Mineral Resources Report No. 8
IDAHO BUREAU OF MINES AND GEOLOGY
MOSCOW, IDAHO
June, 1957

Radioactive Minerals in Idaho

by

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INTRODUCTION

Radioactive minerals have long been known in Idaho. The thorium mineral monazite was first reported in 1897 and was first produced, as a by-product of gold dredging in 1910, 47 years ago. Uranium was discovered in Idaho in 1920. Most of the radioactive mineral production in Idaho has been from the monazite placer deposits, which have been profitably dredged for a number of years. In April of 1955, however, the first Idaho uranium ore was shipped, from a deposit a few miles south of Salmon City, and uranium is now being produced from Bear Valley in Central Idaho, where the only commercial uranium placer deposit in the world is being dredged.

At least 16 radioactive minerals (13 of them uranium-bearing) have been identified from Idaho localities. This great variety of uranium and thorium minerals comes from occurrences scattered throughout the state, and from almost the full range of possible geologic environments. Radioactive minerals have been found in veins and in pegmatites; disseminated through granitic and metamorphic rocks; locally concentrated in volcanic and sedimentary formations; and in many placer deposits.

URANIUM IN IDAHO

Vein deposits in granitic and metamorphic rocks

In 1949 uraninite was found in the lower workings of the Sunshine and Coeur d'Alene mines in the Coeur d'Alene district and since then has been discovered in other mines of the same district. The uraninite is found in veinlets bordered by red, hematite-stained, altered quartzite. None of these occurrences has proven commercial.

Uranium occurs in two mines in the Gibbonsville district of northern Lemhi County; both deposits are associated with quartz veins which cut quartzite and mica schist. At one of these deposits, 3 miles northwest of Gibbonsville, 100,000 tons of uranium ore averaging better than 0.1 percent U_3O_8 have been blocked out in a shattered quartz zone about thirty feet wide. This block of ore could be mined from the surface and might be upgraded by simple beneficiation.

Uranium mineralization of commercial grade occurs in fractured monzonite of the Hailey gold belt, about 12 miles southwest of Hailey in Blaine County. Finely divided uraninite, some of it sooty, is found in fractured bull quartz which also contains some pyrite, gold, galena, and sphalerite. In this same area uranothorite is widely distributed throughout the monzonite and is locally concentrated in veinlets and

and "hot spots". The U. S. Geological Survey is studying these deposits, as well as some placer accumulations of uranothorite derived from the monzonite.

In Stanley Basin late in the summer of 1955 uranium was discovered in a silicified fault zone cutting granitic rock. Little is yet known about the grade or extent of the deposit, but uranophane and autunite have been identified, and samples with high radioactivity apparently contain a finely divided black uranium mineral, possibly uraninite.

Pegmatite deposits

Pegmatites in Garden Valley, Boise County; in the City of Rocks in Cassia County; and near Deary in Latah County, are known to contain uranium minerals. In none of these areas, however, have commercial deposits of uranium been found.

Deposits in sedimentary rocks

Uranium in phosphate rock

Beds of uranium-bearing phosphate rock are contained within the Phosphoria formation, which is widespread throughout southeastern Idaho from Bear Lake County in the south to the Centennial Range on the Montana-Idaho line. The uranium content of these beds increases westward from Wyoming into Idaho and reaches its maximum, about 0.06 percent, in the vicinity of Bear Lake. Any phosphate rock containing more than 0.01 percent uranium is currently considered a possible future source. A process has recently been developed which is being successfully applied to the extraction of uranium as a by-product of phosphate operations in Florida, from rock which contains 0.1 to 0.4 lb. of U_3O_8 per ton. The application of such a process to the phosphate rock of Idaho, all of which is radioactive, is almost certainly only a matter of time; since the reserves of uranium contained within the billions of tons of phosphate rock in the Phosphoria are very large, such production will substantially increase Idaho's uranium output.

Uranium in lignite and coal

Low-grade, uranium-bearing lignites occur in Payette, Twin Falls, and Cassia Counties. These beds are, like the phosphates, a potential low-grade source of uranium.

Uraniferous coal, carbonaceous shale and limestone occur in the Caribou Mountains east of Idaho Falls in Bonneville County. The highest assay obtained by the U. S. Geological Survey in this area has been 0.053 percent uranium. In all these deposits the uranium is believed to have been leached from overlying volcanic rocks and precipitated in the carbonaceous rocks below.

Uranium in other sedimentary rocks

Some radioactivity has been found in southwest Idaho in sediments associated with volcanic rocks. This area contains permeable, locally carbonaceous, sediments of the same type which are productive on the Colorado Plateau and in Wyoming.

A relatively new discovery of radioactivity associated with sedimentary rocks has been made along the North Fork of Big Lost River in Custer County. A narrow, but possibly extensive, zone of radioactive fault gouge and breccia in graphitic argillite and quartzite may contain uranium.

Uranium in volcanic rocks

Deposits of uranophane in iron-stained rhyolite of the Challis volcanic formation were found early in 1955 a few miles south of Salmon City. Although the boom started by that discovery has now faded away, the possibility of finding commercial deposits in volcanic rocks remains fairly good.

A discovery in the summer of 1955, for example, of uranium in the Challis volcanics of the Blackbird area holds promise of developing into a commercial operation. The uranium is associated with organic material in bedded tuffaceous rock of the Challis formation. Assays as high as 0.6 percent U_3O_8 have been obtained. Since there are no visible secondary uranium minerals, this may be a deposit of primary uraninite or pitchblende. The basic host rock is widespread, although the organic portions of it may be more restricted in extent.

Placer deposits of uranium

The only commercial exploitation of a placer deposit of uranium minerals in the world is now under way in Bear Valley, in the southwest corner of Valley County. Uranium minerals are notoriously unstable, being unable to resist either mechanical disintegration or chemical decomposition. In Bear Valley, however, due to favorable chemical and mechanical conditions of deposition, the uranium mineral euxenite has been concentrated relatively near its source (pegmatites in the Idaho batholith). The good deposits result from the blocking of Bear Creek by a glacier during the late Pleistocene. The Bear Valley sands consist of a great variety of minerals; These complex sands are being worked by two bucket-line dredges, and minerals which contain uranium, thorium, columbium, and tantalum are being recovered by beneficiation of the dredge concentrates. The recovered minerals are euxenite, ilmenorutile, and monazite.

Uranium-bearing radioactive black minerals are found in most of the gold-monazite placers of central Idaho. One of these minerals, brannerite, was first found in a gold placer in the Stanley Basin (in 1920). Places where placer deposits containing these radioactive blacks are known and where there is a good possibility of future commercial recovery are: the Whitehawk

Basin just west of Bear Valley in Valley County; Dismal Swamp in Elmore County; and the country around Elk City in Idaho County; especially along the Red and American Rivers which are tributary to the South Fork of the Clearwater.

THORIUM IN IDAHO

Monazite placer deposits

Unlike uranium minerals, thorium minerals are quite resistant and are therefore frequently found in placers. By far the most important thorium mineral is monazite, which was first recognized in Idaho in placer sands of the Boise Basin in 1897; since then monazite has been found in placers from Owyhee County in the south to Clearwater County in the north. Monazite was first recovered in 1910 as a by-product of gold dredging in the Boise Basin. For many years, however, monazite was not in great demand, and in 1937 it was estimated that one dredge operating in the Warren area could have produced in a few days all the monazite the United States used in a year; at that time, the monazite-rich concentrates were being turned back into the dredge ponds and buried. In recent years the increased demand for rare earths has made recovery of monazite from these Idaho placers economical. Among the richest and most productive of the monazite placers are in Long Valley, especially near the mouth of Big Creek in the vicinity of Cascade. Poor market conditions at the present time have caused the monazite dredges of Idaho to suspend operations.

Thorite veins and monazite replacement deposits

In 1950 thorium lode deposits were discovered in Lemhi County. Thorium-rich, blackened fracture zones and veins containing thorite were found near Lemhi Pass and lenses of monazite in marble were discovered in the northern part of the county. Thorite veins or fracture deposits have recently been found in northern Boundary County.

The replacement deposits of monazite near Shoup in northern Lemhi County are the only ones of their kind which have been reported. The monazite has locally replaced phosphatic marble, and monazite deposits have been found for several miles along the strike of the enclosing marble. These deposits have commercial potential.

CONCLUSIONS

Uranium minerals have been found at many widely scattered localities throughout Idaho and in a wide range of geologic environment. Almost no area in Idaho is ruled out as a possible source of uranium. One commercial uranium deposit, the only one of its kind in the world, is now being exploited. Several promising deposits are being explored. Favorable geology,

widespread occurrence, and nearby productive mines in Washington make Idaho an extremely favorable place to look for uranium. Idaho also has a great potential for the production of thorium and the rare earths.

The largest known reserves of uranium in Idaho are within the Phosphoria formation. Published estimates of the total reserves of phosphate rock in Idaho range from 230,000,000 long tons (certainly too low) to 15 billion tons (a figure presently of academic interest only). A reasonable estimate of the total phosphate rock ultimately mineable in Idaho is 1,000,000,000 long tons. If these reserves contain on the average 0.01 percent U_3O_8, there are about 224,000,000 pounds of U_3O_4 in that portion of the Phosphoria formation which will eventually be mined. Since it can probably be assumed that the uranium by-product concentrate from the phoephate operations will run at least 0.20 percent U_3O_8, we may use the figure of $3.50 per pound of U_3O_8 which the government now pays for material of that grade in calculating the value of the uranium reserves in the Idaho phosphate rock. If the above assumptions are correct the Phosphoria in Idaho contains uranium reserves worth $784,000,000.

Incidentally the phosphate rock now produced each year in Idaho contains the better part of a million dollars worth of uranium, which is not being recovered.

NOTE

This summary survey of the radioactive minerals of Idaho has been taken largely from Pamphlet 102 of the Idaho Bureau of Mines and Geology, entitled Prospecting for Uranium, Thorium, and Tungsten in Idaho, still available for $1.50 from the Bureau office in Moscow. The reader who wishes more detailed information on uranium and thorium in Idaho as well as a comprehensive bibliography is directed to Pamphlet 102.