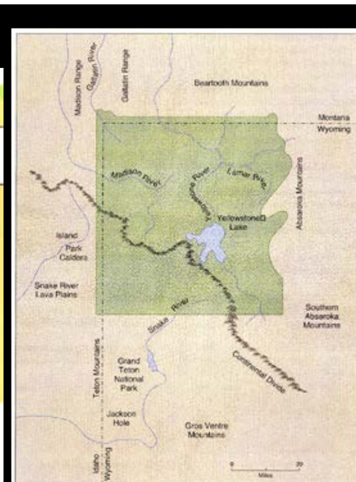
Yellowstone National Park

- est. 1872 (oldest NP in the world)

1


MONTANA
Beaverhead National Forest
Red Rock Lakes N.W.R.
Targhee National Forest
Island Park Geothermal Area
Yellowstone National Park
Yellowstone Lake
North Absaroka Wilderness
Shoshone National Forest
WYOMING
John D. Rockefeller, Jr. Memorial Parkway
Teton Wilderness
Jackson Lake
Camas N.W.R.
IDAHO
Grand Teton National Park
Washakie Wilderness
Targhee National Forest
National Elk Refuge
Jackson
Wind River Indian Reservation
Caribou National Forest
Bridger-Teton National Forest
Snake River
Shoshone River


Beartooth Mountains
Montana
Wyoming
Yellowstone Lake
Absaroka Mountains
Island Park Caldera
Snake River Lava Plains
Snake River
Southern Absaroka Mountains
Grand Teton National Park
Continental Divide
Teton Mountains
Jackson Hole
Gros Ventre Mountains
Idaho
Wyoming

Yellowstone NP

continental divide - separates drainages that flow into the Atlantic from drainages that flow into the Pacific

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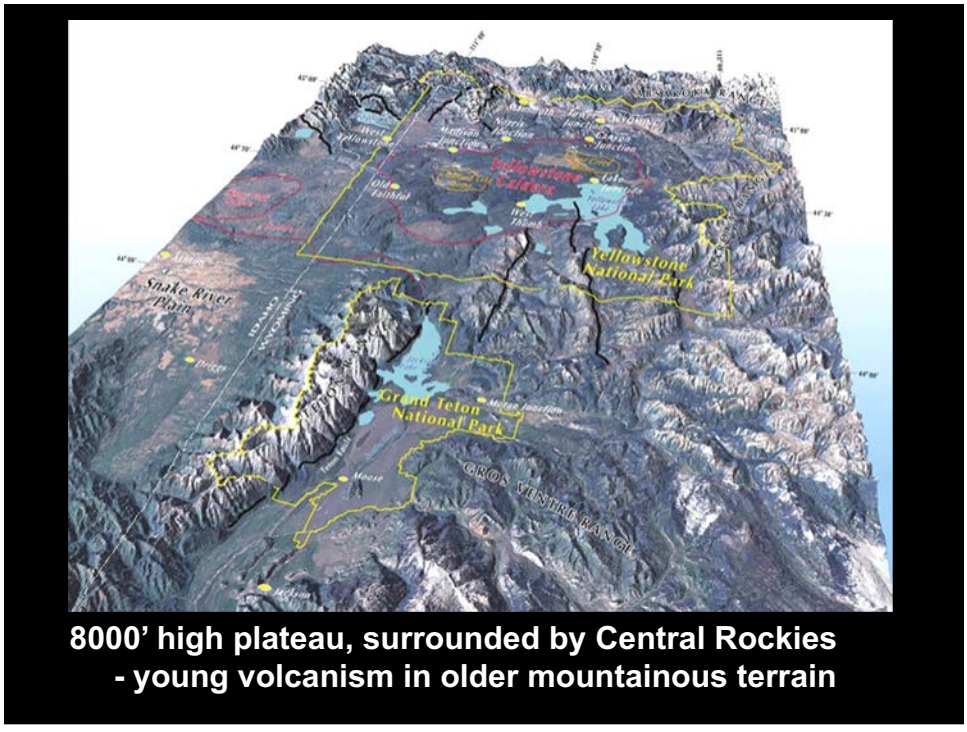

8000’ high plateau, surrounded by Central Rockies
- young volcanism in older mountainous terrain

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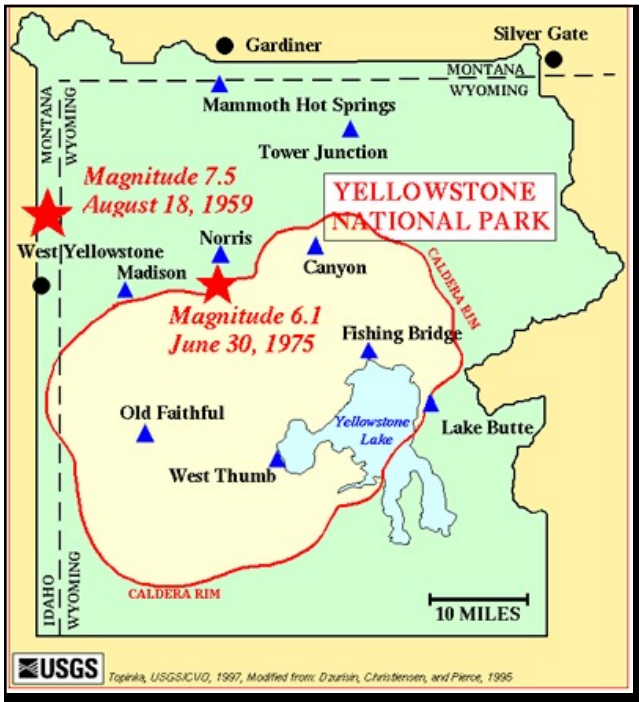

Yellowstone "supervolcano"

30x45 mile caldera

- **active & capable of mega-eruption**
- **past eruptions were orders of magnitude larger than any volcano in historic times**
- **capable of changing climate**

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Sequence of events related to the caldera eruptions at Yellowstone

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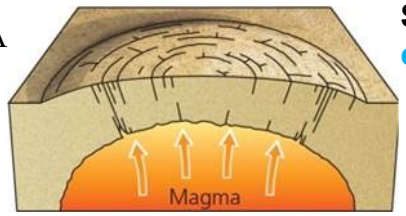
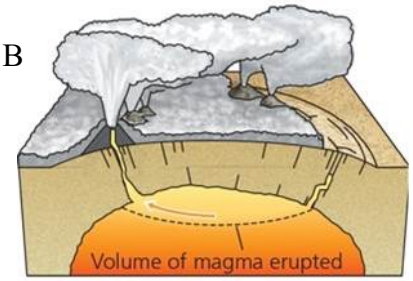


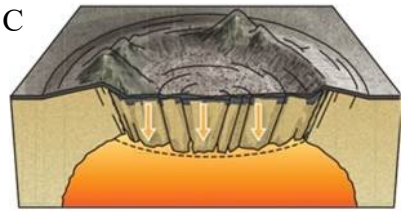
Swelling magma chamber arches and fractures overlying rocks

B



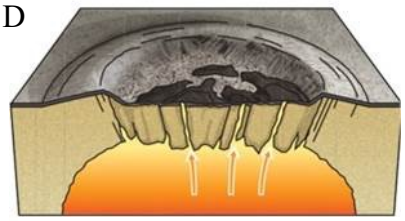
Gas-charged magma rises through ring fractures as massive pyroclastic eruptions

C



Crust collapses into partially emptied magma chamber

D



Later lava flows erupt onto floor of the caldera

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northwest rim of Yellowstone caldera
- caldera created by an eruption 630,000 years ago

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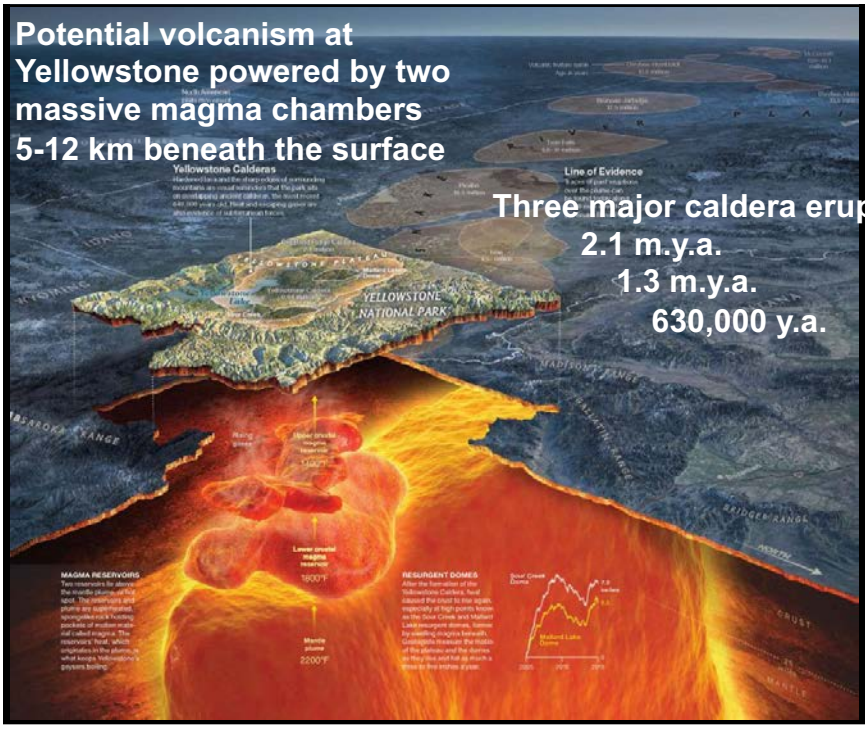
Potential volcanism at Yellowstone powered by two massive magma chambers 5-12 km beneath the surface



Three major caldera eruptions
2.1 m.y.a.
1.3 m.y.a.
630,000 y.a.

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Pyroclastic eruption - ash, rock fragments, gases - when ash settles out it forms a rock called tuff

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Pyroclastic ash-fall tuff, pyroclastic ash-flow tuff, & lava flows

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Yellow ‘stone’ is geologically young volcanic rock (tuff & lava flows)

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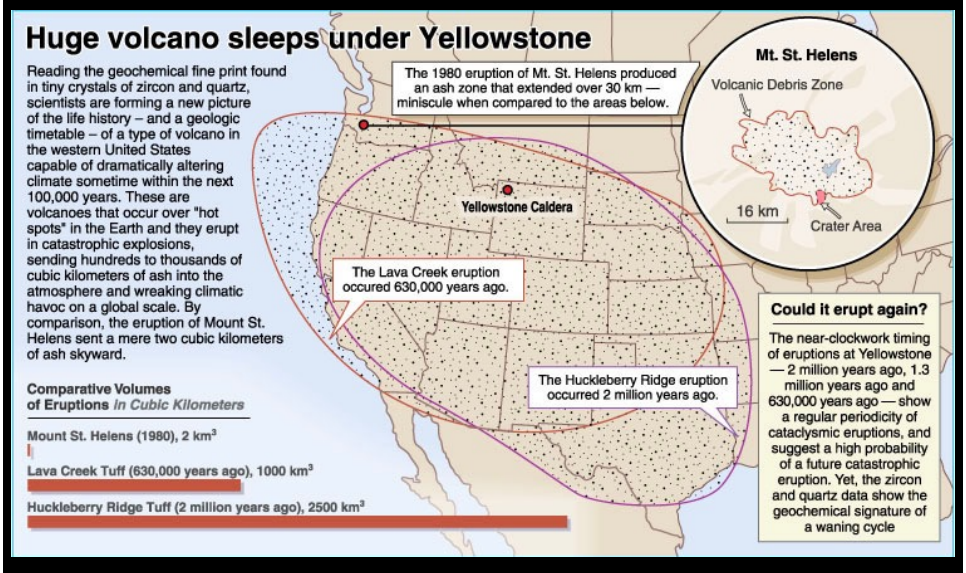

Ash distribution from Yellowstone eruptions

Lava Creek tuff - up to 1600’ thick
Huckleberry Ridge ash 2’ thick across West

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Ice Age bison, smothered by Yellowstone ash

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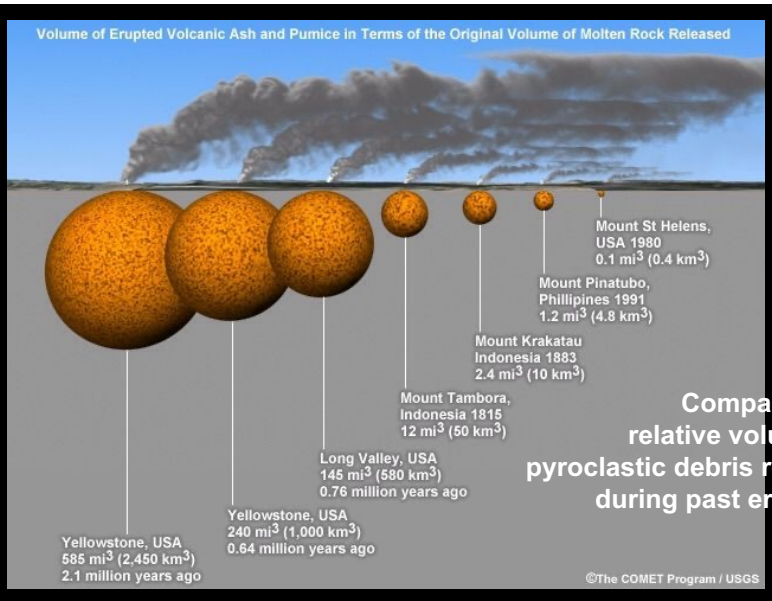

Comparison of relative volumes of pyroclastic debris released during past eruptions

Other than an asteroid or comet impact, a caldera eruption is the most cataclysmic event that can happen to a planet (fortunately, they are rare)

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Future eruptions at Yellowstone?

Very unlikely that humans living today will witness an eruption, but it's inevitable that Yellowstone will erupt sometime in the future.

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Hydrothermal activity at Yellowstone

Norris Geyser Basin - a dense cluster of geysers, milky blue hot springs, steam vents, and a widespread surface crust of white silica and orange bacterial mats.

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Heat flow **- the amount of heat emanating from the surface**

Yellowstone heat flow 30x rest of North America

Hydrothermal features: geysers & hot springs

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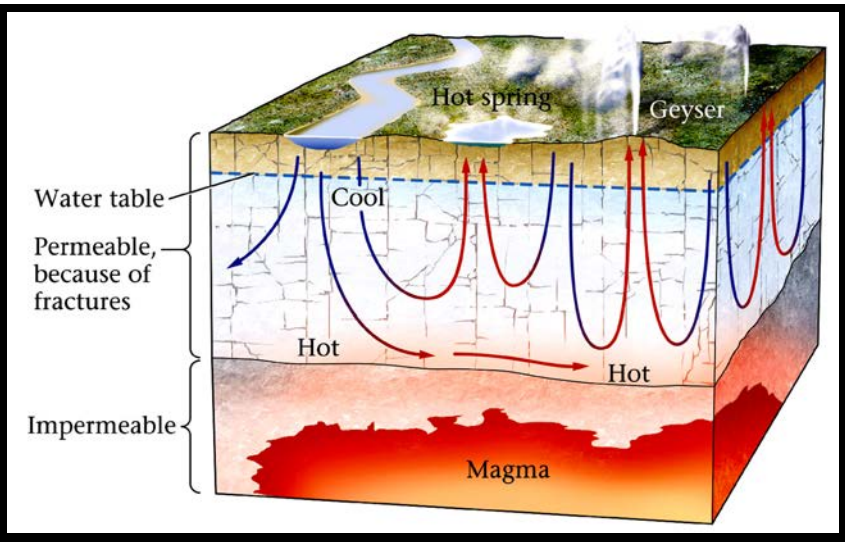

hydrothermal requirements:
- ***powerful heat source***
- ***plentiful supply of water***
- ***natural 'plumbing' system of joints & faults***

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Old Faithful geyser

geysers are intermittent jets of hot water and steam that regularly or irregularly erupt

Old Faithful - plume of hot water and steam that reaches 130’ in elevation - 4 minutes on, 70 minutes off

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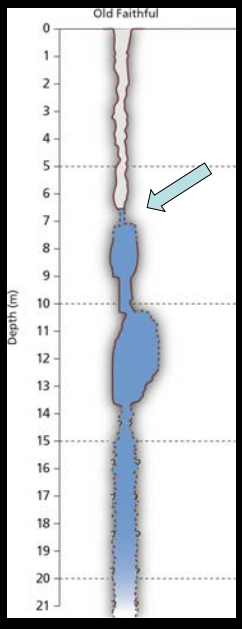
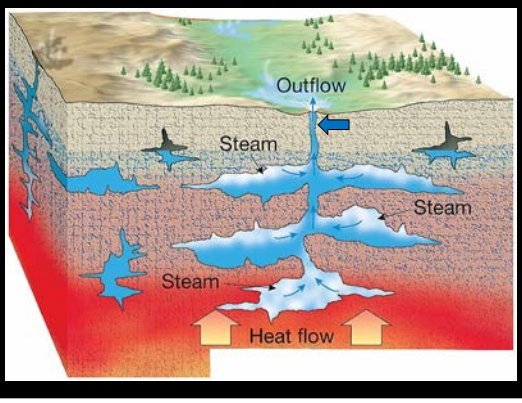


How Old Faithful geyser works

- **narrow constriction ~23 ft deep backs up water flow, building pressure**
- **steam is created in the superheated water below the constriction, eventually pushing through the back-up and jetting upward**



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Grand Prismatic Pool, Yellowstone NP, 200' across

hot springs – pools of permanent hot water fed by a continuous supply from below. Temps range from body temp to near-boiling.

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Heart Spring – the white silica (SiO_2) crust surrounding hot springs and geysers is called **sinter**, deposited from hot water enriched in dissolved silica.

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sinter crusts – SiO_2

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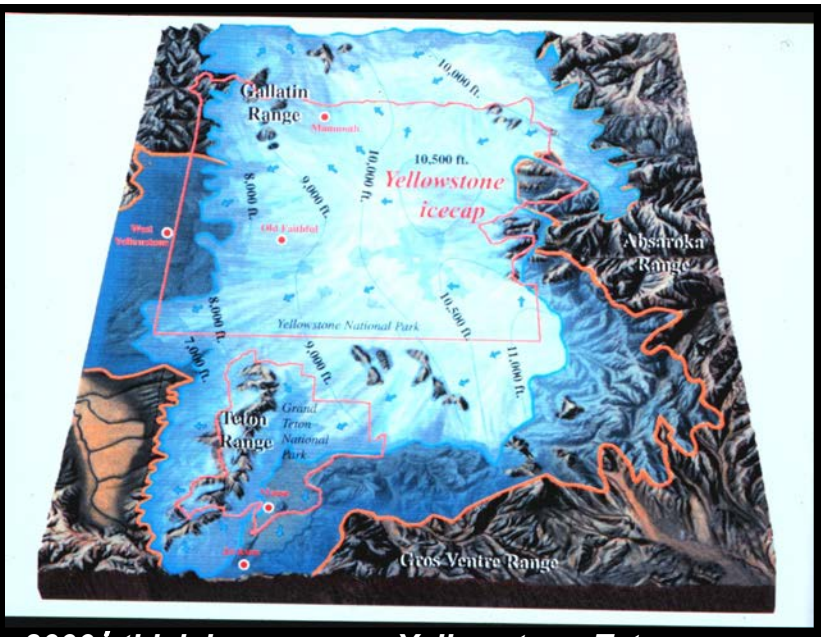

3000’ thick ice cap over Yellowstone-Teton area during Last Glacial Maximum ~20,000 yrs ago

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Glacially carved mountains in Yellowstone - horns

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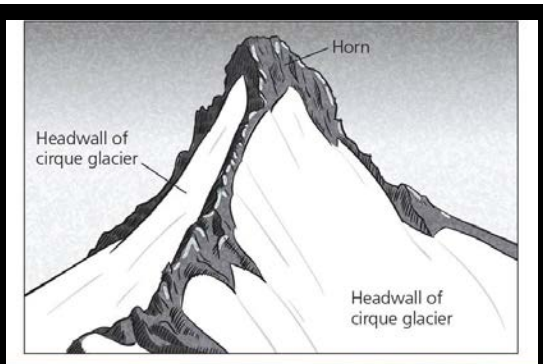

horn – pyramidal peak formed by glacial plucking where the cirques of three glaciers meet

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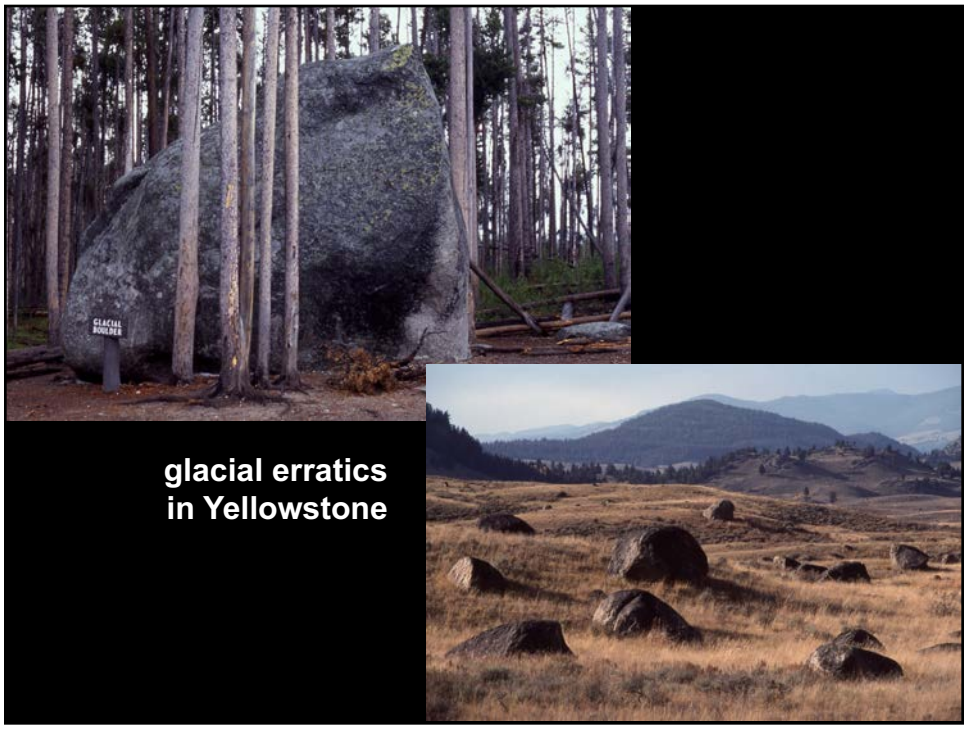
GLACIAL BOULDER
glacial erratics in Yellowstone

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Grand Canyon of the Yellowstone River
Post-glacial incision of river canyons by ice-melt runoff

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Post-glacial incision of river canyons on the Colorado Plateau by ice-melt runoff during phases of interglacial warming

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