RECONNAISSANCE OF BERYL-BEARING PEGMATITES IN THE RUBY MOUNTAINS, OTHER AREAS IN NEVADA, AND NORTHWESTERN MOHAVE COUNTY, ARIZONA

By Jerry C. Olson and E. Neal Hinrichs

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ABSTRACT

Pegmatite occurs widely in Nevada and northwestern Arizona, but little mining has been done for such pegmatite minerals as mica, feldspar, beryl, and lepidolite. Reconnaissance for beryl-bearing pegmatite in Nevada and in part of Mohave County, Ariz., and detailed studies in the Dawley Canyon area, Elko County, Nev., have shown that beryl occurs in at least 11 districts in the region. Muscovite has been prospected or mined in the Ruby Mountains and the Virgin Mountains, Nevada, and in Mohave County, Ariz. Feldspar has been mined in the southern part of the region near Kingman, Ariz., and in Clark County, Nev.

The pegmatites in the region range in age from Precambrian to late Mesozoic or Tertiary. Among the pegmatite minerals found or reported in the districts studied are beryl, chrysoberyl, scheelite, wolframite, garnet, tourmaline, fluorite, apatite, sphene, allanite, samarskite, euxenite, gadolinite, monazite, autunite, columbite-tantalite, lepidolite, molybdenite, and pyrite and other sulfide minerals.

The principal beryl-bearing pegmatites examined are in the Oreana and Lakeview (Humboldt Canyon) areas, Pershing County; the Dawley Canyon area in the Ruby Mountains, Elko County, Nev.; and on the Hummingbird claims in the Virgin Mountains, Mohave County, Ariz.

Beryl has also been reported in the Marietta district, Mineral County; the Sylvania district, Esmeralda County; near Crescent Peak and near Searchlight, Clark County, Nev.; and in the Painted Desert area near Hoover Dam, Mohave County, Ariz.

Pegmatites are abundant in the Ruby Mountains, chiefly in the area north of the granite stock at Harrison Pass. In the Dawley Canyon area of 2.6 square miles at least 350 pegmatite dikes more than a foot thick were mapped, and beryl was found in small quantities in at least 100 of these dikes. Four of these dikes exceed 20 feet in thickness, and one is 55 feet thick. A few pegmatites were also examined in the Corral Creek, Gilbert Canyon, and Hankins Canyon areas in the Ruby Mountains.

The pegmatite dikes in the Dawley Canyon area intrude granite and metamorphic rocks which consist chiefly of quartzite and schist of probable Early Cambrian age. The granite is of two types: a biotite-muscovite granite that forms the main mass of the stock and muscovite granite that occurs in the metamorphic rocks near the borders of the stock. The pegmatites were emplaced chiefly along fractures in the granite and along schistosity or bedding planes in the metamorphic rocks.

Many of the Dawley Canyon pegmatite dikes are zoned, having several rock units of contrasting mineralogy or grain size successively from the walls inward. Aplitic units occur either as zones or in irregular positions in the pegmatite dikes and are a distinctive feature of the Dawley Canyon pegmatites. Some of the aplitic and fine-grained pegmatite units are characterized by thin layers of garnet crystals,

forming many parallel bands on outcrop surfaces. The occurrence of aplitic and pegmatitic textural varieties in the same dike presumably indicates abrupt changes in physical-chemical conditions during crystallization, such as changes in viscosity and in content of volatile constituents.

Concentrations of 0.1 percent or more beryl, locally more than 1 percent, occur in certain zones or parts of zones in the Dawley Canyon pegmatites. Spectrographic analyses of 23 samples indicate that the BeO content ranges from 0.0017 to 0.003 percent in the muscovite granite, from 0.0013 to 0.039 percent in aplitic zones in pegmatite, from 0.0005 to 0.10 percent in coarse-grained pegmatite, and from less than 0.0001 to 0.0004 percent in massive quartz veins.

The scheelite-beryl deposits at Oreana and in Humboldt Canyon, Pershing County, are rich in beryllium. Twelve samples from the Humboldt Canyon (Lakeview) deposit range from 0.018 to 0.11 percent BeO, but underground crosscuts have failed to intersect similar rock at depth. Beryl locally constitutes as much as 10 percent of the pegmatitic ore at Oreana. The beryl was not recovered during tungsten mining at Oreana and is now in the tailings of the mill at Toulon, Nevada, in lower percentages than the Oreana ore because of dilution by tailings from other ores milled at Toulon.

Beryl has been found in numerous pegmatite dikes in the Virgin Mountains. Both beryl and chrysoberyl occur in dikes in the Hummingbird claims, north of Virgin Peak, in Mohave County, Ariz. Spectrographic analyses of five representative samples of the principal dike on the Hummingbird claims range from 0.055 to 0.11 percent BeO.

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PART II

ABSTRACT

The inferred beryl reserves in the deposits examined in Nevada and northwestern Arizona are 337 tons in 174,730 tons of rock, equivalent to 43.4 tons of BeO. The largest beryl deposits found in this investigation appear to be the pegmatite on the Hummingbird claims, Mohave County, Arizona, and in the tailings of the Toulon mill where Oreana scheelite-beryl ore was milled.

BERYL RESERVES

The inferred beryl reserves in the deposits examined in Nevada and northwestern Arizona are 337 tons in 174,730 tons of rock, equivalent to 43.4 tons of BeO (table 1).

Dawley Canyon area, Elko County

Table 1 shows inferred beryl reserves of selected deposits in the Dawley Canyon area, based upon visual estimation of the beryl content. The deposits listed include less than half of the known beryl occurrences. In the half not listed, however, beryl was found as only a few scattered crystals or float and probably constitutes less than 0.01 percent of the rock in most of these dikes.

Two factors that make estimation of beryl reserves difficult are the presence of very fine-grained beryl that is difficult to recognize without microscopic or chemical work, and the fact that selective removal of beryl crystals from pegmatite exposures by prospectors may make the present exposures appear lower grade. The presence of very fine-grained beryl is indicated by spectrographic analyses of samples which contain 0.012 to 0.039 percent BeO (about 0.1 to 0.3 percent beryl) in rocks in which no beryl was noticed in the field. Fine-grained beryl and apatite were also found by E. N. Hinrichs in thin sections of pegmatite on the Errington-Thiel claims. Additional study by chemical tests or examination of stained thin sections would be necessary to determine the amount of very fine-grained beryl in the dikes.

The reserves listed in table 1 indicate the general size and grade of deposits in the area according to visual estimation of beryl content. The two factors, fine-grained beryl and removal of beryl from exposures, both would have the effect of making the actual beryl grade somewhat higher than the observed grade shown in table 1, but it is doubtful that the grade is sufficiently high to make beryl mining and milling feasible at present prices.

Lakeview claim, Pershing County

Twelve samples were collected by R. E. Burns in an area of 40 by 60 feet on the surface and two samples in the heading of the adit. The 12 surface samples average 0.0475 percent BeO (minimum, 0.018; maximum 0.11) for the 40- by 60-foot area. This area is estimated to contain about 460 tons of rock, containing 0.095 tons of BeO, per foot of depth.

Inasmuch as the 450 feet of underground workings did not cut any rich ore like that at the surface, the deposit cannot be inferred even to the depth of the underground workings. The sample taken 0-5 feet from the heading contained only 0.0056 percent BeO, and that 5 to 20 feet from the heading, 0.0009 percent. If the deposit persists to a depth of 20 feet, about half as deep as the adit level, the total tonnage of BeO would be about 1.9 tons for the block 40 by 60 feet and 20 feet deep, average grade taken as 0.0475 percent BeO. The deposit may be as much as 140 feet long, in which case the above figures could be about doubled. This length of 140 feet is assumed in table 1.

The refractive index, $\underline{n}O$, indicates that the BeO content of the beryl is 11.9 percent; thus the 4.3 tons of BeO inferred in table 1 represents about 36 tons of beryl.

Oreana mine, Pershing County

The Oreana mine workings are flooded below the main tunnel level. According to John Heizer, the company's manager at Lovelock, Nev., the two principal veins pinched out both along strike and at depth. Kerr (1946, p. 191) states that the rich scheelite-beryl deposit is practically confined to the metadiorite and apparently does not persist into the limestone beneath. Inasmuch as the mine is reported to be worked out, it is doubtful that significant amounts of beryl remain to be mined.

Surface exposures of the western pegmatite are relatively rich in beryl over a distance of about 200 feet, from the point where it tapers to less than an inch in thickness southeastward to a shaft. The average thickness of the deposit over this distance is probably less than 2 feet. Over most of this distance the beryl content is less than 1 percent, but small, exceptionally rich patches contain as much as 10 percent beryl. The mine map indicates some underground workings in this area. Mapping of the underground workings might reveal a few tons of beryl remaining in unmined parts of this block of pegmatite, and possibly in other unmined parts of the deposit, but it is doubtful that more than a few tons of beryl could be found within the limits of the mine workings.

Toulon mill tailings, Pershing County

The Oreana ore was milled at the Toulon, Nevada, mill of the Rare Metals Corporation. Ore from several other properties, containing no beryl, was also milled. The Oreana mine was abandoned in 1942, but the Toulon mill continued to operate until 1946. During this period, almost the entire tailings pile was remilled for tungsten, but it was considered impractical to recover the beryl at this time.

Thirty samples were collected from the Toulon tailings for spectrographic determination of BeO. They represent various depths in auger holes in the tailings. These analyses indicate that beryl is not limited to certain parts of the tailings pile that could be milled selectively for beryl, and suggest that the whole pile would be remilled if any attempt were made to recover the beryl. A weighted average, considering the length of hole represented by each sample, indicates that the entire main tailings dump averages 0.0244 percent BeO. A rough calculation of the tonnage (at 20 cubic feet to the ton) indicates about 55,000 tons of tailings, containing about 13.42 tons of BeO.

Two samples were taken of tailings from Oreana ore that was milled only once. One of these, containing 0.051 percent BeO, represents only 20 to 30 tons of material, which contains about 0.01 ton BeO. The other sample, containing 0.081 percent BeO, represents about 330 tons of material, containing about 0.27 ton BeO. The total BeO at Toulon mill appears to be about 13.7 tons, or about 110 tons of beryl in about 55,000 tons of tailings.

The uniformity of distribution of BeO in the tailings is shown by the fact that of 28 samples of remilled tailings, 16 have 0.010-0.029 percent BeO, 9 have 0.030-0.050 percent BeO, and 3 are in the range 0.0023-0.009 percent BeO. The two samples of tailings that were not remilled, and thus represent material derived from the Oreana deposit alone, contain 0.051 and 0.081 percent BeO.

Hummingbird claims, Mohave County, Arizona

Data on beryl in the pegmatite on the Hummingbird claims are given in table 2, in which the dike is divided into 7 segments differing in size and grade. The depth to which the beryl-bearing pegmatite body extends is unknown, and is arbitrarily assumed to be 250 feet - about half the outcrop length.

One sample of the parallel pegmatite dike 200 feet northwest of the principal deposit on the Hummingbird claims contains 0.091 percent BeO, which is in both chrysoberyl and beryl. Reserves of this deposit were not estimated because of insufficient data. Although the average grade of this dike may be somewhat less than the Hummingbird deposit, it is thicker, and further study may show the beryllium content to be of the same order of magnitude as the dike exposed in the Hummingbird prospects.

Table 2.--BeO content of pegmatite on Hummingbird claims

Length of segment of pegmatite (from southwest to northeast)	Range in thickness (feet)	Average thickness (feet)	Tons of pegmatite per foot depth	BeO[a/] (percent)	Tons BeO per foot of depth
80 ft.	0.3-1.5	1	7	0.11	0.0077
80 ft.	1-3	2.5	17	.11	.0187
80 ft.	1.3-1.7	1.5	10	.11	.0110
80 ft.	1.6-4	3.3	22	b/	.0132
80 ft.	1-1.9	1.5	10	b/	.0060
40 ft.	.6-1.9	1.5	5	.066	.0033
120 ft.	1.8-5	4.5	45	.055	.0248
Total 560 ft.	0.3-5	2.5	116	0.073 (average)	0.0847

a/ Spectrographic analyses by Saratoga Laboratories

b/ Assumed 0.06 percent in tonnage calculations

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Kerr, P. F., 1946, Tungsten mineralization in the United States: Geol. Soc. America Mem. 15, 241 p.