WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
WASHINGTON GEOLOGICAL SURVEY
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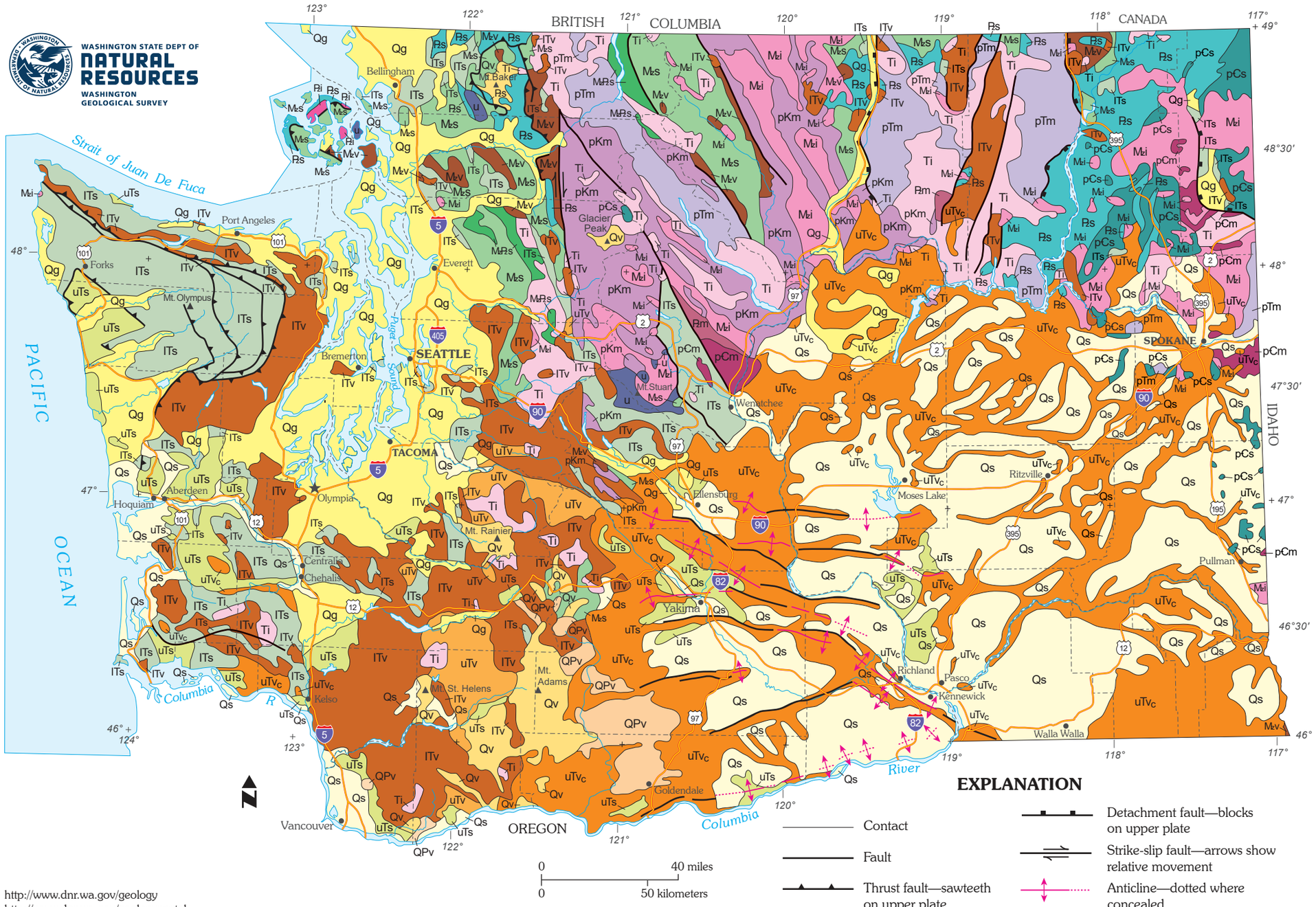
GEOLOGIC MAP OF WASHINGTON



EXPLANATION

- Contact
- Fault
- Thrust fault—sawteeth on upper plate
- Detachment fault—blocks on upper plate
- Strike-slip fault—arrows show relative movement
- Anticline—dotted where concealed

GEOLOGIC UNITS

Unconsolidated Deposits

- Qs — Quaternary sediments, dominantly nonglacial; includes alluvium and volcaniclastic, glacial outburst flood, eolian, landslide, and coastal deposits
- Qg — Quaternary sediments, dominantly glacial drift; includes alluvium

Sedimentary Rocks

- uTs — Upper Tertiary (Pliocene–Miocene)
- lTs — Lower Tertiary (Oligocene–Paleocene)
- Ms — Mesozoic
- MPzs — Mesozoic–Paleozoic
- Pzs — Paleozoic
- pCs — Precambrian

Volcanic Rocks

- Qv — Quaternary
- QPv — Quaternary–Pliocene
- uTv — Upper Tertiary (Pliocene–Miocene)
- uTvc — Columbia River Basalt Group
- lTv — Lower Tertiary (Oligocene–Paleocene)
- Mv — Mesozoic

Intrusive Igneous Rocks

- Ti — Tertiary
- Mi — Mesozoic
- Pi — Paleozoic

Metamorphic Rocks

- pTm — Pre-Tertiary
- pKm — Pre-Cretaceous
- Pm — Paleozoic
- pCm — Precambrian
- u — Ultramafic rocks

Note: Some pre-Tertiary sedimentary and volcanic rock units include low-grade metamorphic rocks. Ages assigned to metamorphic rocks are protolith ages.

http://www.dnr.wa.gov/geology
http://www.dnr.wa.gov/geologyportal

THE GEOLOGY OF WASHINGTON STATE

Washington consists of a diverse collection of rocks that tells an amazing geologic history. The deepest rock in Washington, called "basement", consists mostly of terranes accreted to North America over the last 200 million years. These basement terranes are overlain by a variety of sedimentary and volcanic rocks that add detail to the history.

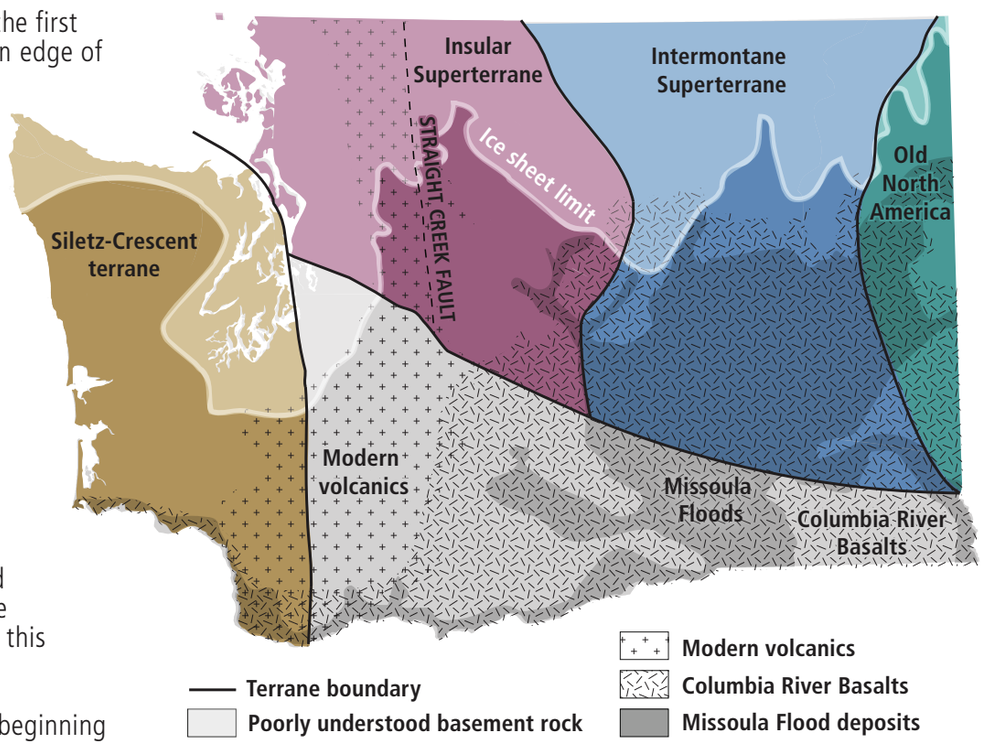
At the eastern edge of Washington State are exposures of **Paleozoic North America**. These rocks are overlain by metamorphosed sedimentary rocks dated around 1.46 billion years ago (unit pCm). These are the oldest rocks that have surface exposures in the state. Overlying the oldest rocks are metamorphosed sedimentary and volcanic rocks, dated around 700 million years (unit pCs).

For much of the Paleozoic (540 to 250 million years ago), the western coast of North America was tectonically inactive and bordered an ancient ocean. Some Paleozoic rocks in northeast Washington, including quartzite and conglomerate (unit Ps), indicate river, coastal, and ocean environments.

By 250 million years ago, the first of several subduction zones formed along the western edge of Washington.

The onset of subduction brought the first of what would be many arrivals of exotic terranes. The first accreted terrane included a collection of already accreted volcanic islands, collectively known as the **Intermontane Superterrane**. The collision of this terrane around 170 million years ago caused metamorphism and magmatism throughout the region.

Following the arrival of the first superterrane, the western edge of Washington hosted the prehistoric ocean, the Methow ocean. Marine sand and mud built upon the ocean floor (unit Ms), later to be thrust eastward with the arrival of another accreted terrane.



The complex patchwork that is the **Insular Superterrane** arrived throughout the Mesozoic, between 250 and 60 million years ago. Intermittent volcanic arcs contributed plutons that intruded the accreted terranes during this time.

Tectonic rearrangement beginning around 60 million years ago exerted a northward push that created extensive north–south strike-slip faulting through the middle of the North Cascades. Right-lateral motion along these faults, notably the Straight Creek fault, resulted in approximately 90 km of displacement. At the same time, extension created and exposed metamorphic core complexes in the Okanogan Highlands (unit pTm) and the metamorphic and intrusive igneous rocks of the North Cascades terranes (unit pKm). About 50 million years ago, the final major addition to Washington had arrived. The **Siletz-Crescent terrane** (unit lTv) was an exceptionally large chunk of basaltic islands and ocean floor. When it collided with North America, subduction temporarily ceased.

By 40 million years ago, subduction resumed west of Siletzia, resulting in another volcanic arc and uplifting rocks of the Cascade Range. By 17 million years ago, the Yellowstone Hot Spot caused the eruption of the Columbia River Basalt Group, the youngest continental flood basalt eruption on Earth. These eruptions ended by 6 million years ago, and they covered vast areas of southeastern Washington, Oregon, and Idaho (unit uTvc). During these eruptions, continental rifting in the Basin and Range and northward drift of much of California caused clockwise rotation and deformation of the Pacific Northwest, creating the Yakima fold and thrust belt. Rotation about a pole near the northeast corner of Oregon is still ongoing.

This rotation likely contributed to the onset of the modern Cascade arc ~10 million years ago. Volcanism and uplift of the mountain range introduced stratovolcanoes that are still active today (unit Qv). The mostly basaltic Boring Volcanic Field was also active beginning about 2.7 million years ago.

Pleistocene cooling brought broad continental ice sheets across the northern half of the state (unit Qg). Repeated glacial advances and retreats carved the modern landscape, including the Puget Sound and surrounding lowlands. Massive glacial lakes were dammed by ice and episodically breached during this time, releasing the enormous Missoula Floods that spread across eastern Washington to the western coast, traversing the Columbia River.

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