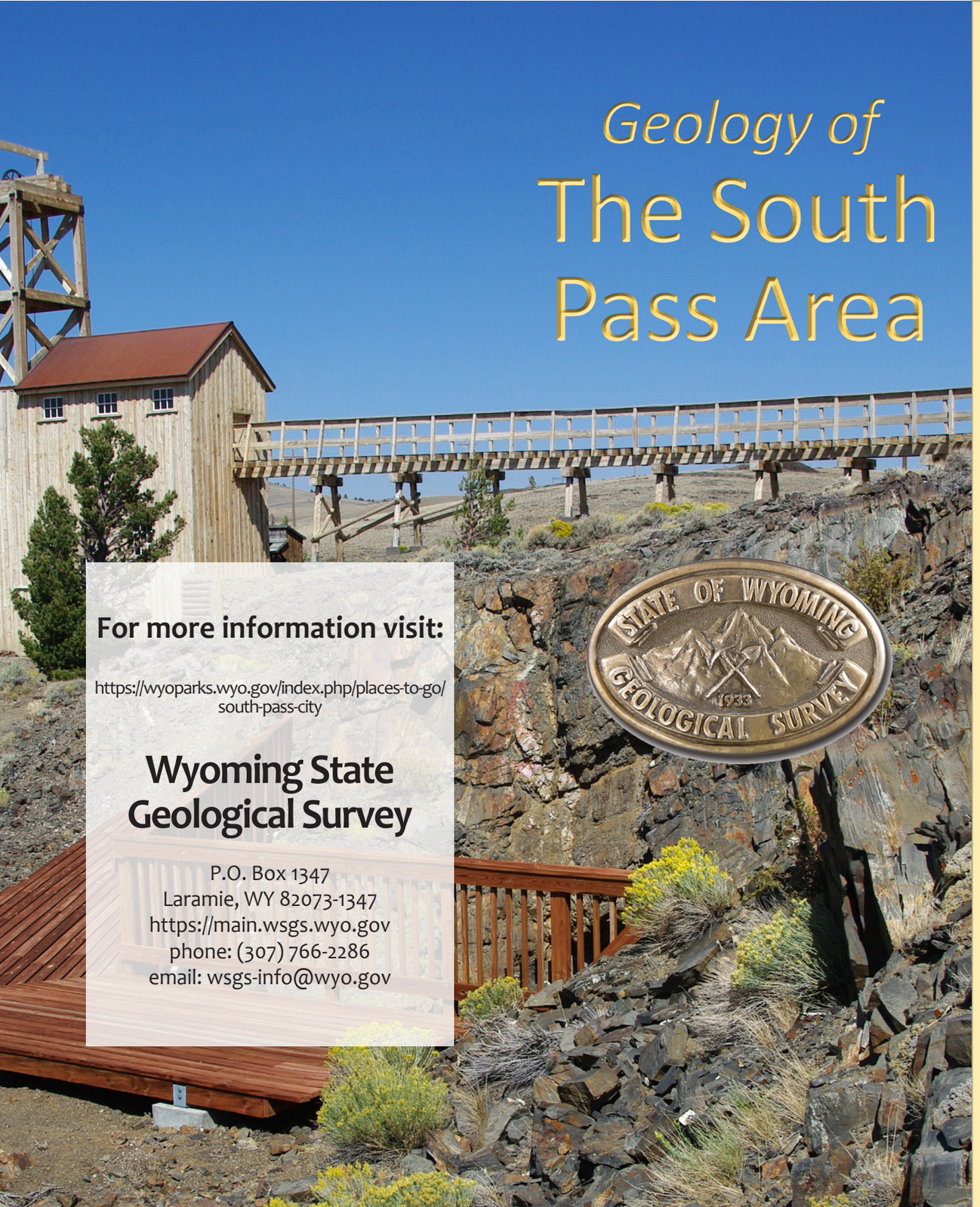
Geology of The South Pass Area



For more information visit:

https://wyoparks.wyo.gov/index.php/places-to-go/south-pass-city

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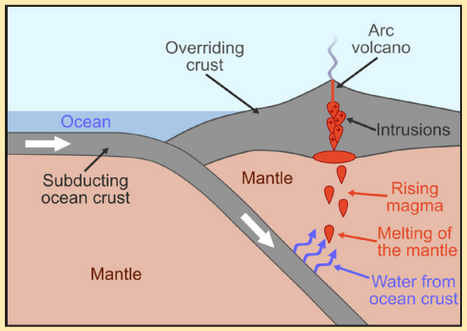
INTRODUCTION

The South Pass-Atlantic City area sits at the southeastern edge of the Wind River Range, about 25 miles south of Lander. The region's intricate geology, with abundant deposits of gold and other metals, prompted mineral exploration efforts that date back to the 1860s and continue today.

GEOLOGIC HISTORY

Nearly 2.7 billion years ago, South Pass looked very different. At that time, central Wyoming was at the edge of a continent in what geologists call a subduction zone, where dense oceanic rock is forced, or "subducted," beneath lighter continental crust. As the oceanic crust subducted, it released water, making the mantle above easier to melt. The resulting magma rose to the surface, forming volcanoes composed of igneous rocks like basalt and gabbro.



Schematic diagram of a subduction zone and arc volcano. Water from the ocean crust causes partial melting of the mantle.

As the volcanoes eroded, sediment accumulated in the surrounding basins. Both the sedimentary and volcanic rocks were later metamorphosed and deformed as they collided with the Wyoming Craton—an ancient, stable piece of continental crust that underlies much of Wyoming. Packages of metamorphosed sediments and volcanic rocks that are sandwiched against continental crust, like the rocks exposed at South Pass, are called greenstone belts due to the typically green color of the metamorphic rocks. After these collisions occurred, huge volumes of magma intruded into the metamorphic rocks and crystallized to form granitic igneous rocks. Over the next billion years, numerous magmatic dikes intruded into and cut across rocks of all types. All of this occurred during a period called the Precambrian.

Folded quartz veins in metagraywacke of the Miners Delight Formation.

Geologic events that occurred from about 1.5 billion to 500 million years ago are missing from the area's rock record. This gap, known as the Great Unconformity, is marked by an abrupt contact where younger sedimentary rocks of the Cambrian Flathead Sandstone lie directly on top of older Precambrian crystalline rocks. The Flathead Sandstone is exposed east of Atlantic City.

Around 65 million years ago, a mountain-building event called the Laramide orogeny pushed Precambrian crystalline rocks over younger sedimentary rocks along large faults across the region and throughout Wyoming. This period of uplift exposed the ancient, gold-bearing metamorphic rocks in the South Pass area.

ROCKS IN THE SOUTH PASS AREA

The oldest rocks exposed in the South Pass-Atlantic City area range from 3 to 1.5 billion years old. These Precambrian gneisses, metasedimentary, and metavolcanic rocks form the South Pass greenstone belt.

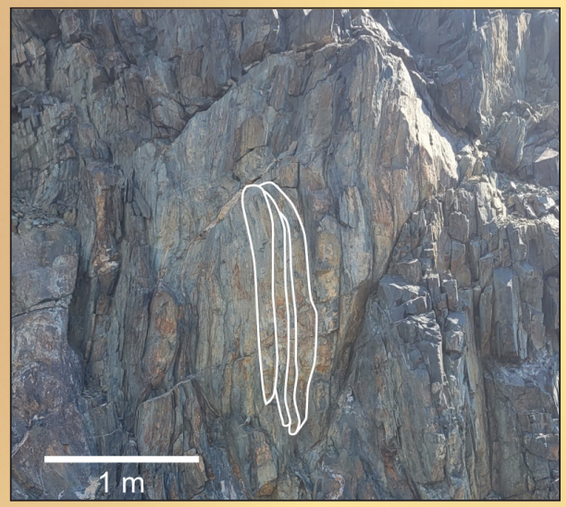
The oldest rock in the area is a 3-billion-year-old gneiss found northwest of South Pass and Atlantic City. This layered metamorphic rock is composed of feldspar, quartz, muscovite, and biotite.

The next youngest rocks are roughly 2.67-billion-year-old metasedimentary and metavolcanic rocks primarily exposed southeast of the gneiss. Oldest to youngest, these are the Diamond Springs Formation, Goldman Meadows Formation, Roundtop Mountain Greenstone, and Miners Delight Formation. The Diamond Springs largely consists of dark, dense metamorphosed volcanic rock. The Goldman Meadows is primarily metamorphosed sedimentary rock, including banded iron formation. The Roundtop Mountain Greenstone is mostly metamorphosed pillow basalt, which is basalt that erupted underwater or flowed into the sea.

Folded banded iron formation in the Goldman Meadows Formation.

The Miners Delight Formation, separated from the Roundtop Mountain Greenstone by a fault, covers most of the South Pass area and includes several rock types, primarily metamorphosed sedimentary rocks called metagraywackes.

Large batholiths of igneous rocks were later intruded into the metamorphic sequence, including the approximately 2.63-billion-year-old Louis Lake and Lewiston Lake granodiorites to the northwest and southeast of the South Pass area, respectively, and the roughly 2.5-billion-year-old South Pass and Sweetwater granites in the western and central part of the area.



Examples of vertically stretched pillow basalts in the Roundtop Mountain Greenstone are outlined in white.

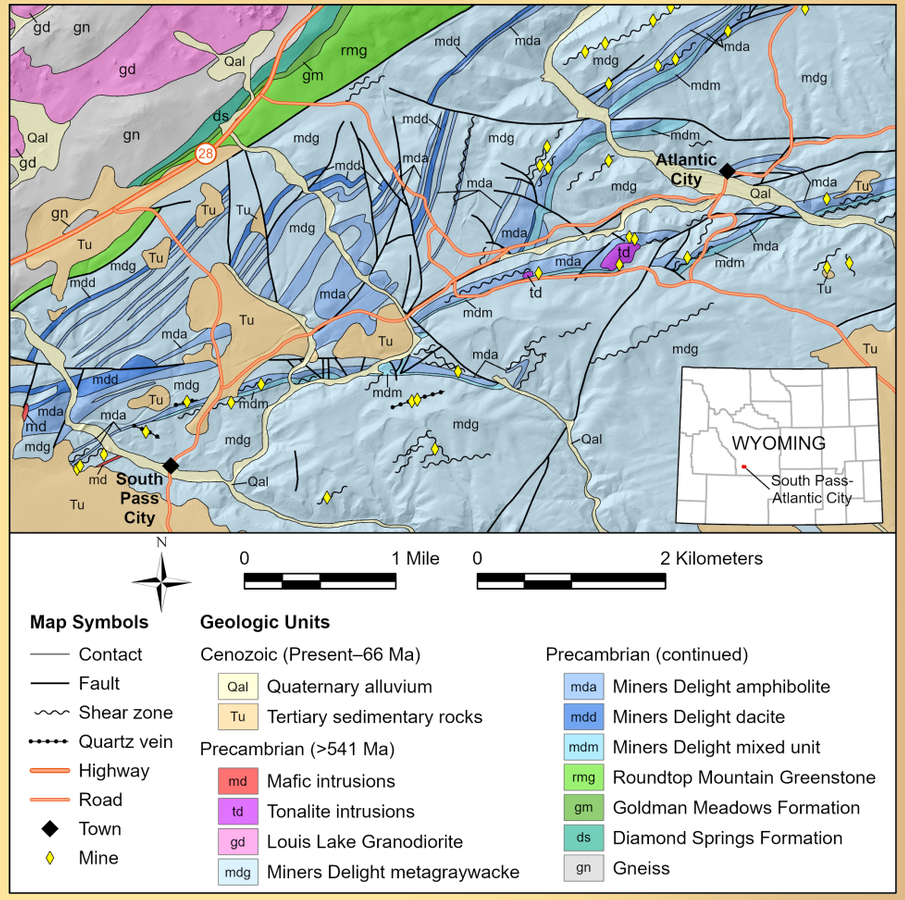
The youngest Precambrian rocks include several age groups of dark mafic dikes and pink to white felsic dikes.

During the Cenozoic era, which spans from 66 million years ago to present day, sediments eroded from uplifted mountains and ash from volcanoes across much of western North America were deposited as conglomerates and sandstones in valleys and streams across the region.

MINERAL RESOURCES

The South Pass area has a wide range of known and potential mineral resources, including gold, copper, and iron. Gold in the area is mainly hosted in the Miners Delight Formation, primarily occurring in quartz veins associated with Precambrian shear zones. Hot fluids carrying gold traveled along these shear zones, and eventually cooled and crystallized into quartz with gold-bearing minerals. Other metals, including copper, silver, and tungsten, were deposited in similar ways.

The Carissa mine, northeast of South Pass City, opened in 1867 and was the largest gold-mining operation in the region. The mine targeted a shear zone in the Miners Delight Formation with numerous quartz veins hosting gold mineralization. The Carissa produced more than 50,000 ounces of gold over its lifetime, lasting through several boom-and-bust cycles until finally closing in the late 1950s.



Generalized geologic map of the South Pass-Atlantic City area, modified from WSGS Report of Investigations No. 44. Ages are in millions of years (Ma).

Gold also occurs in Cenozoic sedimentary rocks in the area. As gold-bearing Precambrian rocks eroded, the sediment and gold traveled downhill in streams. Gold is very dense, so it settles out of streams when currents slow down, forming deposits known as placers. Prospectors in the 1860s targeted these placer deposits first because they are easier to mine than the primary quartz veins.

In previous decades, the banded iron formation in the Goldman Meadows Formation served as a source of iron in the area. The now-closed Atlantic City iron mine, about 6 miles northeast of South Pass City, operated from 1962 to 1983 and produced more than 90 million tons of iron ore. The open pit mine, currently in reclamation, can still be seen today on the northwest side of Wyo. Highway 28.

Exploration for gold and other valuable mineral resources in the South Pass-Atlantic City area continues to the present day.