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Mineral resource assessment: Custer & Gallatin National Forests, Montana

by

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The U.S. Geological Survey (USGS) conducts mineral resource assessments to assist the USDA Forest Service in meeting their legislated mandate to include the best available scientific information in issuing land-use decisions, preparing environmental impact statements, and updating Forest Plans.

The Custer and Gallatin National Forests include a number of discrete parcels of federal land across southern Montana. Mineral resources are an important land management issue in parts of these Forests because of historic metal mining and recent exploration activity. Proximity to Yellowstone National Park and wilderness areas pose land use controversies because recreational use and habitat preservation compete with resource development.

The USGS has compiled the existing data and collected new data on the geology, known mines, prospects, and mineral occurrences, energy resources, regional geophysics (gravity and magnetics), and rock and stream sediment geochemistry at the Forest Service map scale of 1:126,720. These data provided the basis for a mineral resource assessment. The assessment was comprised of the following (Singer, 1993):

♦ *Delineation of the permissive areas that may contain particular types of mineral deposits and energy resources.*

♦ *Estimation of the mineral deposit characteristics using grade, tonnage, and descriptive mineral deposit models.*

♦ *Estimation of the number of undiscovered deposits (only where sufficient data and appropriate mineral deposit models existed).*

Mineral resource assessments provide a perspective on the nature, probable location, and quantity of undiscovered mineral resources for Forest planning.

Separate reports were prepared for each of 4 study areas. Most of the mineral resources of the Forests are in the Absaroka-Beartooth area (1 - heavy outline on the map).

The Absaroka-Beartooth Area (1)

● Mines have operated in the area since the 1860's to produce gold, silver, copper, lead, zinc, arsenic, tungsten, chromium, and platinum-group elements. Mines in production within the past 5 years include the Stillwater platinum-palladium mine, the Mineral Hill gold mine, and the Livingston Marble and Granite quarry, which produces travertine as a decorative stone. Plans for development of a new mine with known reserves in excess of 2 million ounces of gold in the historic New World mining district were abandoned in 1998 when the site of the proposed mine was acquired by the Forest Service.

● The area contains the Stillwater Complex, a feature that is geologically unique in the western U.S. The Complex is a mafic to ultramafic layered igneous intrusion that extends for 26 miles (42 kilometers) along the northern edge of the Beartooth Plateau. Essentially all of the identified lode resources of platinum-group elements and 75 percent of the identified chromium resources in the U.S. are associated with the Complex. Evaluation of exploration data indicates that thousands of metric tons or more of metals such as copper, nickel, chromium, palladium, platinum, gold, and rhodium remain to be discovered.

● Nine areas are permissive for the occurrence of 20 types of mineral deposits. In addition to the deposits associated with the Stillwater Complex, other geologic controls include Archean metamorphic rocks that contain local iron formation and low-sulfide gold deposits, and a series of deeply eroded Cretaceous and Tertiary stratovolcanoes. Deposit types that have been exploited or explored for in the recent past are the most likely types to be the focus of future minerals activity in the area. These types include porphyry copper deposits, gold-bearing skarn and replacement deposits, Archean lode gold deposits, and banded iron formation.

● The 1993 assessment predicted a 50% chance or more for 8 metric tons or more of gold in undiscovered Archean lode gold deposits. Recent exploration has resulted in discovery of a 500,000 ounce gold resource (15.5 metric tons) and additional reserves (McCulloch, 1997) in the study area. Additional copper,molybdenum, gold, and silver may be present in undiscovered porphyry-type deposits and skarn associated with exposed or shallowly buried igneous complexes. Parts of the area have a low to moderate potential for placer gold deposits, uranium, oil and gas, coal, and coal-bed methane.

The Pryor Mountains (2)

● The mineral resources in this area are associated with rocks in the upper parts of the Madison Limestone Group of Mississippian age.

● Uranium was mined from about 40 small (median size of 154 metric tons), relatively high-grade (median grade 0.26% U_3O_8, 0.23% V_2O_5), solution-collapse breccia deposits from mining districts near the Custer National Forest during the years 1956 to 1970. About 80 percent of the area in the Forest is permissive for additional, undiscovered deposits that may contain as much uranium as was produced from the nearby

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mining districts in the past. However, exploration and development of these resources is unlikely in the foreseeable future due to availability of major reserves elsewhere. High radon levels in abandoned mines and localized concentrations of radioactive rocks in the paleokarst horizon in the upper part of the Madison Limestone Group may pose future land-management problems.

● High-purity (high calcium) limestone is readily available and has been quarried locally, crushed, and sold for agricultural and industrial uses. Other limestones and dolomites of varying purity may be suitable for concrete or light aggregate. Liesegang-banded rocks adjacent to uranium deposits may have commercial value as colorful landscape rock. Sand and gravel resources in the Forest are limited and there is a low probability of occurrence for oil and gas reserves.

The Ashland Division (3)

● The rocks exposed at the surface in this northern part of the Powder River Basin belong to the Paleocene Fort Union Formation and consist of shale, siltstone, sandstone, coal beds (as much as 65 ft thick), clinker, and limestone.

● Enormous reserves of lignite and subbituminous coal (estimated at 42 billion short tons of non-leased federal coal within 3,000 feet of the surface) with low sulfur and low to moderate ash content are present in the area. Sixteen strippable coal deposits are present throughout the Forest, covering about one-third of the area.

● Clinker (formed by the natural burning of an underlying coal bed) is abundant, accessible, and easy to excavate. Clinker is used for surfacing unpaved roads, or as aggregate material for paving. The area is also permissive for coal-bed methane in locations where the Fort Union Formation coal beds are deeper than 500 ft. This resource has not been proven in the Forest proper.

● Five hypothetical, prospective petroleum plays have been identified in the area. The area has been explored for oil and gas but without success.

● No metallic mineral occurrences are known in the area. The geology, combined with results of reconnaissance geochemical surveys, argues against any significant metallic mineral resources.

The Gallatin Area (4)

● Over 100 inactive mines, prospects, and mineral occurrences are present in the area. Past production included asbestos (both anthophyllite and chrysotile), gold, silver, copper, lead, zinc, mica, corundum, and coal.

● The two most significant identified resources have been explored, but not developed. These are the Pass Creek lead-zinc-silver-gold deposit in the Bridger Range and the Half Moon lead-copper-silver-gold deposit in the Crazy Mountains. Identified phosphate reserves are relatively low-grade and spatially discontinuous.

● The geology in the southern part of the area is similar to the geology in the Absaroka-Beartooth area and permissive for the occurrence of porphyry copper and related mineral deposits, such as skarns and polymetallic veins. Given the proximity of the southern part of the area to Yellowstone National Park and designated wilderness areas, as well as the lack of surface expression of such deposits, these speculative resources are unlikely to be sought in the foreseeable future.

● Coal was produced for local consumption prior to 1943. Parts of the highly prospective Electric coal field in the Forest are on patented land. Oil and gas plays in the area have a low potential for hydrocarbons.

Products

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