FROM NEOPROTEROZOIC ‘PRE-CURSOR’ CLAMS TO THE KLAMATHS: DOCUMENTING THE PALEOGEOGRAPHIC EVOLUTION OF THE EASTERN KLAMATH TERRANES, AN EDUCATION OUTREACH MODEL

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Session No. 184

T76. Geocorps™ America and Mosaics in Science Programs: Successful Partnerships Promoting Individual Professional Development and Application of Geoscience and Related Fields to Management of America’s Public Lands

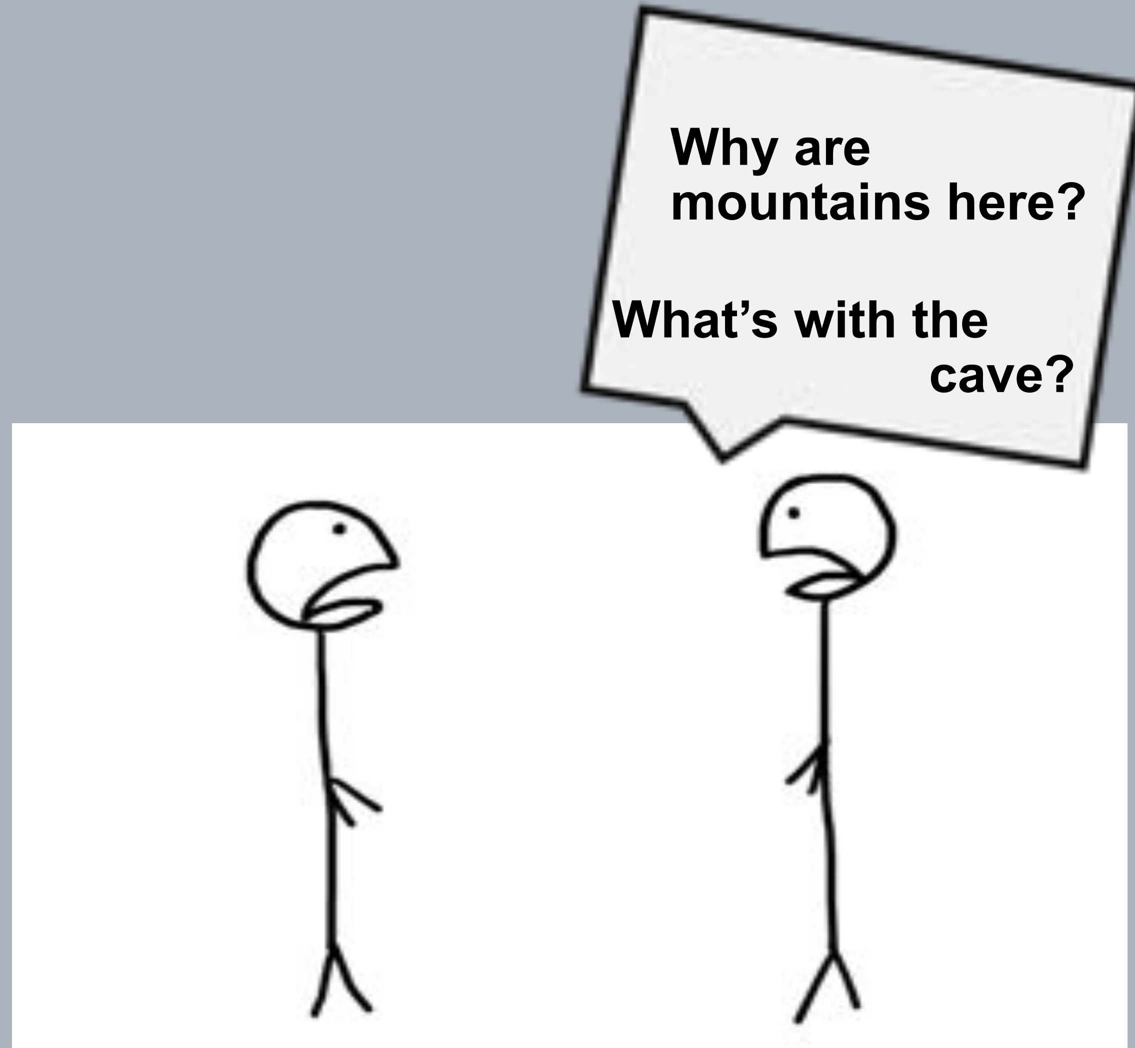
Tuesday, 3 November 2015: 8:00 AM- 12:00 PM.

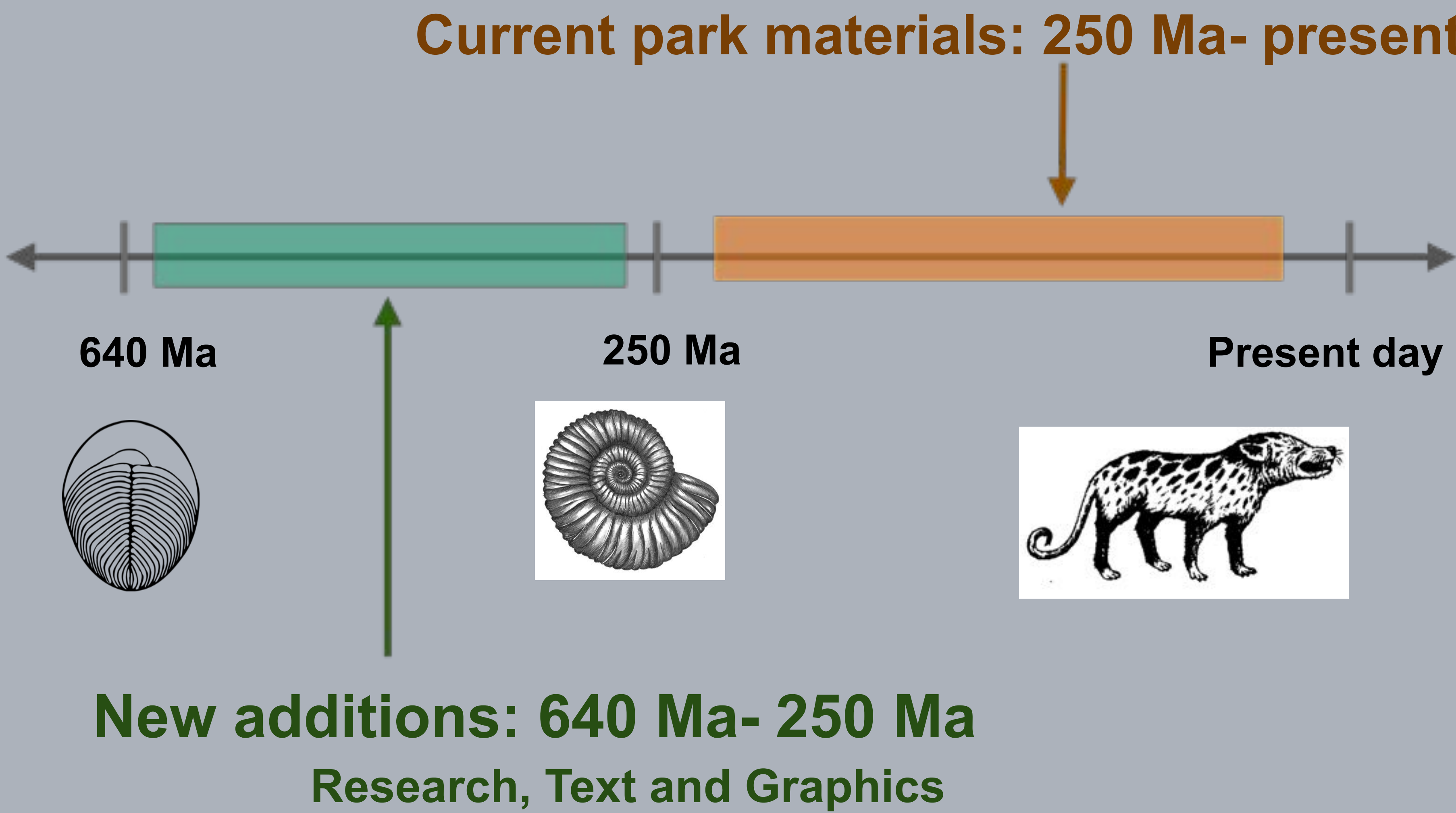
GeoCorps Project 2014-2015
Public Education Outreach: Geologic History of the park and surrounding region


Field Experience


Oregon Caves National
Monument receives ~75,000
visitors annually.

Outreach goal: **describe the geologic history** in a text **accessible to a public audience**





GeoCorps assignment Fall 2014-Spring 2015
Oregon Caves National Monument

Overview map highlighting the geographic relationship between the Klamth, Sierra Nevada and Blue Mountains. Adapted from King (1967, 1970) by Snoke and Barnes et al., GSA Special Papers 2006, v. 410, p. 1-29.
Modified by Gina Roberti, 2015.

Where is Oregon Caves located?

The Klamaths a microcosm for understanding the geologic history of the entire Western Cordillera.

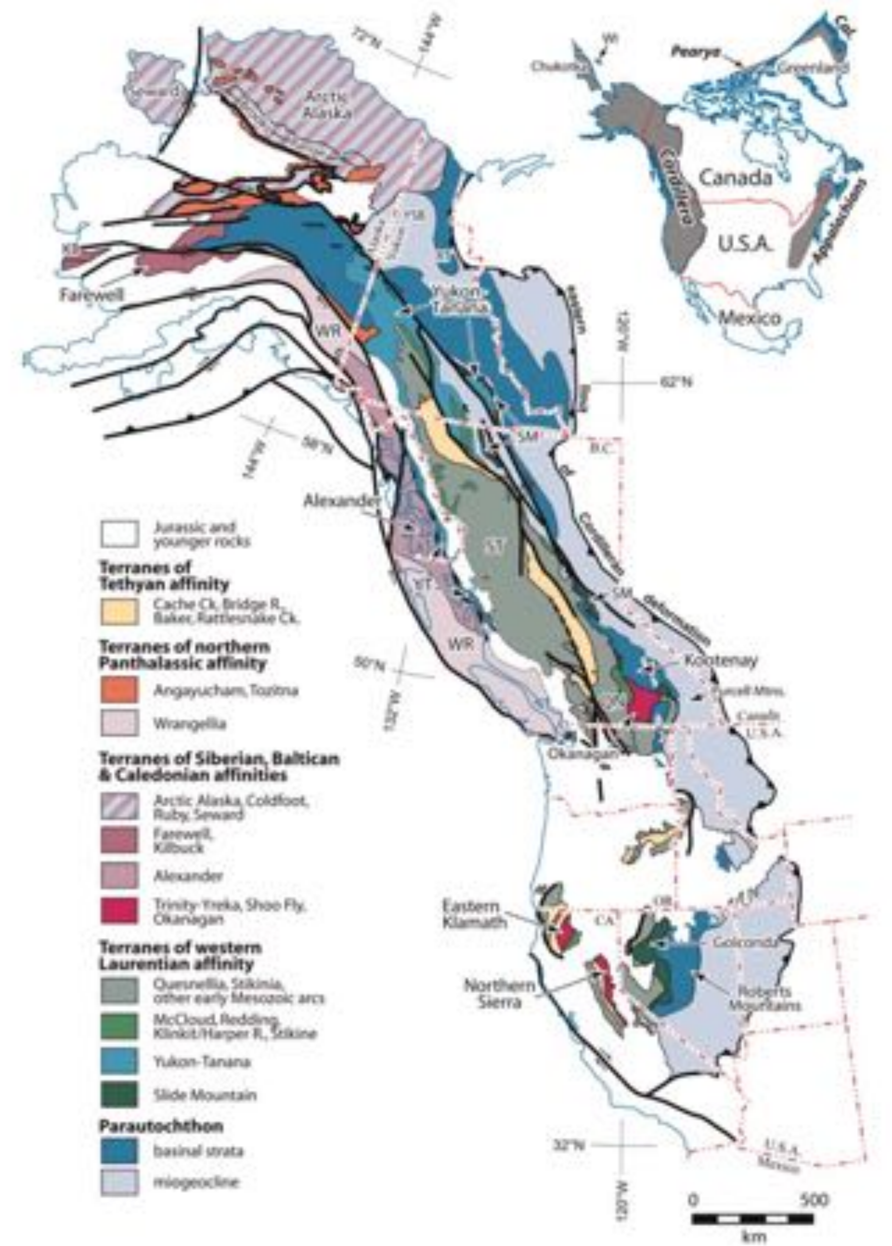
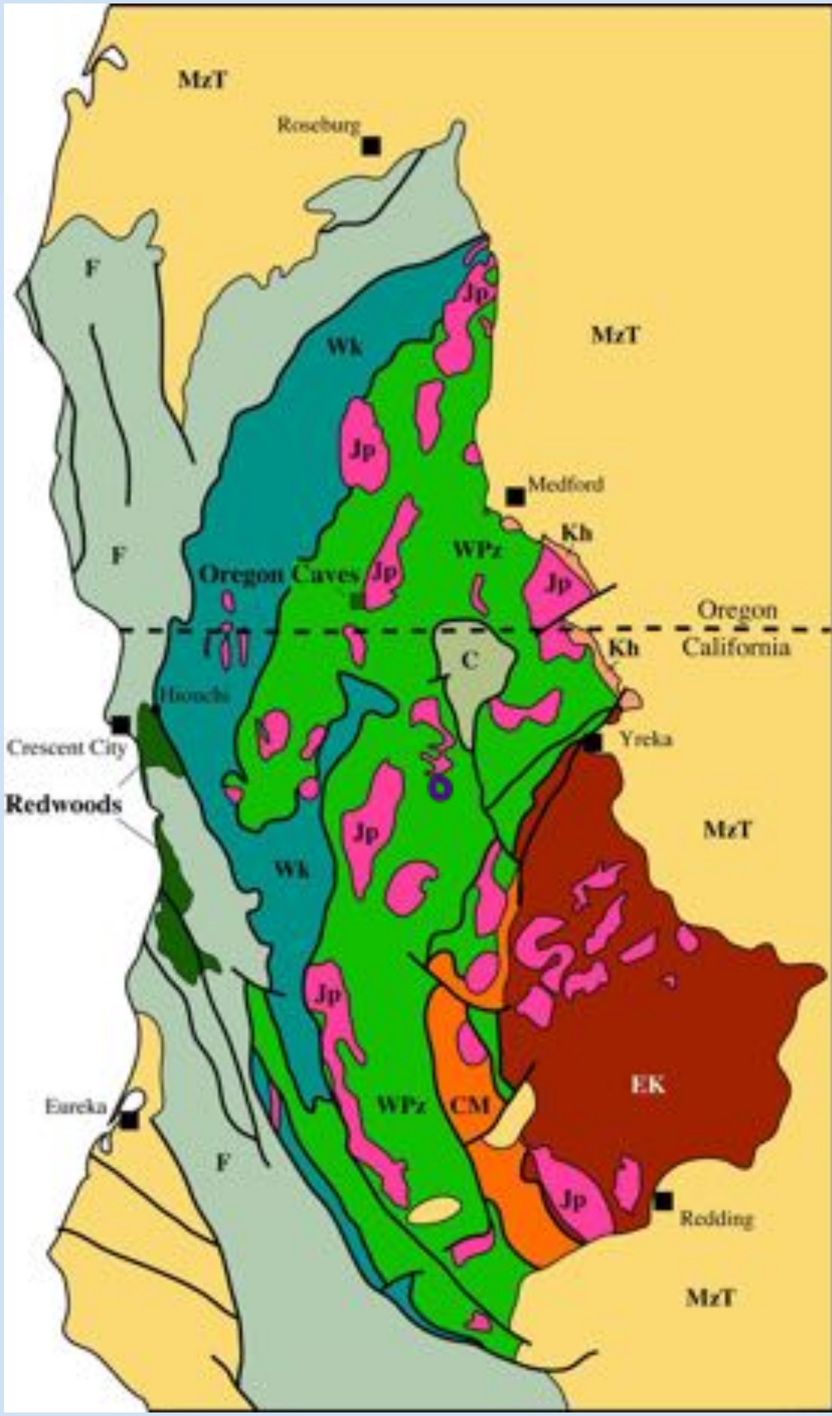


Fig. 1. Palaeozoic to early Mesozoic terranes of the North American Cordillera. Terranes are grouped according to faunal affinity and/or source region in early Palaeozoic time. Terrane and geological abbreviations: KB, Kilbuck; QN, Quesnellia; RT, Richardson trough; SM, Slide Mountain; ST, Stikinia; YSB, Yukon Stable Block; YT, Yukon–Tanana terrane in the Coast Mountains; WR, Wrangellia. Inset shows location of the Cordilleran orogen in western North America with respect to Chukotka and Wrangel Island (WI), Pearya in the Arctic Islands, the Greenland Caledonides (Cal.) and the Appalachians along the east coast.



Terrane map of the Klamath Mountains, Oregon and California.

compiled by Marli Bryant Miller, University of Oregon

- **MzT** Mesozoic and Tertiary sedimentary rock, postdates accretion of Klamath terranes.
- **Kh** Cretaceous Hornbrook Formation.
- **F** Mesozoic rock of Coast Ranges; mostly Franciscan Fm.
- **C** Condrey Mountain Schist, Mesozoic.
- **Wk** Western Klamath Terrane, mostly Jurassic.
- **WPz** Western Paleozoic and Triassic Terrane.
- **CM** Central Metamorphic Terrane (Devonian).
- **EK** Eastern Klamath Terrane (Early Paleozoic to Jurassic).
- **Jp** Jurassic Plutons.

N

0 km 50

Range in ages of terranes in the Klamaths.

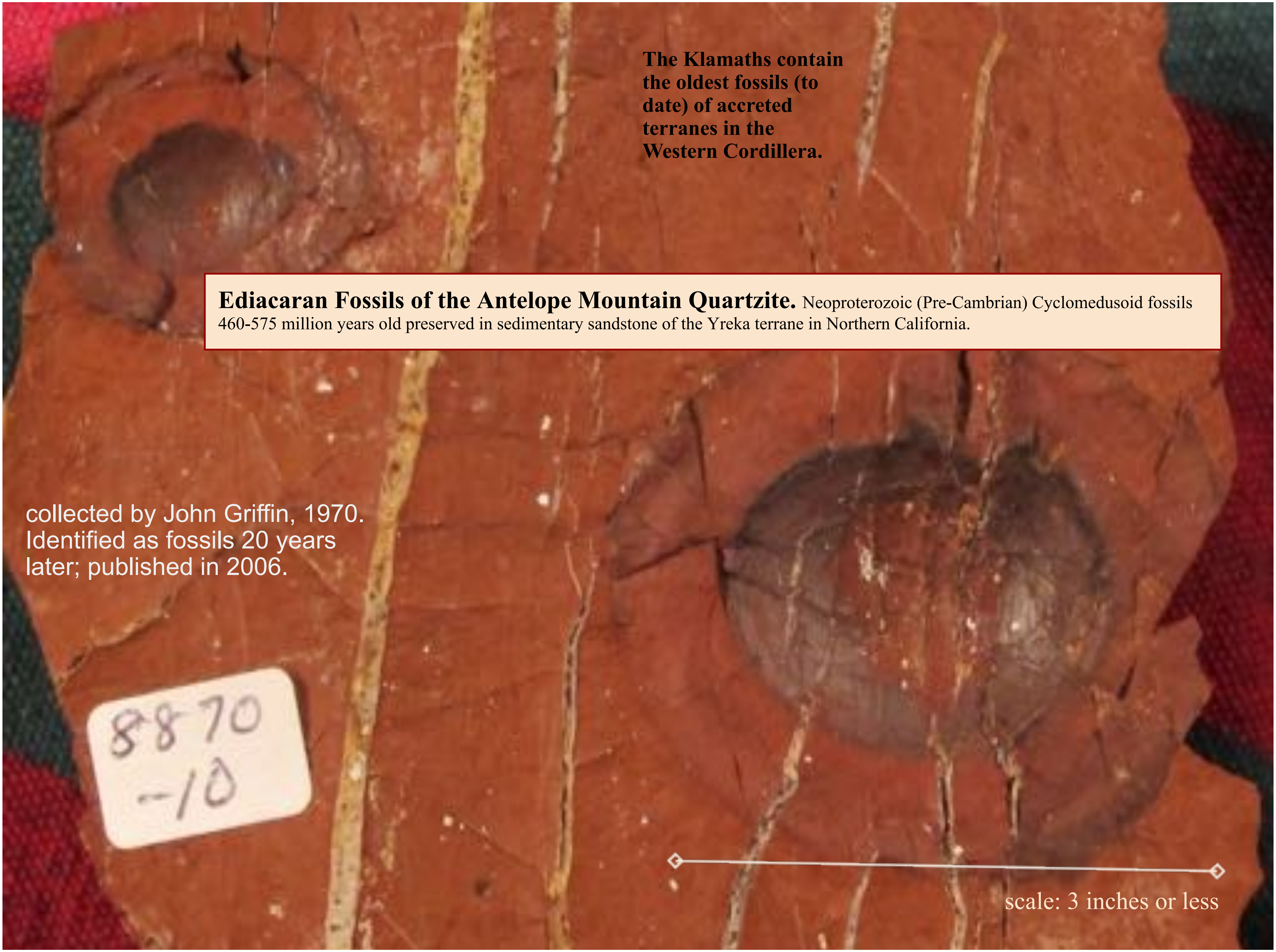
144-60 Ma

200-144 Ma

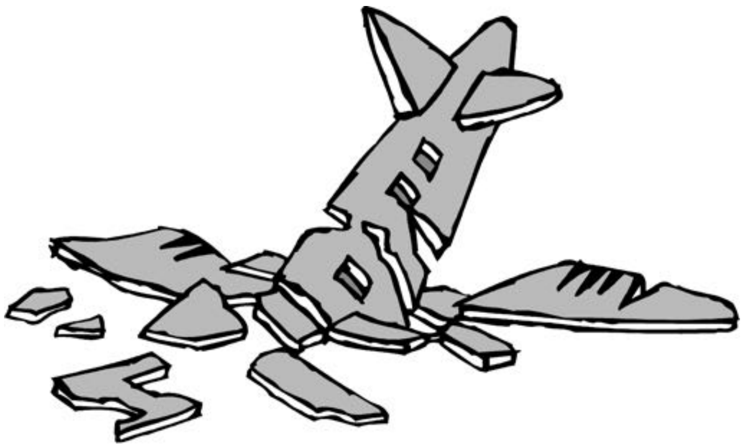
250-160 Ma

400-360 Ma

640-180 Ma


The Klamaths contain the oldest fossils (to date) of accreted terranes in the Western Cordillera.
Ediacaran Fossils of the Antelope Mountain Quartzite. Neoproterozoic (Pre-Cambrian) Cyclomedusoid fossils 460-575 million years old preserved in sedimentary sandstone of the Yreka terrane in Northern California.
collected by John Griffin, 1970. Identified as fossils 20 years later; published in 2006.
8870 -10
scale: 3 inches or less

What tools can be used to communicate this complex geologic history?

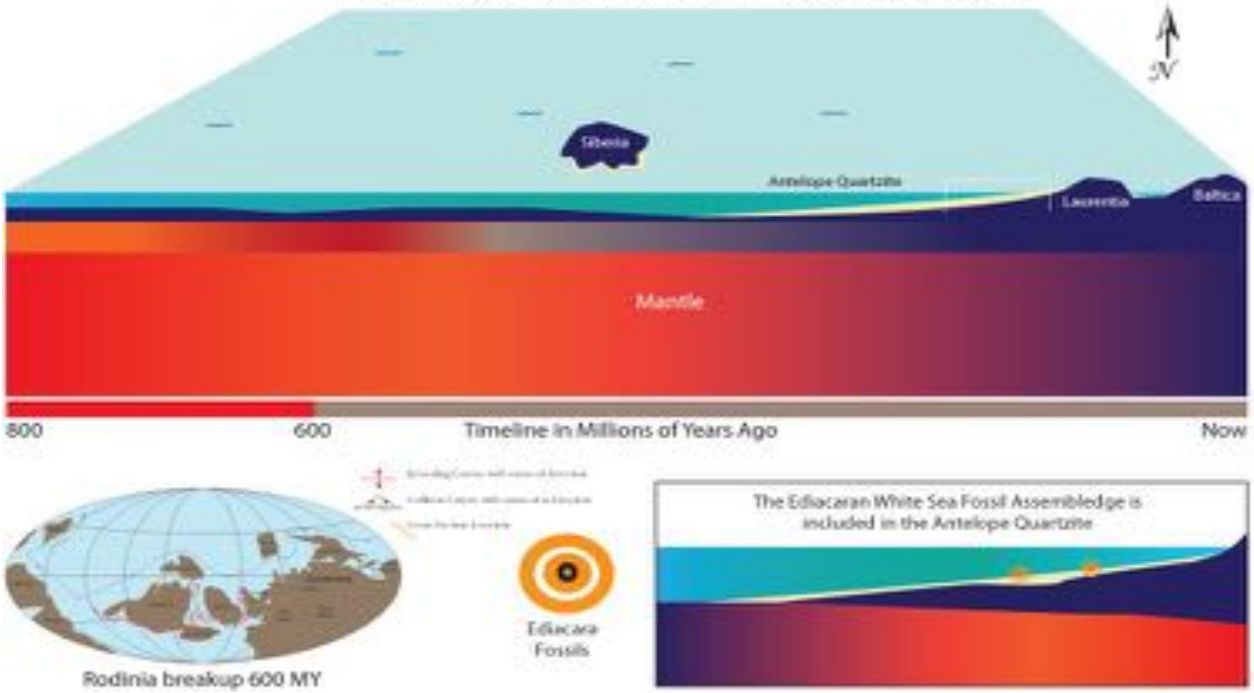


Problem: the earth looked (and behaved) very differently in the deep past.

(It is a dangerous case of unfamiliarity…

Oregon Caves GeoCorps Project: Creating timeline and text for geologic history pre-250 Ma Combining text with original geologic illustrations, paleogeographic maps and photographs.

The supercontinent of Rodinia begins to rift apart as spreading centers rise between continental pieces, pushing them away from each other. The oldest rocks in the Klamath terranes, the Antelope Mountain Quartzite, begins to form from the sandy debris of the nearby continental pieces, which accumulates in the shallow parts of oceans on continental edges. These sedimentary rocks preserve the fossilized impressions of pre-Cambrian aged cyclomedusoids.



Work at Oregon Caves:

Illustrations by Audrey Ledford, text by John Roth, illustration consultation and text by Gina Roberti.

600 Million Years

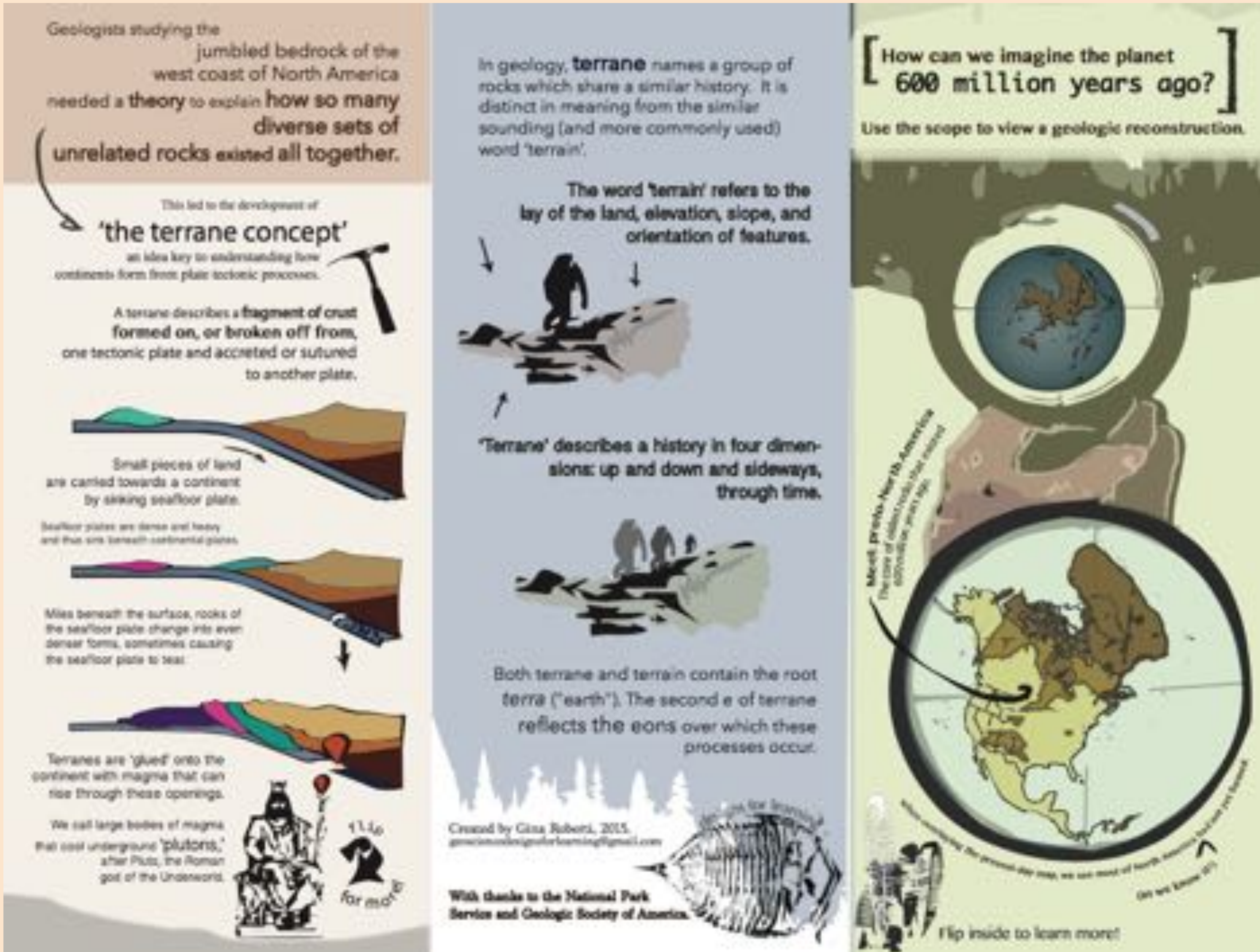
The oldest rock unit in the Klamath terranes, the Antelope Mountain Quartzite, begins to form from the sandy debris eroding from nearby continental pieces between 640 and 575 million years ago (Griffin 2008). This material accumulates on the shallow parts of oceans around continental edges. The Yreka terrane includes a range of shallow to deep marine sandstones and mudstones that accumulated from 600 to 400 million years ago. Cementing sedimentary debris into a sandstone preserved the fossil imprints of the cyclomedusoids, grouped taxonomically with the White Sea Assemblage. Some of these flattish lifeforms may be sponge, jellyfish or left/right symmetrical (like us) ancestors. Some became extinct once bacteria exhaled enough oxygen to seep deep into and keep alive bigger newcomers that replaced some of the older life (MacGabhann et al.

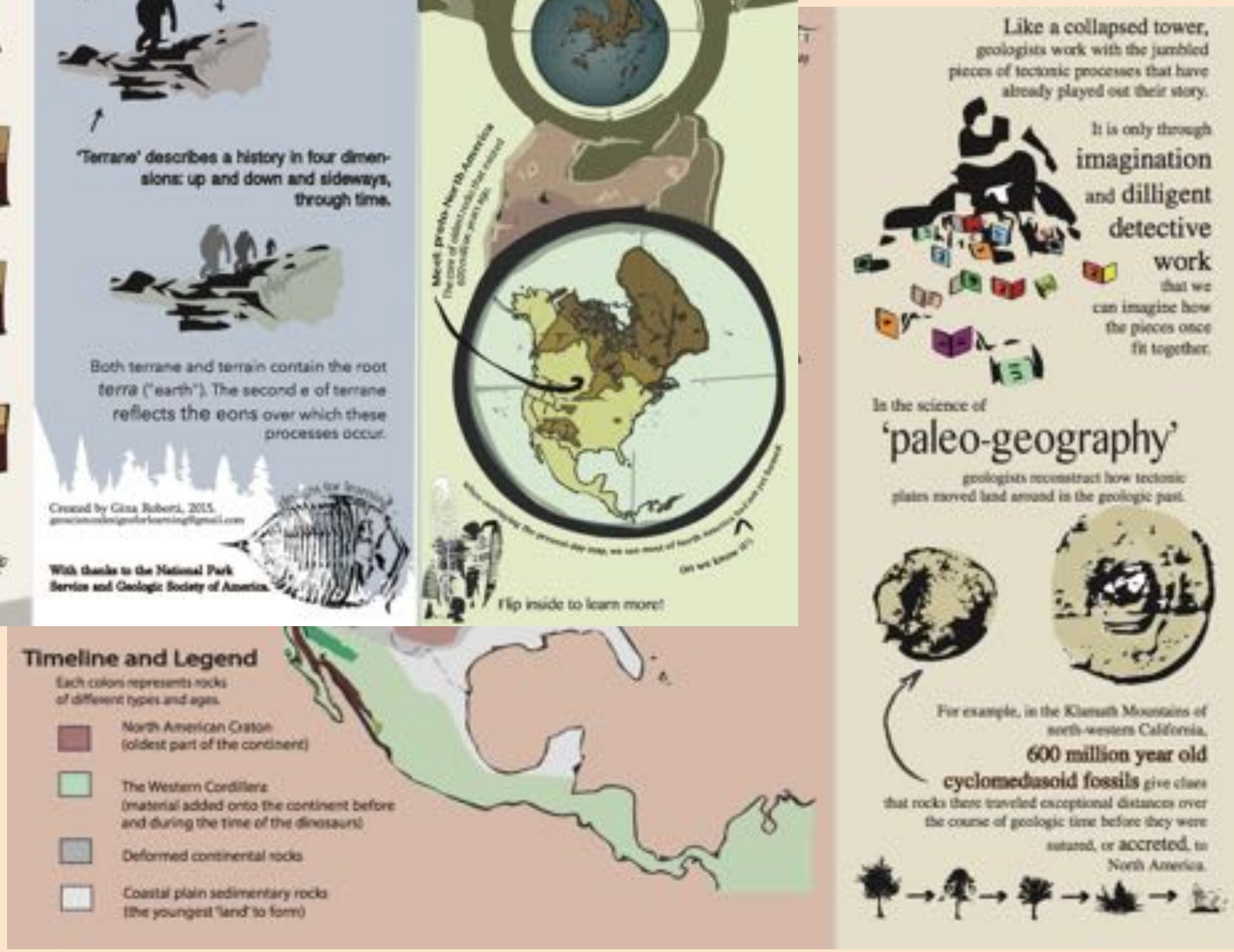
Quartz-rich sands and muds washed off from the former pieces of the supercontinent form the oldest rocks in the Klamaths between 640 and 575 millio years ago (Griffin 2008). The Antelope Mountain Quartzite is so named because of pressure and heating during burial metamorphose the silica-rich sandstone into quartzite.

Fossils were first discovered by John Griffin in the 1970s though not described as Proterozoic fauna and published until 2006.

Independent Graphic Design:

Gina Roberti





To ‘ERR’ on the side of effective science communication:

1. Engagin
g

2. Exciting

3. Relevant

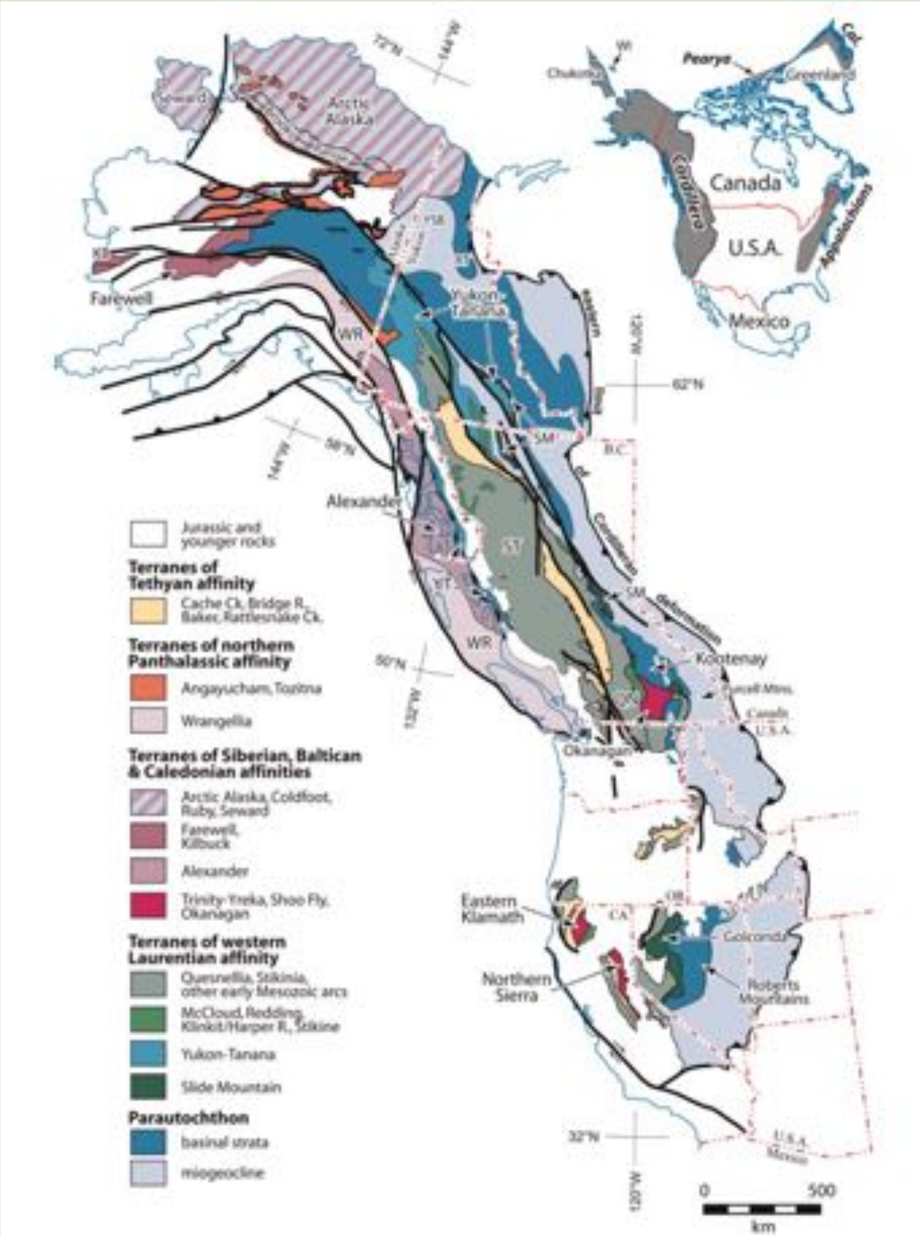
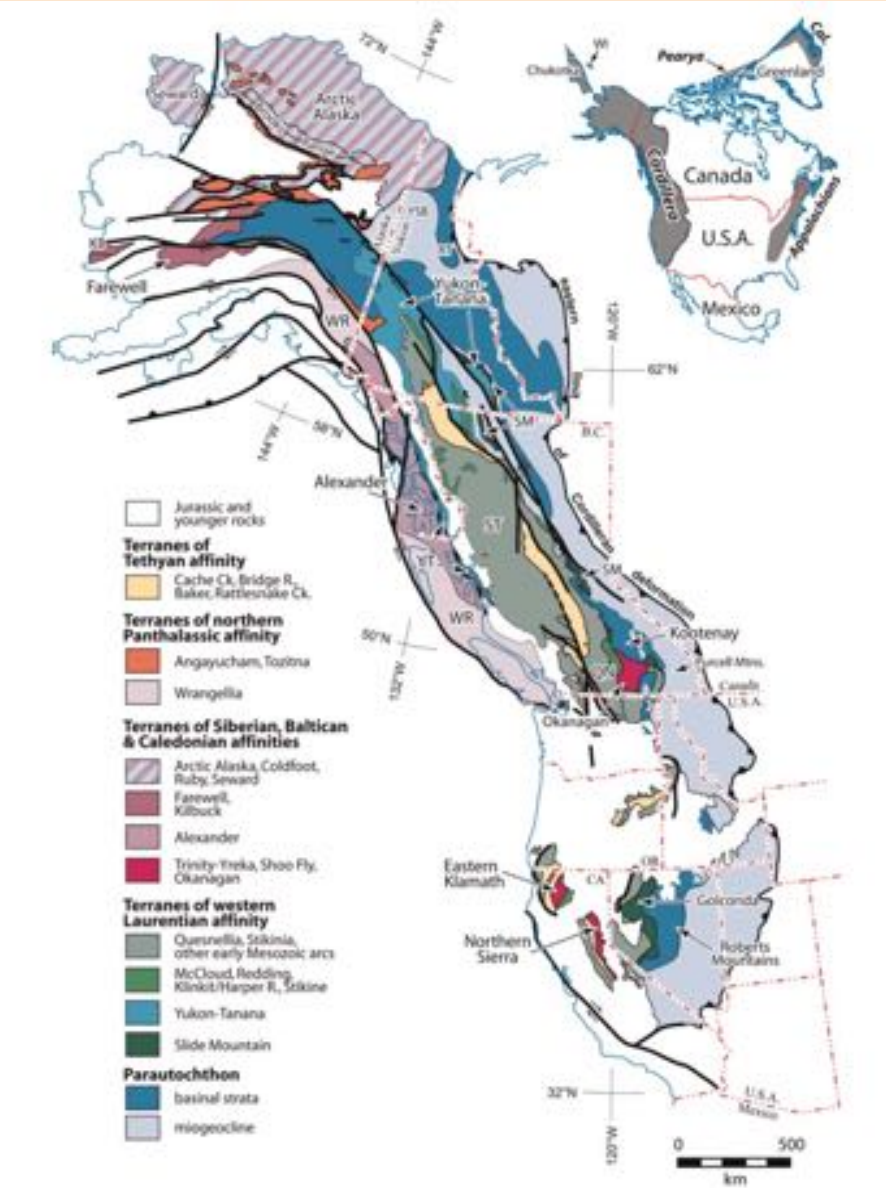


Fig. 1. Palaeozoic to early Mesozoic terranes of the North American Cordillera. Terranes are grouped according to faunal affinity and/or source region in early Palaeozoic time. Terrane and geological abbreviations: KB, Kilbuck; QN, Quesnellia; RT, Richardson trough; SM, Slide Mountain; ST, Stikinia; YSB, Yukon Stable Block; YT, Yukon–Tanana terrane in the Coast Mountains; WR, Wrangellia. Inset shows location of the Cordilleran orogen in western North America with respect to Chukotka and Wrangel Island (WI), Pearya in the Arctic Islands, the Greenland Caledonides (Cal.) and the Appalachians along the east coast.

START: a complex 4D problem.

Simplifying. Overlays.



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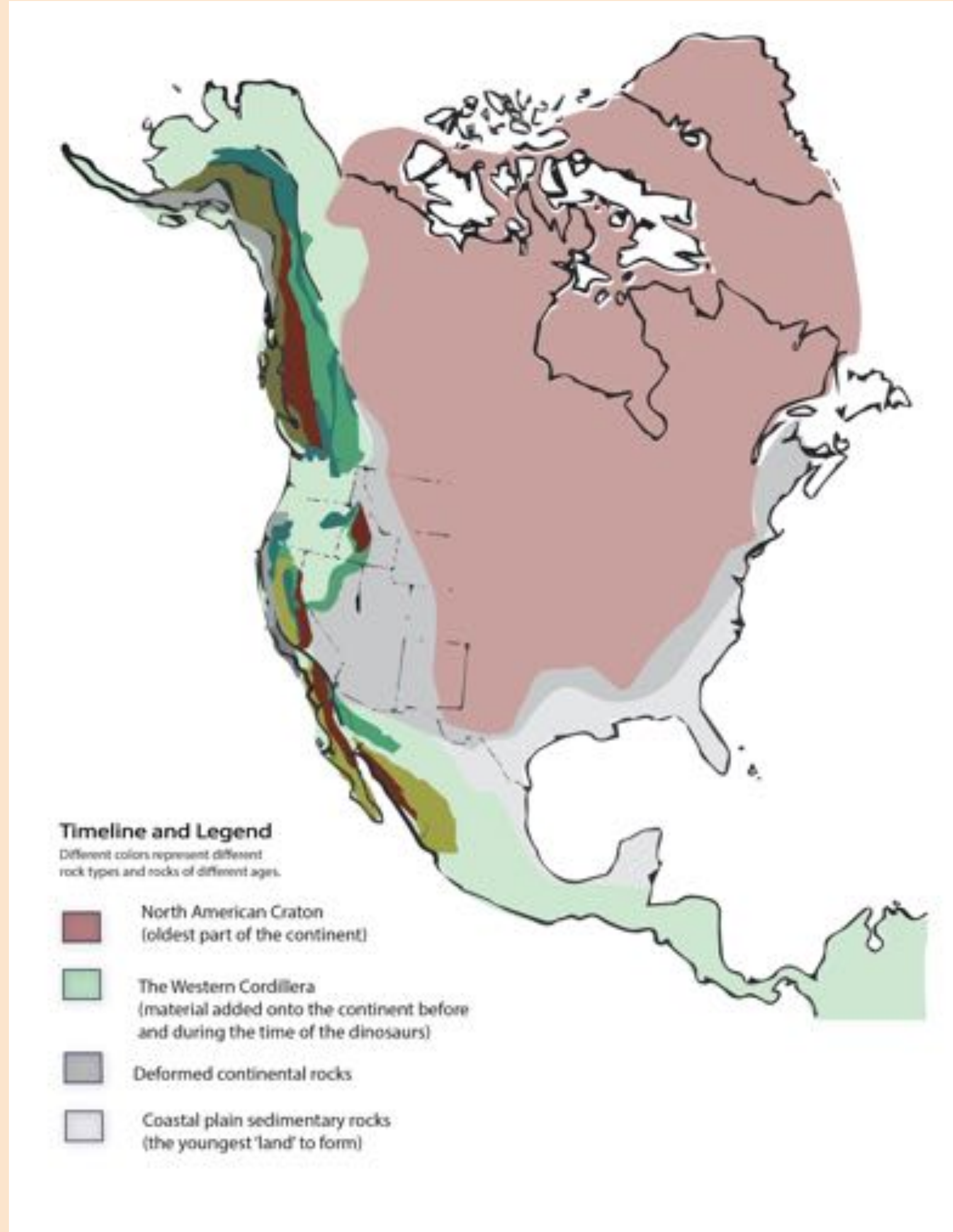
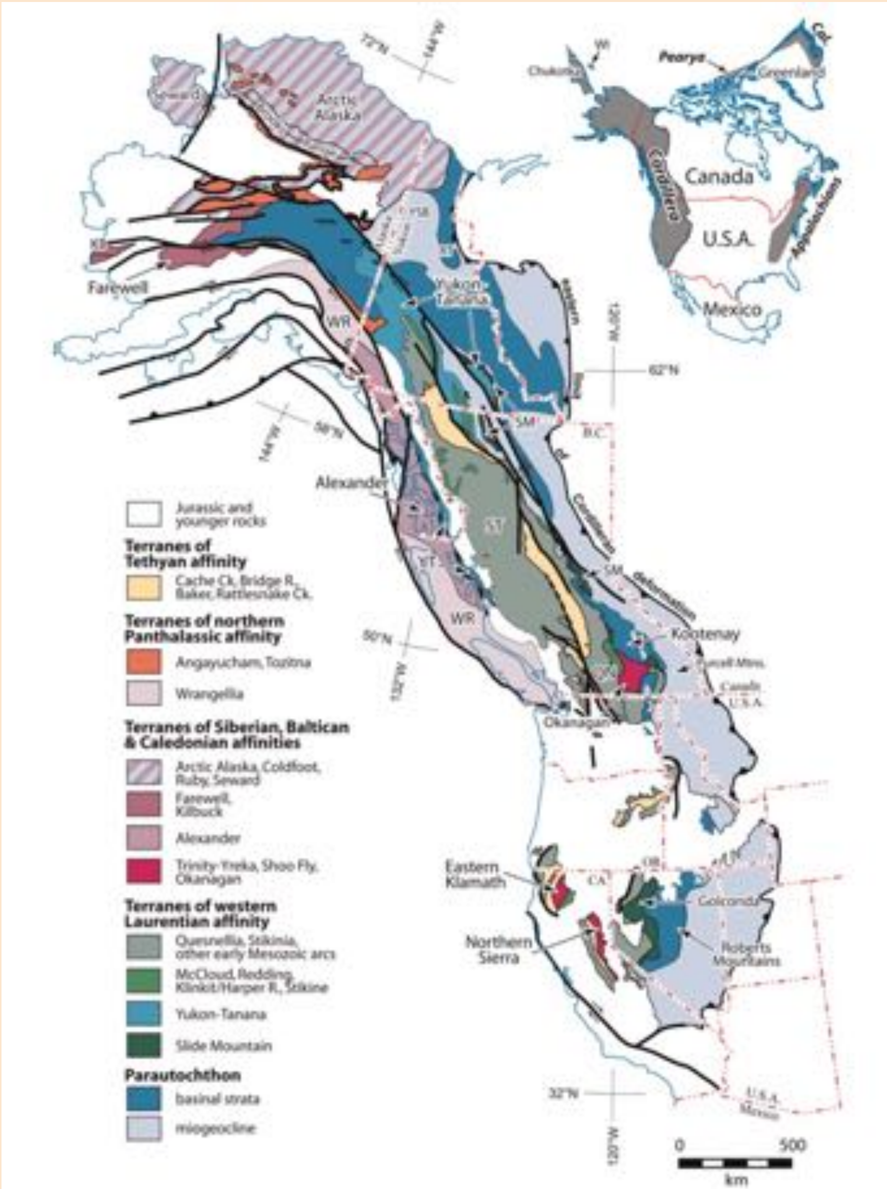


Using analogies.



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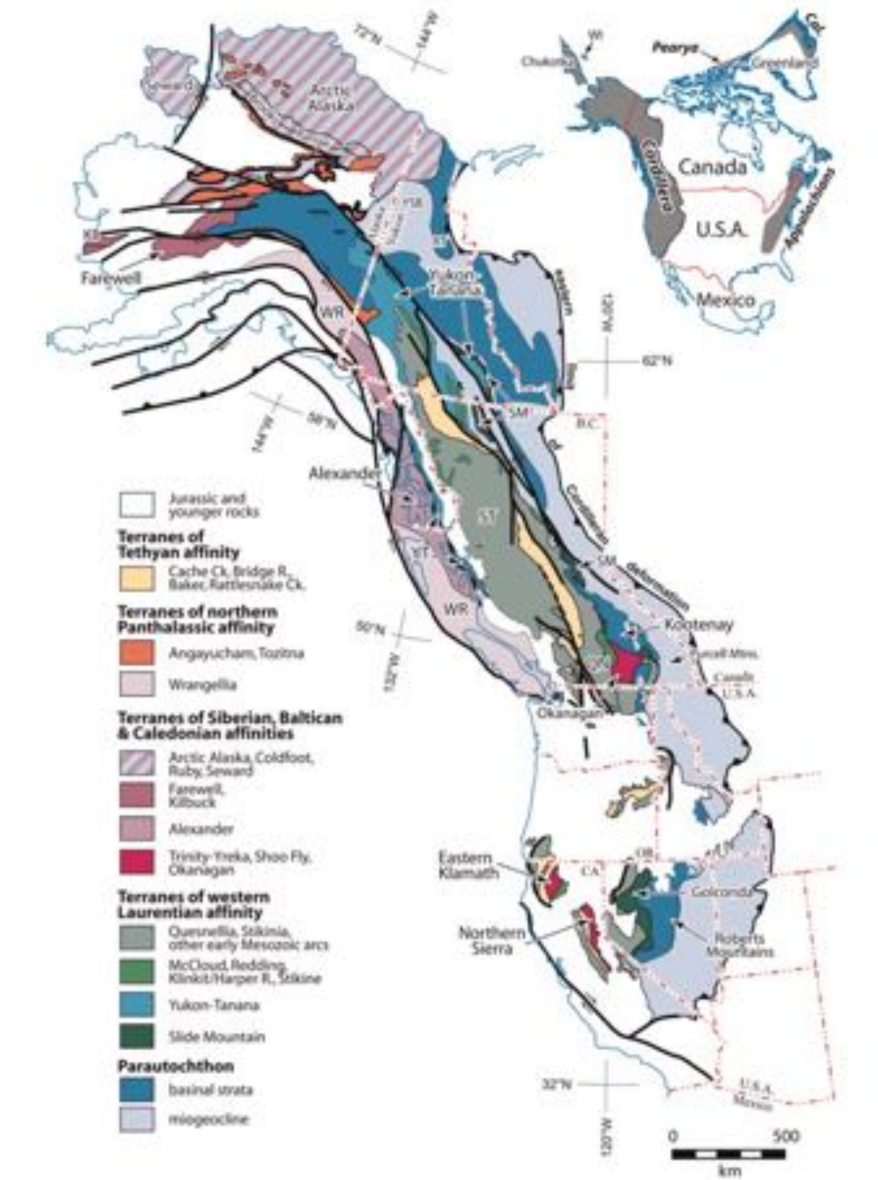
Like a collapsed tower, geologists work with the jumbled pieces of tectonic processes that have already played out their story.

It is only through imagination and dilligent detective work that we can imagine how the pieces once fit together.



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Using jargon as a teaching tool.

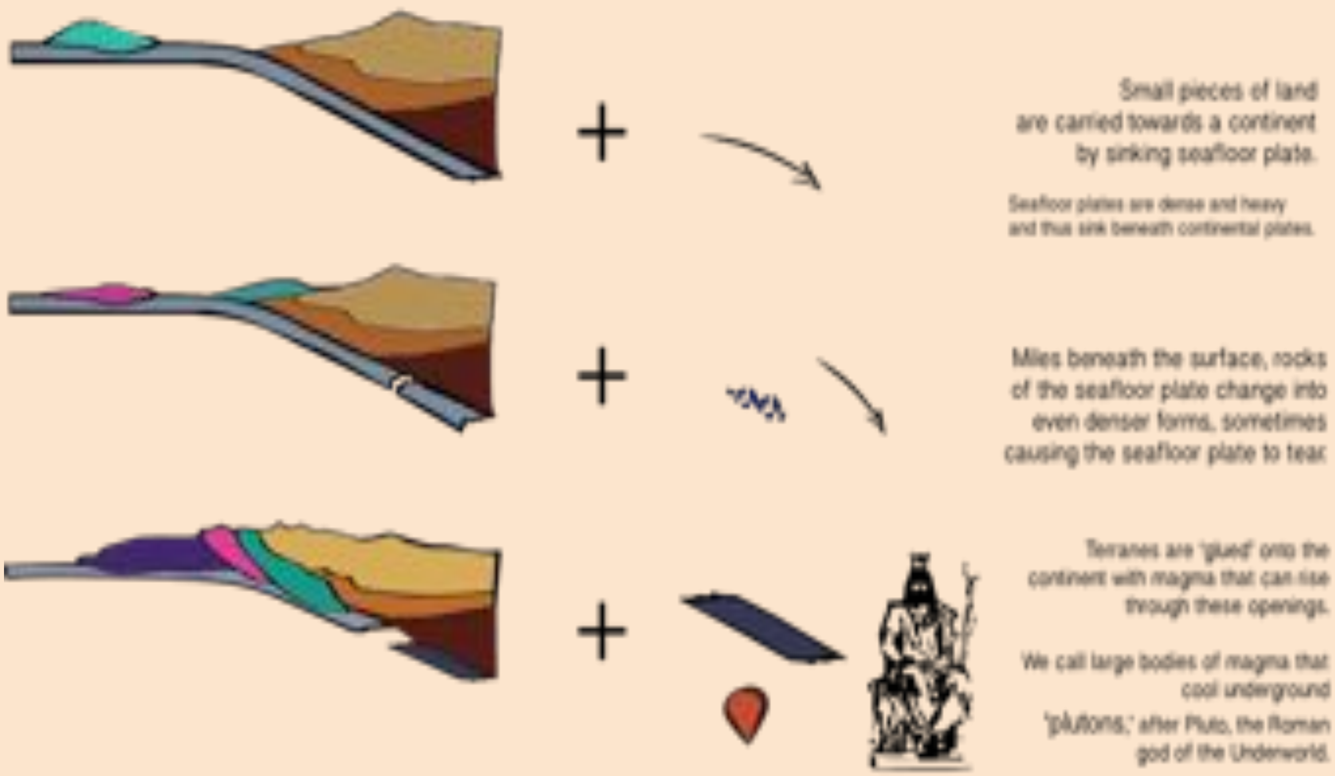
In geology, **terrane** names a group of rocks which share a similar history. It is distinct in meaning from the similar sounding (and more commonly used) word 'terrain'.

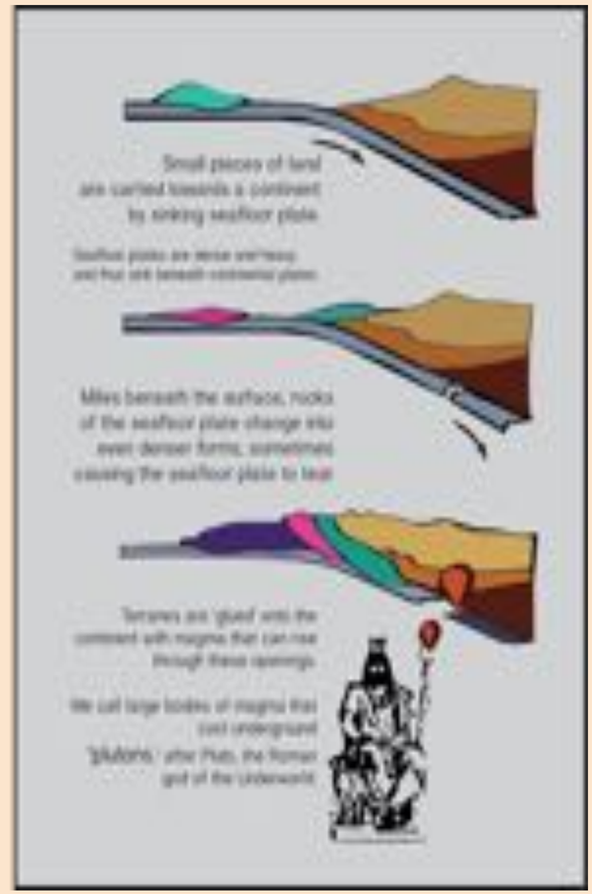
The word 'terrain' refers to the lay of the land, elevation, slope, and orientation of features.

'Terrane' describes a history in four dimensions: up and down and sideways, through time.

Both terrane and terrain contain the root *terra* ("earth"). The second *e* of terrane reflects the eons over which these processes occur.

Simplifying concepts with a combination of visuals and text.





With **many thanks** to the support of John Roth, Audrey Ledford, GeoCorps America, and the staff and resources of Oregon Caves National Monument.

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Individual citations for photographs and images used in this presentation listed on slides.