



CSMS GEOLOGY POST

WELCOME TO MIKE'S CABINET OF NATURAL CURIOSITIES "WHERE ONE MAN IS STILL TRYING TO FIND ANSWERS TO LIFE'S PERSISTENT QUESTIONS" (AS IS GUY NOIR, PRIVATE EYE).



Saturday, December 22, 2012

PRECAMBRIAN WYOMING: SNOWY, MEDICINE BOW, LARAMIE & HARTVILLE RANGES

The southeastern part of Wyoming contains a number of interesting geological features, including several mountain ranges that extend north from Colorado. One particular part of the country is the Medicine Bow Range of both states whose high peaks in Wyoming are known as the Snowy Range. Another is the Wyoming extension (Laramie Range) of the Front Range of Colorado. I have camped, hiked, collected and fished along a good part of these ranges and have tried to pay some attention to the great exposures of Precambrian rocks.

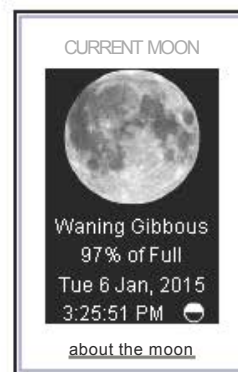
In all of my other articles I have used the term Precambrian in a very loose sense to indicate very old rocks of the earth's crust. What I have failed to indicate is that the Precambrian represents a very, very long time span, perhaps the first four billion years of geologic time—the vast amount of mind-boggling time before the appearance of hard-bodied animals (animals with shells or bones). In contrast to the Precambrian, these hard-bodied animals have only been around for less than .5 billion years. So, the time period of life, as we generally know it, is only about 12% of geologic time.

The Precambrian, and it is formally called a Supereon, is divided into three Eons (remember the Paleozoic, Mesozoic, and Cenozoic are Eons): the Hadean (4.5-3.95 Ga), Archean (3.95-2.5 Ga) and Proterozoic (2.5-.542 Ga) with the abbreviation Ga referring to billions. The .542 Ga or 542 Ma (542 million) is the base of the Cambrian and the time when geologists begin to find hard-bodied animals such as trilobites

THANKS

I APPRECIATE THE ~4500-5000 MONTHLY READERS—A WARM FUZZY FEELING THAT "SOMEONE" IS INTERESTED :) I HAVE NOW REACHED 100,000 VIEWERS, A NUMBER THAT BOGGLES MY MIND. THE BLOG KEEPS ME INTELLECTUALLY ALIVE SO I WILL KEEP POSTING.

CHECK OUT THE BLOG INDEX POSTING.



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and brachiopods. Since these shelled fossils are often used to date rocks, the time since the Precambrian has been subdivided into quite small units of time. Another mitigating factor is that many/most Precambrian rocks have been subject to episodes of metamorphism and igneous activity, both in the Precambrian and the later Eons. It is easy to go out and locate a post-Precambrian sandstone or limestone. However, very few of these sedimentary rocks are preserved as such in the Precambrian record (except some very young ones). Most have been metamorphosed to quartzite or schist or gneiss or marble or actually re-melted and turned into igneous granite.

For additional information on geologic time see the Geological Society of America time scale at:

www.geosociety.org/science/timescale/timescl.pdf

Sims and Finn (2001) have described the Precambrian rocks (aka “the basement”) of Colorado in great detail and the following description is from their paper. In most of our state, the basement consists of crystalline igneous and metamorphic rocks lying stratigraphically below the layered sedimentary rocks of the post-Precambrian (aka Phanerozoic).

In some places, however, sequences of younger Precambrian sedimentary rocks overlie the crystalline rocks; these sequences are included as basement.

The oldest rocks in Colorado are found in a very small area (less than 50 acres) in far northwestern Colorado in the Uinta Mountains (Matthews, 2009). These rocks are termed the Owiyukuts Complex and were metamorphosed about 2.7 Ga—in the Archean. This means that the original rocks were older than this date; something had to be there to metamorphose! The Owiyukuts Complex is actually part of Wyoming—more on this later.



Owiyukuts Complex (Archean) exposed in northwestern Colorado overlain by the Proterozoic Uinta Mountain



Monthly meetings held 3rd Thursday at CO SPS Senior Center, 7:00 pm.



Annual federation meeting will be hosted by the Tulsa Rock and Mineral Society, July 9-13 2014. The American Federation of Mineralogical Societies will meet concurrently. WWW.RMFMS.ORG

Forgive my formatting errors. I have a tough time with Blogger! Most of the time it does not like me.

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Group. Photo cropped from Matthews, 2009.

Most of the Precambrian rocks of Colorado, the ones that core the north-south trending mountain ranges and are composed largely of Proterozoic metamorphosed volcanic-sedimentary gneisses and schist, and some igneous intrusive rocks. The radiometric dates cluster around 1.75 Ga but again there needed to be earlier rocks to metamorphose—geologists just don't know where they came from but suspect oceanic volcanic island rocks. Then around 1.4 Ga a second major intrusive event emplaced several granitic types of rocks such as the Sherman Granite in northern Colorado. And finally, a single large batholith (large intrusive event) left us the Pikes Peak granite at ~1.05 Ga. In summary, readers can think of Precambrian rocks in Colorado as being ~1.75 Ga metamorphic rocks, ~1.4 Ga granite, and ~1.05 Ga Pikes Peak granite.

The Precambrian rocks of Wyoming consist mainly of three major geologic terranes: the Archean *Wyoming Province*, the Proterozoic *Trans-Hudson Orogen*, and the Proterozoic *Colorado Orogen* (part of the Yavapai Terrane). In this usage orogen refers to a belt of deformed rocks commonly metamorphosed and intruded by igneous bodies—the rocks associated with a tectonic or mountain building event.

The oldest rocks in Wyoming include intrusive igneous and granite-like rocks as well as some metamorphic rocks. The Wyoming Province is often called the Wyoming craton since it represents a very stable part of the Precambrian “continent”. Most of the state's mountain ranges where the Precambrian crops out have rocks of this age. Rocks of the Trans-Hudson Orogeny, ~1.9 Ga, are found only in the subsurface in the eastern part of the state, but are exposed in the nearby Black hills. The Colorado Orogen, or Colorado Province, includes the metamorphic rocks with dates around 1.75 Ga as well as the 1.4 Ga intruded granites in the southern Laramie and Medicine Bow ranges such as the Sherman Granite.

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About Me



Mike

Mike is a former University professor and administrator

who now lives in Colorado. I enjoy outdoor activities such as hiking, rock/mineral collecting, fishing and camping. You may read other articles in the Newsletter of the Rocky Mountain Federation of Mineralogical Societies (www.rmfs.org) or the Colorado Springs Mineralogical Society newsletter, the Pick & Pack Pack (www.csms.us). I also am writing and speaking about members of the Colorado Cavalry/Infantry who participated in the march to Glorieta Pass (1862), helped settle central Kansas (1865), and later fought at Beecher Island (1868). Mostly I just try and enjoy life and collect mundane facts and pretty rocks/minerals.

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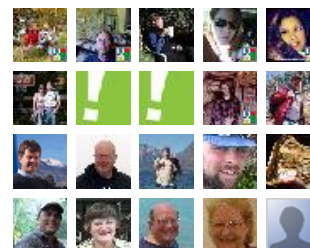
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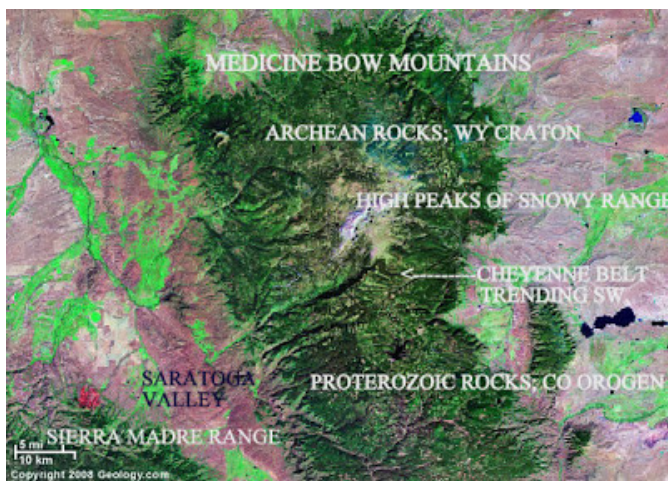
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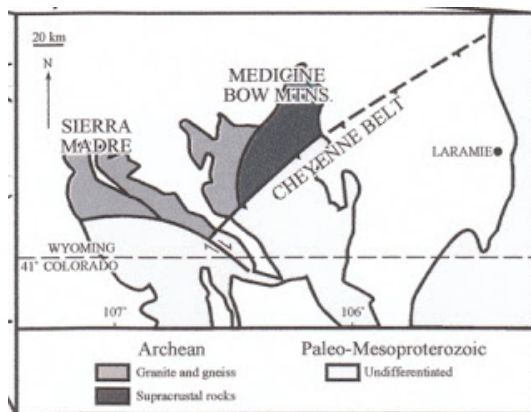


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Landsat satellite image Medicine Bow Mountains, Wyoming. Cheyenne Belt trending NE-Sw below high peaks of the Snowy Range (compare with map below). Image from www.geology.com

One of the amazing features associated with the Precambrian rocks of Wyoming is a narrow belt of highly deformed and tectonically disturbed rocks termed the Cheyenne Belt. This zone is the tectonic suture between two Precambrian provinces, a place where the older Archean rocks collided (plate tectonics) with the younger Colorado Province and were welded together. This is an amazing site, at least for a geologist!



Sketch map showing location of Cheyenne Belt in southeastern Wyoming. From Ward, 2010:

www.colorado.edu/GeolSci/Resources/WUSTectonics/CheyenneBelt/index.html

One of the best places to see the suture zone up close is to travel WY 130 west from Laramie through Centennial over the Medicine Bow Mountains to Saratoga. Popularly known as the Snowy Range Scenic Byway, the highway travels through some of the most fantastic scenery in Wyoming. At the Nash Fork Campground the road crosses the suture line and travelers may observe slate and phyllite that is complexly folded and crinkled (Hausel, 1993). Rocks north

of the Cheyenne Zone in the Medicine Bow Mountains contain the very old Archean crystalline rocks overlain by several tens of thousands of feet of late Archean and early Proterozoic metavolcanics, metasediments (last two terms refer to lightly metamorphosed sediments and volcanics), quartzite, conglomerate and various other rocks that were deposited in rivers, braided streams and shallow marine waters in this ancient Precambrian environment—perhaps an environment similar to the Atlantic coast of North America. The best known geologic unit is the Snowy Pass Supergroup that includes the Medicine Peak Quartzite, the almost white sugar sand quartzite that forms the high peaks of the Snowy Range. Also in the Snowy Pass Supergroup are other sedimentary rocks containing some of the most beautiful stromatolites in the U.S. These features are composed of calcium carbonate, cabbage-like domes deposited in shallow marine waters by cyanobacteria (aka blue-green algae). They may be seen near the Sugarloaf Recreation area.

For a very good description of the Snowy Range, complete with road log stops, see the Wyoming Geological Survey Information Circular No. 32 (author: Dan Hausel) at: www.wsgs.uwyo.edu/Publications/OnlinePubs/docs/PIC/PIC-32.pdf.

Rocks south of the Cheyenne Belt are metamorphic rocks (~1.75 Ga) intruded by granitic plutons (~1.4 Ga).

The Cheyenne Belt extends southwest and barely clips northwestern Colorado where the Owiukuts Complex is part of the old Archean Wyoming Craton; hence the earlier statement that these rocks are part of Wyoming! To the east the Belt is buried under the Great Plains. Chamberlain (1998) believes the Cheyenne Belt may extend as far as northeastern Nevada.

All of this discussion on the Precambrian leads the traveler back to WY 34 heading northeast from Bosler (north of Laramie). The highway traverses through numerous outcrops called the Laramie anorthosite and they are worth a stop to examine the road cuts. Anorthosite is a rather strange igneous rock that is composed almost entirely (at least 90%) of the feldspar mineral plagioclase, but especially common is the variety termed laboradorite. Geologists have determined that the igneous process forming the rock could not have been 90% enriched with plagioclase. Therefore, the mineral must have somehow segregated from the main magma mass (Lindsley and others, 2010). At any rate, the anorthosite was intruded into the Laramie Mountains during the ~1.4 Ga

igneous event. North of these outcrops the mountains cross the shear zone and the rocks become older. Many rocks display the laboradorense of the mineral, and specimens are really nice when slabbed and polished.



Outcrop of anorthosite east of Bosler, Wyoming, Laramie Range.

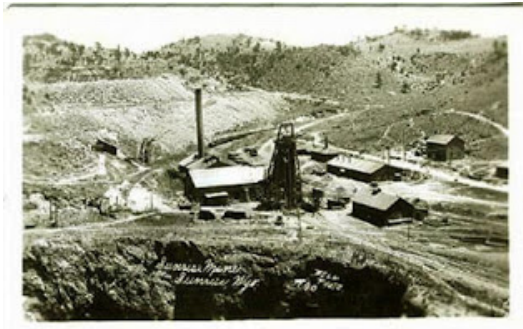


Hand specimen of anorthosite showing laboradorensence.

The final tour of the Wyoming is to examine exposures along WY 270 from Guernsey north to Manville. This road bisects a geologic structure called the Hartville Uplift, a north-south trending Laramide (Rocky Mountain) uplift exposing Precambrian rocks in the center surrounded by outward dipping Paleozoic rocks (Sims and Day, 1999). The uplift is part of the Wyoming Craton and ties in the Laramie Range to the Black Hills and also separates the Denver Basin (east) from the Powder River Basin (west); the rocks are mostly Archean in age but there are some Proterozoic igneous intrusions.

The Precambrian exposures are of interest to Coloradans since the rocks contain large deposits of iron, both banded iron formations and specular hematite. Iron was first produced from the Sunrise mine, and later the Chicago, Central, and Good Fortune mines, near the towns of Hartville and Sunrise in the late 1800's. These mines then shipped this hematite ore to the Colorado Fuel and Iron Corporation open-hearth furnaces in Pueblo, Colorado. (Sims and Day, 1999). At the time when

mining ceased at the Sunrise mine in 1980, the Hartville district had produced about 45 million tons of iron ore (Hausel, 1989).



Sunrise Mine ca. 1907. Photo courtesy of [Wyoming Tales and Trails](#).

The September 13, 1907 edition of the *Mines and Mining* reported: *Sunrise is a company town in the fullest sense. Everything, and may it be said everybody, is owned by the Colorado Fuel and Iron Company. No special brand is necessary, for the fact impresses itself indelibly on all who come here. Visitors are not especially welcomed, which a glance at the passenger accommodations on the train that meets the Colorado & Southern at Hartville Junction forces itself on all comers.*

From Hartville Junction the spur to Sunrise via Guernsey, a distance of about fifteen miles, belongs and is operated by the Colorado Fuel and Iron Company. It is a fine piece of railroad engineering with its high grades and frequent curves and one would not mind paying two prices for transportation, as he must. If only the accommodations were adequate, but, as has been said, the company seems not to care for that sort of traffic. Having constructed the line for its own convenience, no doubt it considers itself an accommodator of the public by attaching a caboose to its trains of ore cars, which caboose has poor seating capacity for about eight people, through several times that number travel over the route as a rule.

The employees were forced not only to depend on the favor of the Company for the opportunity to earn a living, but to live in such houses as the Company furnished, to buy such food, clothing and supplies as the Company sold them, to accept for their children such instruction as the companies wished to provide, and to conform even in their religious worship to the Company's wishes.

In summary, southeastern Wyoming has a number of interesting geological features and rocks associated with the Precambrian. The southern Medicine Bow and Laramie

ranges have rocks that belong to the Colorado Orogen and date to the younger part of the Precambrian termed the Proterozoic. Metamorphic rocks have dates ~1.75 Ga and are intruded by granites, such as the Sherman, with dates clustering around ~1.4 Ga. The northern boundary of these rocks is a shear zone termed the Cheyenne Belt and represents the suturing of the Colorado Orogen to the much older Wyoming Craton (rocks of the older Precambrian termed the Archean). These Archean rocks are exposed in the northern part of these ranges as well as in the Hartville Uplift. In addition, in areas around the suture zone in the Laramie Range (northeast of Bosler) large plutons of anorthosite crop out.

Travelers should make every effort to travel these secondary as they offer many more chances to examine the geology than say, I-25! We also need to remember that the total environment back in the Precambrian was so much different than what we see at the present. Physical environments were similar in that the land contained streams and the oceans had different marine zones; however, plants and animals as we know them did not exist. In addition, the atmosphere contained much less oxygen and the ozone layer did not exist.

Enjoy the travel and remember the words of J. W. Schopf: *For four-fifths of our history, our planet was populated by pond scum!*

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Posted by **Mike** at 4:19 AM

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