

June 14, 2021

Opening Notes and Comments

A few notes before I go on:

I am going to start my blog entries with short comments of issues in geology or science in general. Today I want to expand on a sentence in my Standard Caveat:

In science, the only authority is the evidence.

In making this statement I want to distinguish between two different meanings of the word science. The first is the use of the word to mean the scientific method. The scientific method is a technique to ascertain the truth about something by making observations, gathering evidence, and then postulating an explanation for the phenomena, based on the evidence. It works regardless of whatever prejudices you may have, provided you apply the process honestly.

On the hand, Science is a social institution made up of people. People can be honest or not, selfish or not, open to new ideas or not. People can have any number of good or bad characteristics. As an institution, Science will seek to perpetuate its power and privileges. Geology is no different, and I don't think we can expect it to be any more noble and virtuous than the people who are part of it. The one thing that should keep our Science in line is a rigid, even religious, adherence to the scientific method. The alternative is to allow the institution of Geological Science to become museum piece whose best days are behind it.

Geologists reading this should realise that their choices are part of the ongoing development of the scientific project and that bad choices often have more significant outcomes than good ones. I think that Shakespeare was right when he had Mark Anthony say this at Julius Caesar's funeral:

*The evil that men do lives after them;
The good is oft interred with their bones;*

[Julius Caesar \(3.2.82\)](#)

If we stick to the scientific method, then the good that we do will outlive us.

A few other notes:

- My article for the [Summer 2021 Keystone Professional](#) is on page 14 of [The Keystone Professional](#) which is the quarterly newsletter of [Engineers Geoscientists Manitoba](#).

- The [LinkedIn posting](#) that went viral now has had 439,781 views, 10,901 reactions and 643 comments as of 9:10 AM CDT, June 14, 2021. I continue to be astonished.
- I will bundle up the first six months of my postings into a PDF file that I'll post on this site. If you want to use it as an introduction to Geology, go ahead, it's free for you to use. Just give credit where credit is due.

Extrusive Igneous Rocks - Part 1

Introduction

While I could go on with many, many other examples of interesting minerals, I think that I've covered the main ones for now. For the next few postings I will discuss the main types of rocks, starting with extrusive igneous rocks. However, I will first define some of the terminology starting with the difference between rocks and minerals.

Now, the difference between rocks and minerals is a fairly basic one. Minerals are naturally occurring solid substances made up of a single chemical compound. Rocks are generally made up of a suite or collection of minerals, although some rocks are made a single mineral.

What are Igneous Rocks?

Igneous rocks are made from molten rock or [magma](#); in that sense they are the original rocks that made the Earth going back to the [Hadean](#), 4.5 to 3.8 billion years ago, when the Earth was a ball of molten material. While we have no examples of igneous rocks from the Hadean, except for meteorites, we have igneous rocks from the early Archean to present.

The two main types of igneous rocks are extrusive (also called [volcanic rocks](#)) and intrusive rocks (also called [plutonic rocks](#)). In my post of March 8, 2021, I posted the following chart showing a general scheme of classification for igneous rocks:

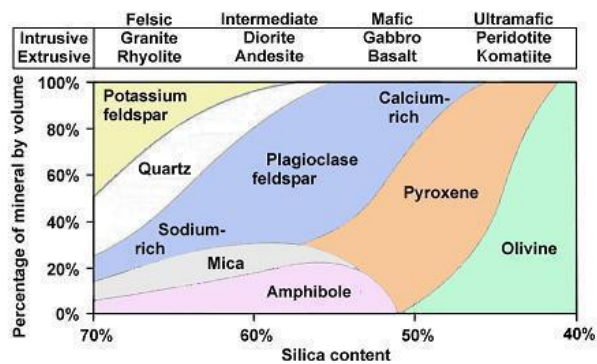


Figure 1 - General Classification of Igneous Rocks

Credit: [Actualist](#), [Creative Commons Attribution-Share Alike 3.0 Unported](#) license

The main difference between extrusive and intrusive igneous rocks is that extrusive rocks cool and crystallize at or very near the Earth's surface. On the other hand, intrusive rocks cool and crystallize deeper in the Earth's crust. Intrusive rocks cool slowly and are made up of coarse to medium sized crystals. Extrusive rocks cool more rapidly than intrusive rocks and tend to be made of fine crystals. For my discussions, I will include [pyroclastic rocks](#) and [volcanic glass](#) among extrusive igneous rocks although [some classifications](#) treat them as separate.

In this week's post I'll look at the classification of extrusive rocks.



Figure 2 - Mt. Etna Making Extrusive Rocks

Credit: U.S. Navy, [Creative Commons Attribution 2.0 Generic](#) license.

Extrusive Rock Classification

There is a wide variety of volcanic rock that you can observe in the field. In an effort to bring some order to the subject, geologists have developed many schemes to classify extrusive igneous rocks. The [International Union of Geological Sciences](#) has proposed two schemes for classifying volcanic rocks:

- **QAPF** - the relative proportions of **Q Quartz**, **A Alkali-Feldspars**, **P Plagioclase Feldspars** and **F Foids (abbreviation for Feldspathoids)**
- **TAS** - Total **Alkali** versus **Silica**

Figure 3 shows the QAPF classification scheme for volcanic extrusive rocks.

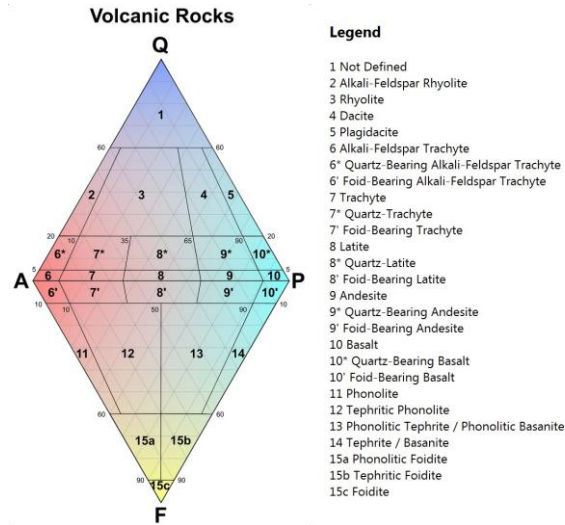


Figure 3 - QAPF Classification of Volcanic Extrusive Rocks
Credit: Adapted from [Definition of qapf diagram, mindat.org](http://www.mindat.org)

Figure 4 show the TAS classification scheme for volcanic extrusive rocks.

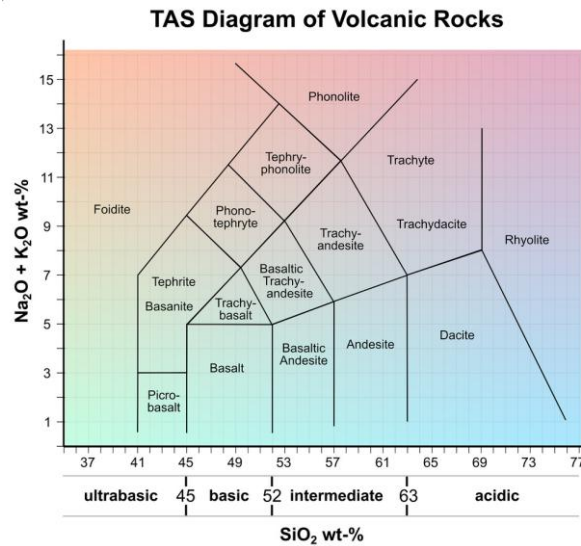


Figure 4 - TAS Classification of Volcanic Rocks
Adapted from: Le Bas, M. & Streckeisen, A.. (1991). The IUGS systematics of igneous rocks. *Journal of The Geological Society - J GEOL SOC.* 148. 825-833.
 10.1144/gsjgs.148.5.0825 and [mindat.org](http://www.mindat.org)

In future posts I will discuss the rock types listed above, here are references to the main classifications:

- [Rhyolite](#)
- [Dacite](#)
- [Trachyte](#)
- [Latite](#)
- [Andesite](#)
- [Basalt](#)
- [Phonolite](#)
- [Tephrite](#) / [Basanite](#)
- [Foidite](#)

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.