July 5, 2021

Opening Notes and Comments

A few news items of interest:

- June 30th was the 113th anniversary of the Tunguska Event. The universe is not a safe place. Along the same lines, a large comet is heading our way.
- The end of the Cretaceous is still under investigation. In their recent paper published in Nature Communications, Fabien L. Condamine, Guillaume Guinot, Michael J. Benton and Philip J. Currie indicate that while the infamous asteroid that caused the Chicxulub crater was probably the proximate cause of the mass extinction at the Cretaceous–Paleogene boundary, climate change was already causing trouble for the dinosaurs as evidenced by a decline in biodiversity.
- All that glitters is not gold; in Science Alert, 'Fool's Gold' Actually Contains a Newly Discovered Type of Real Gold, Scientists Find. Pyrite mineralization often contains gold and other metals, so the big news here is the discovery of a new way for gold to be found in pyrite.
- It's hot in Western Canada and the consequences are not pretty: Western Canada burns and deaths mount after world's most extreme heat wave in modern history. Most of the homes in Lytton, British Columbia have burned to the ground. Climate change is pretty well baked in now so we will have to learn to manage the unpleasant effects.
- If you are worried about the future, Ugo Bardi has a good essay at The Seneca Effect.

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Plutonic Rocks

Figure 1 - Various Granites
Credit: Jstuby at en.wikipedia, public domain

When molten rock cools slowly, the result is a medium to coarse grained rock. Classification of these plutonic or intrusive igneous rocks is usually based upon the suite of minerals found in the

rock. Classification schemes vary from simple to complex. Figure 1, from my old *alma mater* of the University of Saskatchewan, shows a simple classification scheme.

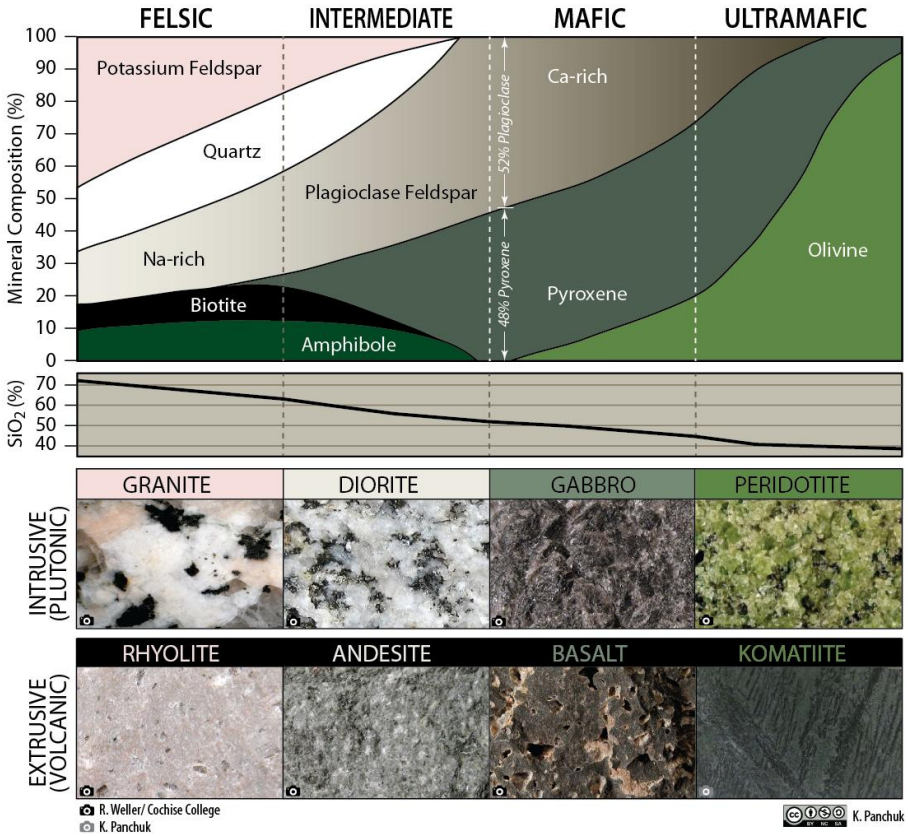

Figure 2 - Classification Scheme for Igneous Rocks

Credit: ***Physical Geology, First University of Saskatchewan Edition***, **Ch. 7.3**

Figure 3, based on the Streickeisen nomenclature for plutonic rocks, is more complex.

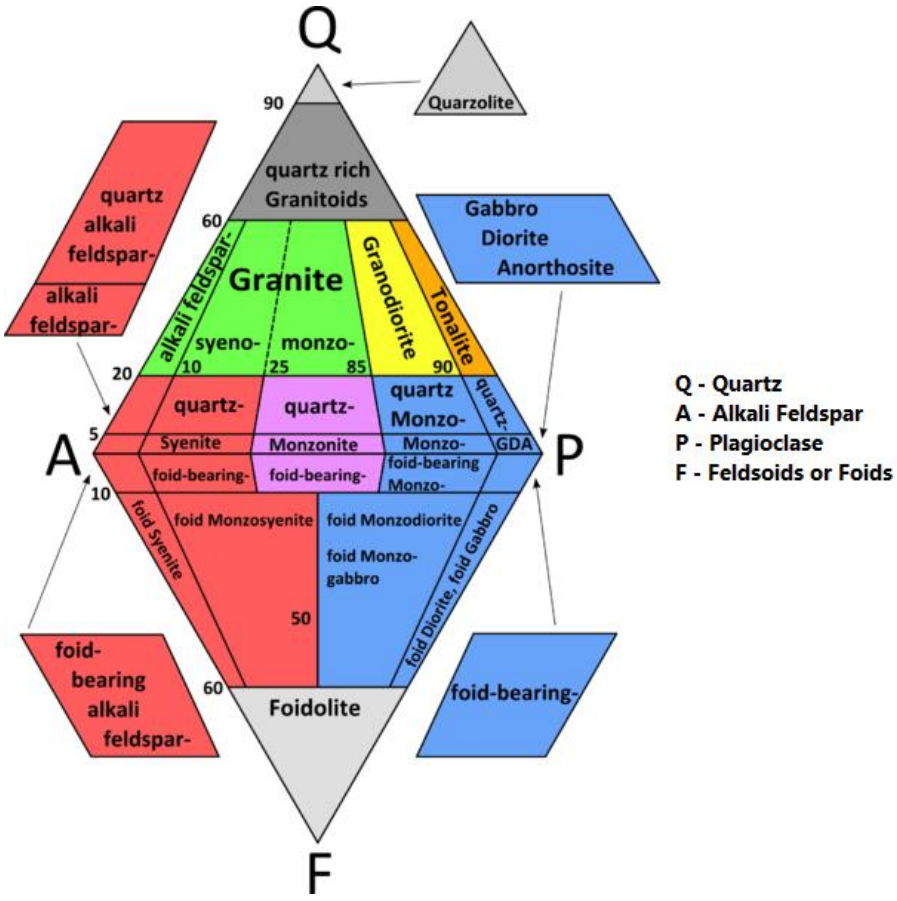

Figure 3 - Streickeisen (QAPF) Classification of Plutonic Rocks
Credit: Tobias1984, Creative Commons Attribution-Share Alike 3.0 Unported license

For simplicity's sake, I am going to discuss the more common kinds of plutonic rocks that are out there.

Granite, Granodiorite and Tonalite

Figure 4 - Granite Obelisk of Hatshepsut, Karnak, Egypt
Credit: Jorge Láscar, Creative Commons Attribution 2.0 Generic license

Most of what is called "granite" falls under one of the three terms for granitic rocks in the Streickeisen nomenclature scheme in Figure 3. These are all light coloured (felsic) rocks made up of feldspars and quartz with minor mafic minerals such as mica and hornblende.

Strictly speaking, granite is a rock made up of predominately alkali feldspars and quartz with minor plagioclase and mafic minerals. Granodiorite is similar, except that the feldspars are roughly evenly divided between alkali feldspars and plagioclase. In tonalite, the feldspars tend to be plagioclase with minor alkali feldspars.

One of the most important use for granitic rocks is in building stone. Whether as crushed rock aggregate or as dimension stone, granitic rocks have been extensively use for construction materials and especially monuments, as in Figure 4. Most gravestones are made out of granitic rocks nowadays due to their beauty and durability.

Pegmatite

Figure 5 - Granitic Pegmatite

An important intrusive rock, pegmatite is defined mostly by its very coarse grain size. Depending on the suite of minerals, the pegmatite may be called granitic, diorite or mafic although granitic pegmatites are the most common.

Pegmatites are important for their minor and trace minerals that make them important ores for lithium, boron, fluorine, niobium, tantalum, uranium, and rare earths. Pegmatites crystallised from the last and most hydrous portion of a magma. This created the environment for the deposition of high concentrations of minerals present only in trace amounts in granitic rocks.

Diorite, Syenite and Monzonite

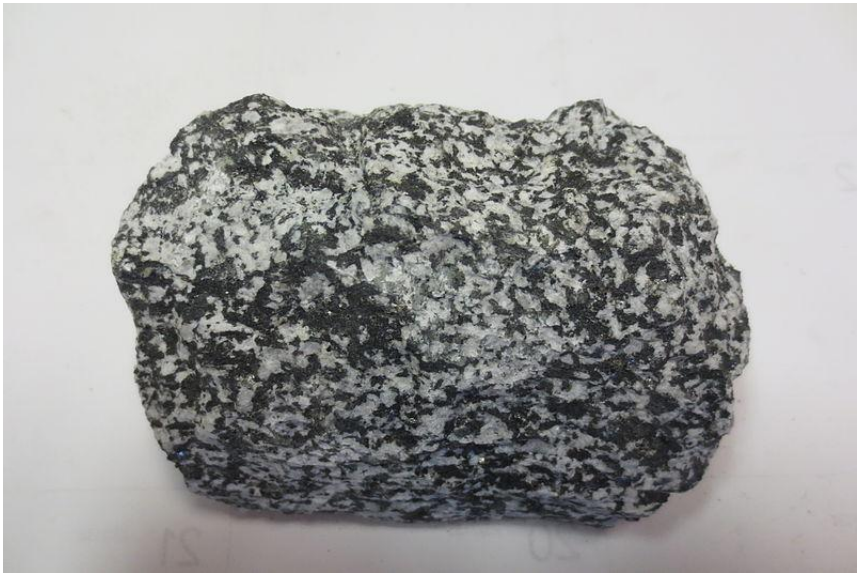

Figure 6 - Diorite

These three intermediate rocks are similar in that they are mostly feldspar with little or no quartz. In diorite, the feldspar is mostly plagioclase, in syenite the feldspars are predominately

alkali feldspar and in monzonite the proportions of plagioclase and alkali feldspar are roughly equal. Nepheline syenites are rich in feldspathoid minerals.

Some of these intermediate rocks, such as nepheline syenites, are important hosts for useful minerals. Other intermediate rocks are useful for building aggregate, especially for the aggregate in concrete where the lack of quartz is advantageous.

Diorite is a very resilient rock and has been used for tools. In Neolithic times, diorite was used to make polished axes, as in Figure 7, below.

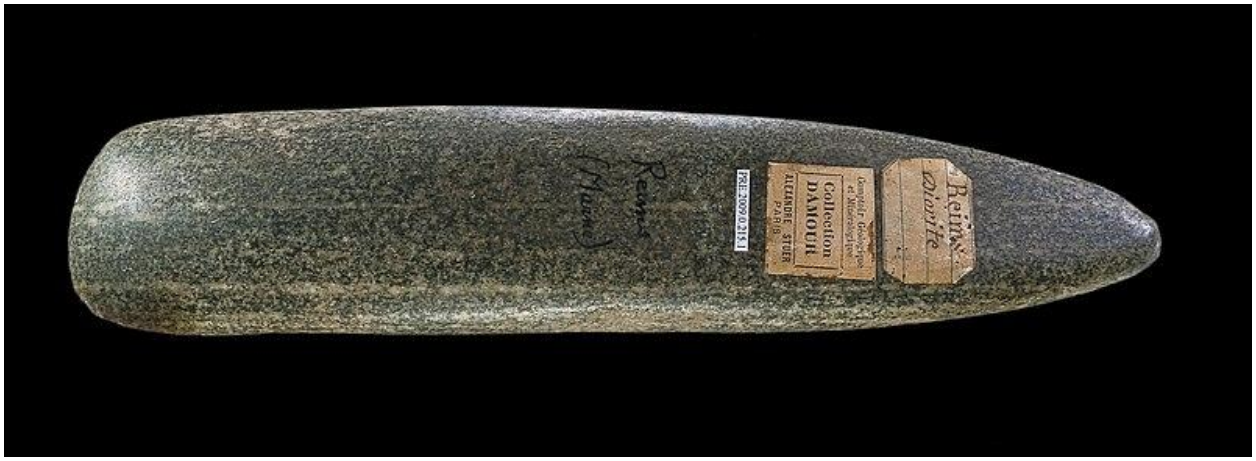

Figure 7 - Diorite Axe

Credit: Muséum de Toulouse, Creative Commons Attribution-Share Alike 3.0 Unported license

Dolerite or Diabase

Figure 8 - Neolithic Dolerite Axes

Credit: Henry Nead, The Portable Antiquities Scheme, Creative Commons Attribution 2.0 Generic license

Another resilient intermediate rock is dolerite, also called diabase. Typically found in igneous intrusive sills and dykes, its mineral composition is similar to basalt and gabbro. Diabase also

has a on ophitic texture where crystals of plagioclase are embedded in a much larger pyroxene crystals, as in Figure 9.

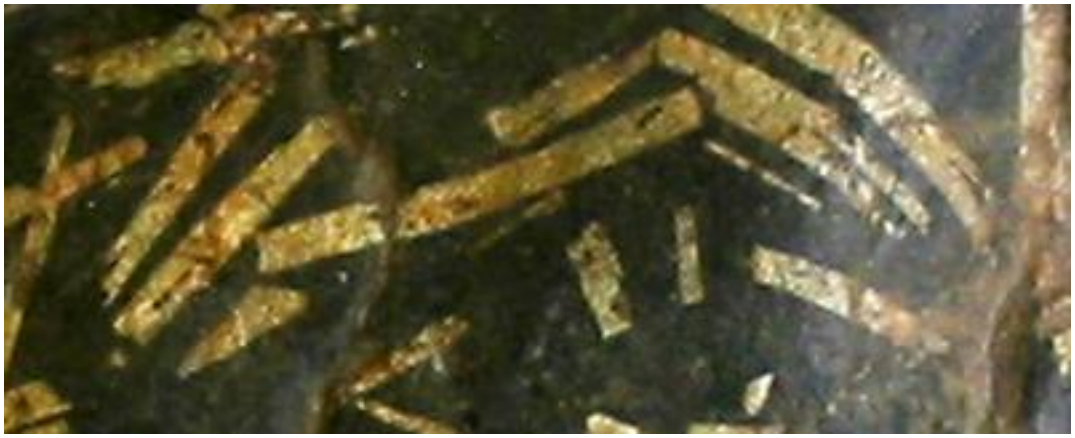

Figure 9 - Diabase Detail

Credit: Siim Sepp, Creative Commons Attribution-Share Alike 3.0 Unported license

Diabase balls were used to carve out the granite obelisks in Egypt by repeated pounding on the granite to wear away channels and quarry the obelisk. Think about that for a while.

Gabbro

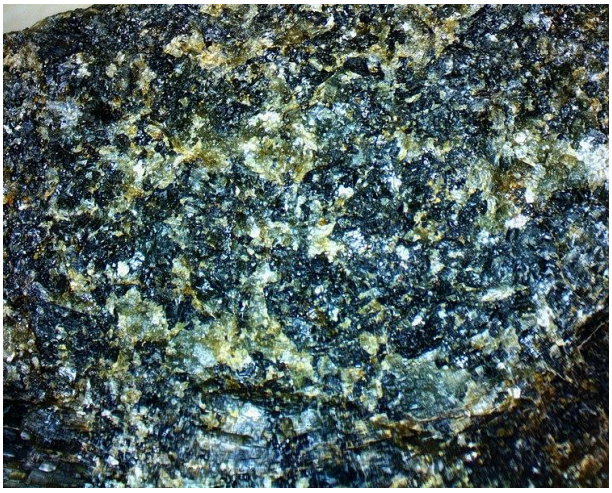

Figure 10 - Gabbro

Credit: Randolph Black, public domain

Gabbro has the same mineral suite as the volcanic rock, basalt; the distinguishing difference is grain size - gabbro has medium to coarse crystals. The mineral composition of gabbro is typically plagioclase and pyroxene, sometimes with olivine. Common accessory minerals are apatite, magnetite, and ilmenite. Much of the oceanic crust is made up of gabbro.

Gabbro is used as a dimension stone and it goes by the trade name of black granite. Gabbro can also host ores of titanium, nickel and chromium.

Peridotite

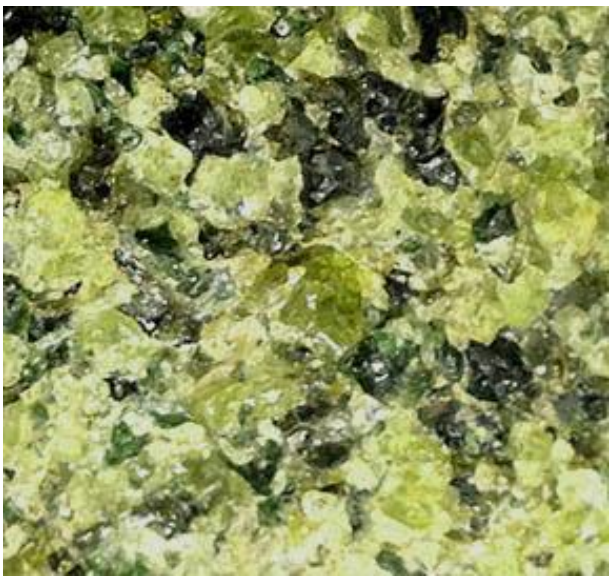

Figure 11 - Peridotite

An ultramafic rock, peridotite is chiefly composed of olivine together with other mafic minerals such as pyroxenes, amphiboles, or micas. It generally contains little or no feldspar. Spinel group minerals, such as chromite, and garnets are common accessory minerals. Peridotite is associated with rocks originating in the Earth's mantle.

An important variety of peridotite is kimberlite, the host rock for diamonds. Kimberlite usually occurs as "pipes" that present as small circular formations with deep roots. The olivine content in kimberlite is usually altered to serpentine minerals. Some peridotite deposits are chromium ores due to their chromite content.

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.