November 1, 2021

News and Notes

Before going on to discuss the Archean Eon, here are a few news stories that I thought were interesting:

Volcanoes

Here are the Worldwide Volcano News and Updates, some more information:

- Webcams of volcanoes are here, neat stuff.
- The Alaska Volcano Observatory is here; there are Code Orange alerts on Great Sitkin, Pavlof and Semisopochnoi volcanoes.
- La Palma volcano, live updates today: eruption, tsunami warning and latest news | Canary Islands.
- More on La Palma on YouTube: La Palma Volcano Eruption Update; Strongest Eruptions Yet, Landslide Occurs.
- Mount Etna's Eruption, As Volcano Spews Ash Clouds Into The Air; spectacular video from CNN here.
- From the United States Geological Survey (USGS): Volcano Watch — How high is that lava fountain?
- Also from the USGS: How much heat is emitted by hydrothermal areas on the floor of Yellowstone Lake?
- The mobility of a rolling volcanic boulder; useful information if you visit an active volcano.

Earthquakes

The latest earthquake news is here, some highlights:

- World Earthquake Report for Sunday, 31 October 2021
- USGS, Queen Charlotte Fault Mapping offshore of British Columbia.
- California is helping people prepare their houses for earthquakes, here in the Los Angeles Times.
- Production of semi-conductors affected by earthquake in Taiwan; the story focuses on the implications for financial investors; information on the earthquake here.
- Duh, yeah, An earthquake early warning system for Alaska could save lives and reduce property damage.

Energy

- U.S. Energy Information Administration (USEIA): Hurricane Ida reduced U.S. natural gas production more than any other hurricane over the past ten years.
- Also from the USEIA, Petroleum Supply Monthly.
- From Reuters: U.S. demand for oil surges, depleting tanks in Oklahoma.

Environmental

- From the USGS: Groundwater Flow to CO River May Decline by a Third over Next 30 Years.
- Air Pollution Killed a Million People in Africa in 2019.

Mining News

- Airborne geophysics by the USGS: Media Alert: Airplane to Make Low-Level Flights Over Western and Northern Nevada and Part of Eastern California and USGS and Rio Tinto Partner to Survey for Critical Minerals in Southwest Montana.
- Iamgold convoy attacked in Burkina Faso, several missing; wouldn't happen if they were looking for gold in some safer place like Canada, just saying.
- Chile copper output sinks to seven-month low.
- Manitou Gold Intersects 19.7 g/t Au in New Discovery at the Bald Eagle Gold Zone on its Goudreau Project, Wawa, Ontario.
- Opinion piece: Editorial Counterpoint: Assault on mining harms all Minnesota, America.

Paleontology

- This is cute, a dinosaur visits the United Nations.
- Jurassic Graveyard Reveals Oldest Evidence That Dinosaurs Traveled in Herds.
- Giant Ammonites Once Thrived on Both Sides of Atlantic.

Pretty Rocks

- Big stones: The Story Behind the New 8,000-Pound Quartz at the Smithsonian.
- Gemstones Market Comprehensive Study Explore Huge Growth in Future.

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Archean Eon - Part 1

As you see below in Figure 1, the Archean Eon lasted from 4.0 to 2.5 billion years before present,. That's a long time, so I think that it deserves more than just one post. Geology always starts with the rocks, so in this week's posting we'll look at where Archean aged rocks are found and what they are made up of. In future postings we'll look at the events of the Archean.

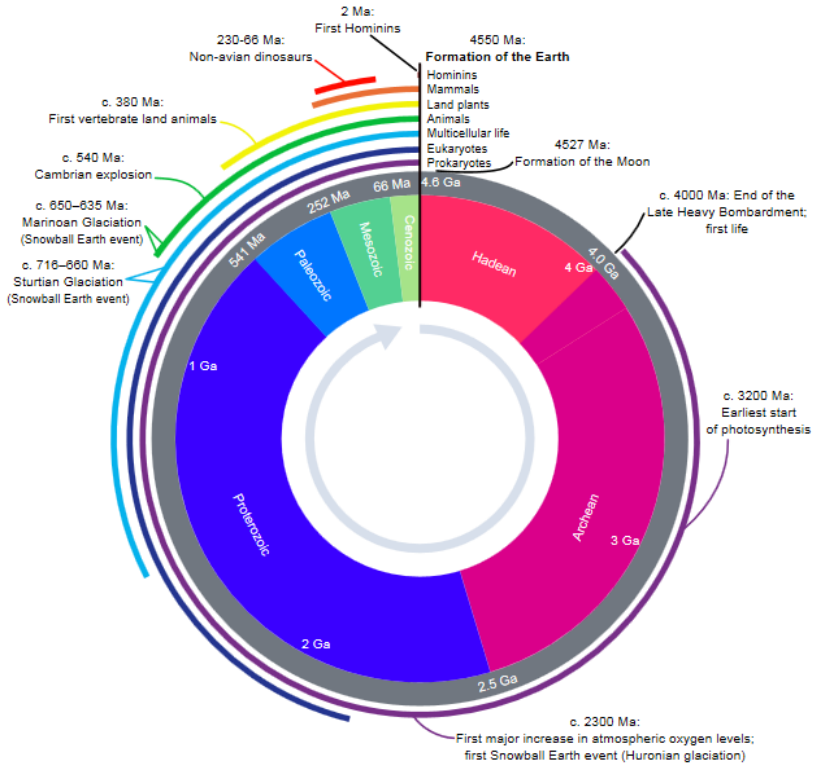

Figure 1 - Geological Time Scale Clock
Credit: Woudloper, public domain

Worldwide Distribution of Archean Rocks

Archean rocks are at the cores of the Stable Cratons around which the continents are built. Figure 2 shows the locations of these continental cores. The yellow dots in Figure 2 show where the oldest rocks have been found.

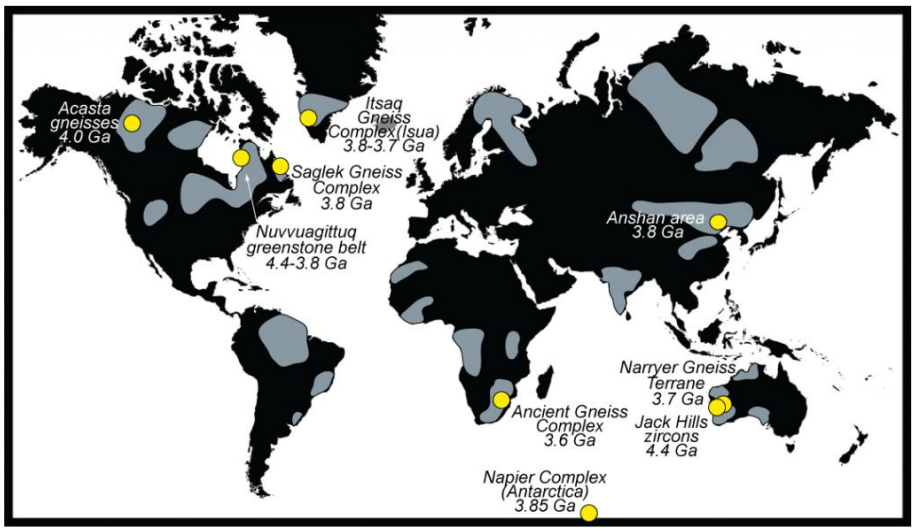

Figure 2 - Archean Rocks Worldwide
Credit: **Historical Geology**

Figure 3 shows the location of Precambrian age rocks in North America and illustrates the accretionary nature of the North American Craton, also called Laurentia.

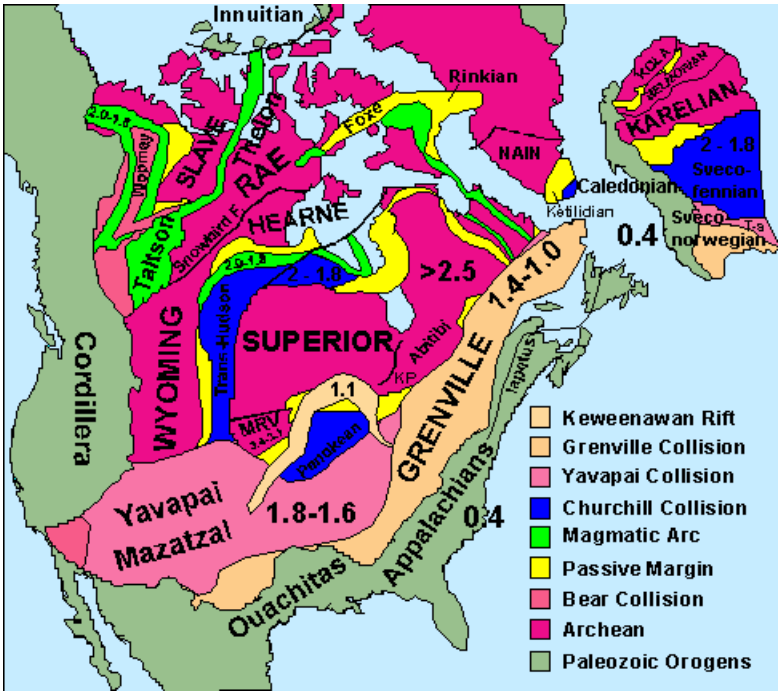

Figure 3 - North America Basement Rocks
Credit: United States Geological Survey, public domain

As you can see, it complicated. The North American Craton was made up when successive events brought together the various areas of the craton. Let's look at just one of the areas, or provinces, the Superior Province. We can also look closer at what kind of rocks make up the Superior Province.

Superior Province

The Superior Province of the North American Craton is located in the Canadian provinces of Quebec, Ontario, and Manitoba as well as the part of American state of Minnesota. The main subcomponents of the Superior Province are shown in Figure 4, below.

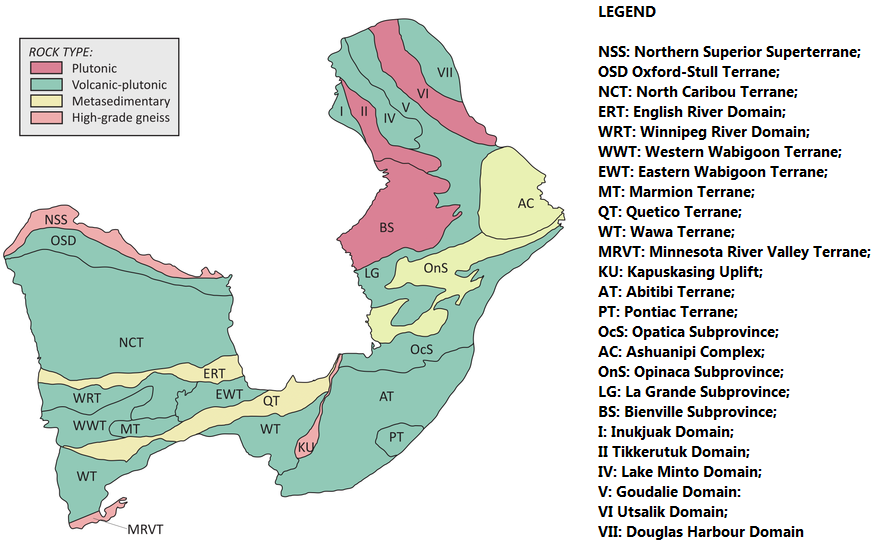

Figure 4 - Superior Province
Credit: Charlespsml, Creative Commons Attribution-Share Alike 4.0 International license

Like the North American Craton as a whole, the Superior Province was assembled by tectonic forces that brought together the subcomponents, variously called superterranes, terranes and domains. Let's look at these subcomponents. The Superior Province is generally divided into a western and an eastern branches.

Western Superior Province

The **Northern Superior Superterrane** (NSS) is made up of granitic rocks (tonalite, granodiorite and granite) and gneiss with some mafic-intermediate volcanic rocks and minor greywacke. The origin of the NSS was probably in the deep burial of rocks that lead to the creation of granite magma and in the shallower burial that lead to metamorphism forming amphibolite. The NSS hosts lode type gold deposits and diamond deposits in kimberlite pipes.

The **Oxford-Skull Domain** (OSD) contains basalt of the Hayers River Assemblage and volcaniclastic rocks of the Oxford Lake Assemblage. It is underlain by a pluton made up of tonalite, granodiorite and granite with intrusions of mafic rocks. The OSD was probably

deposited in an oceanic setting. It is also known to contain lode type gold deposits such as the Monument Bay gold deposit.

The **North Caribou Superterrane** (NCS) consists of a base of plutonic rocks (ranging from granite to tonalite) overlain by volcanic rocks in oceanic arc sequences. The NCS is known to contain gold deposits, such as the Red Lake Gold Camp and massive sulphide deposits.

The **English River Domain** (ERT) seems to have been formed in the suture zone between the North Caribou Superterrane and Winnipeg River Terrane. It is composed of sedimentary rocks like wackestone, amphibolite, granulite, migmatite and diatexite.

Made up of gneiss, foliated tonalite and granite, the **Winnipeg River Terrane** (WRT) appears to be the result of the deep burial of rocks to create metamorphic and igneous rocks. Iron deposits and native silver deposits have been found in the WRT.

The Wabigoon Terrane (WWT & EWT) is split into two parts. The west part is made up of mafic volcanic rocks and a tonalite pluton. The eastern part consists of greenstone belts intruded by a granite pluton. The western part appears to have been deposited in an oceanic arc setting and the eastern part seems to have been deposited in a continental margin setting.

The **Quetico Terrane** (QT)is mainly greywacke, migmatite and granite together with metasedimentary successions intruded by tonalite, nepheline syenite, carbonatite and granite. It appears to be an ancient forearc deposit.

Made up an oceanic tectonic mélange the **Wawa Terrane** (WT) consists of calc-alkaline to alkaline volcanic rocks and granitic sanukitoid rocks. Mineral deposits include iron, gold, copper and minor nickel in the Michipicoten-Mishubishu belt and iron, gold, nickel and massive sulphide deposits in the Shebandowan-Schreiber belt.

The **Kapuskasing Uplift** (KU) is an uplifted zone within the Superior Province consisting of tonalite, paragneiss and anorthosite.

Eastern Superior Province

The **Abitibi Terrane** (AT) is divided into north, central and southern zones. The north consists of layered-intrusion-related volcanic rocks. The central zone is made up of plutonic rocks and minor volcanic rocks and the south is made up of greywacke, conglomerate and alkaline volcanic rocks. Mineral deposits in the north zone include massive sulphide deposits, copper zinc vein deposits, lode gold deposits. The central zone contains massive sulphide deposits and vein gold deposits and the south has gold deposits, copper zinc massive sulphide deposits, intrusive nickel deposits, and minor porphyry deposits.

Part of an ancient fold-thrust belt, the **Pontiac Terrane** (PT) is made up of schists and paragneiss in the north and volcanic rocks in the south. It is known to contain quartz-vein-hosted gold deposits and gabbroic-sill-hosted nickel-copper sulphide deposits.

The **Opatica Subprovince** (OCS) contains tonalite, granodiorite, granite and pegmatite. The tectonic movements appear to have been west moving shearing followed by southern movements. The mineral deposits include massive sulphide deposits, copper-gold vein deposits, intrusion-hosted nickel deposits and iron formations.

Consisting of metagreywacke and a massive leucogranite intrusion, the **Opinaca Subprovince** has deposits of rare metals in granites and pegmatites.

The **Ashuanipi Complex** (AC) is made up of tonalite and diorite with granulite and an intrusion of diatexite, syenite, granodiorite and granite.

The **La Grande Subprovince** (LG) consists gneiss basement rock with komatiites. The subprovince has porphyry deposits and mineralization other in igneous rocks.

The **Bienville Subprovince** (BS) consists of granitic and granodiorite intrusions is the north and a massive granodiorite complex in the south.

The **Northeastern Superior Province** is divided into five zones:

I. tonalite and tonalitic gneiss
II. pyroxene-bearing plutonic rocks
IV. metasedimentary and pyroxene-bearing pluton
V. pyroxene-bearing pluton with minor tonalite
VI. magnetic pyroxene-bearing pluton
VII. tonalite complex

There are two types of mineral deposits in the Northeastern Superior Province:

1. Syngenetic Deposits : Algoma-type iron formation, volcanogenic massive sulphide, nickel-copper deposits, iron, titanium-vanadium deposits (hosted by mafic intrusions), and uranium-thorium-molybdenum bearing porphyry deposits;
2. Epigenetic Deposits: copper, nickel, silver, gold, rare earth elements (REE) and limited uranium deposits.

As you can see from the example of the Superior Province, Archean deposits can be extremely complex. We'll look at the events and processes that occurred during the Archean in next week's posting.

Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.