse Mercator | Datum: WGS 1984 | Units: Meter

Satellite and DEM Data obtained from the United States Geological Survey, Geology data obtained from the Montana Bureau of Mines and Geology

Would you like to learn more?

Check with the visitor's center for the complete guide to the Geology of Tippet Rise.

Unit	Name	Age	Description
Qal	Alluvium of modern channels	Holocene (0—0.01 Ma)	Gravel, sand, silt, and clay along active stream channels.
Qc	Colluvium	Holocene—Pleistocene (0—2.6 Ma)	Slope-wash deposits mainly of sand, silt, and clay. Contains well-rounded cobbles derived from alluvial terrace gravel. May also contain glacial lake deposits behind end moraines.
Qaf	Alluvial fan deposit	Holocene—Pleistocene (0—2.6 Ma)	Gravel, sand, silt, and clay deposited in fans being formed by modern streams along major valley margins. Display characteristic fan-shaped map pattern and convex upward profile.
Qls	Landslide deposit	Holocene—Pleistocene (0—2.6 Ma)	Unconsolidated mixture of soil and blocks of bedrock transported down steep slopes by mass wasting. Characteristic hummocky surface with concentric swales and ridges near downslope limits.
Qat	Alluvium of alluvial terrace deposits	Holocene—Pleistocene (0—2.6 Ma)	Gravel, sand, silt, and clay underlying terraces about 20 to about 600 ft (6-185 m) above present altitude of modern streams and rivers. Equivalent to Qat1-Qat5.
Qat 5	Alluvium of oldest (highest) alluvial terrace level	Pleistocene (0.01—2.6 Ma)	Gravel underlying terraces 400 to 600 ft (120-185 m) above present altitude of rivers. Occur mainly as small discontinuous erosional remnants. Cobble- and pebble-size clasts are mainly granite, granitic gneiss, schist, and quartzite. Calcite cement, especially at base.
Tfle	Lebo member of Fort Union Formation	Paleocene (56—66 Ma)	Predominantly dark gray to olive shale, and thin, interbedded, yellowish-gray sandstones and siltstone, locally includes yellowish-gray claystone. Typically forms smooth grassy slopes below the Tongue River Member. Thickness 200 to 500 ft (60-150 m).
Tft	Tullock Member of Fort Union Formation	Paleocene (56—66 Ma)	Yellowish-gray, fine- to medium-grained, ledge-forming sandstone, cross-bedded in part. Interbedded with gray to greenish-gray claystone, siltstone, and minor carbonaceous shale. Supports growths of pine trees.
K-Pg Extinction Event Horizon			
Khc	Hell Creek Formation	Late Cretaceous (66—100.5 Ma)	Interbedded light-brownish-gray, cliff- and ledge-forming, fine-grained, thin- to thick-bedded sandstone, and gray, pale-greenish-gray and pale-purple-gray mudstones. Sandstone beds support growths of pine trees.
Klsr	Sliderock Mountain formation, member of Livingston	Late Cretaceous (66—100.5 Ma)	Includes all the volcanic rocks erupted from the Sliderock stratovolcano. Mostly andesite breccia (lahars) gray, pale purple gray, pale greenish gray. Andesite in clasts is porphyritic with phenocrysts of chalky plagioclase, hornblende, and pyroxene.
Kjr	Judith River Formation	Late Cretaceous (75—80 Ma)	Interbedded brownish-gray sandy shale and light-brown to pale-yellowish-brown, argillaceous, very -fine- to fine-grained lenticular sandstone in beds as much as 10 ft (3 m) thick. Sandstones friable to moderately well indurated, cross-bedded, and support growths of pine trees.