Pamphlet 58 October, 1942

STATE OF IDAHO
Chase A. Clark, Governor

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IDAHO BUREAU OF MINES AND GEOLOGY
A. W. Fahrenwald, Director

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# MICA AND BERYL OCCURRENCE

# IN

# EASTERN LATAH COUNTY, IDAHO

By

J. Donald Forrester

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University of Idaho
Moscow, Idaho

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# MICA AND BERYL OCCURRENCE
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## INTRODUCTION

The primary purpose of the field study upon which the data of this pamphlet are based, was to ascertain the geologic occurrence, relations, and possible potential resources of the mica and beryl mineral deposits that were reported to occur in relatively close association in eastern Latah County, Idaho.

Both mica and beryl are highly important industrial mineral substances of which the United States does not have major or sufficiently developed reserves. In fact, certain types or varieties of mica are presently "critical" minerals and are in urgent demand for a multitude of uses by the war industries and related commercial enterprises. Beryl is the ore mineral of beryllium, which element is the lightest of all metals. Beryllium possesses unusual and outstandingly desirable properties as an alloying medium with copper, aluminum, and magnesium. Its use is growing very rapidly, particularly under the stimuli of present war conditions.

It was deemed desirable, therefore, in view of the occurrence of such vitally important resources to conduct this study and analysis of the situation. Accordingly, the writer, assisted by Dr. John A. Wilson of the Department of Geology, University of Idaho, spent most of the month of August, 1941, examining the relationships of these substances in the field. The writer wishes to acknowledge the work of Mr. Clarence Zeuch, Analyst, Idaho Bureau of Mines and Geology, for his quantitative and qualitative determinations of the several mineral samples.

The surveying method used to determine the relative position and distribution of the deposits was Brunton-tape traverse. Correction for slope departure was maintained and the traverse was closed with remarkable accuracy when the difficult nature of the terrain is considered.

The presence of mica and beryl in this district of Latah County, Idaho, has been technically described by both Douglas B. Sterrett* (5,6) and A. L. Anderson (1,3) in relatively early previous reports which are open to public inspection. In addition, there have been some popularized publications, and several private enterprises have likewise sponsored examinations of the occurrences. Unfortunately, the results of private researches are not generally available for public perusal but the governmental reports and descriptions may be freely used.

The general geology of Latah County, as a whole, has recently been mapped and described by Edward L. Tullis (7) and a copy of this manuscript is on file in the library of the Idaho Bureau of Mines and Geology at Moscow, Idaho. This treatment is of considerable aid to anyone interested in developing a knowledge

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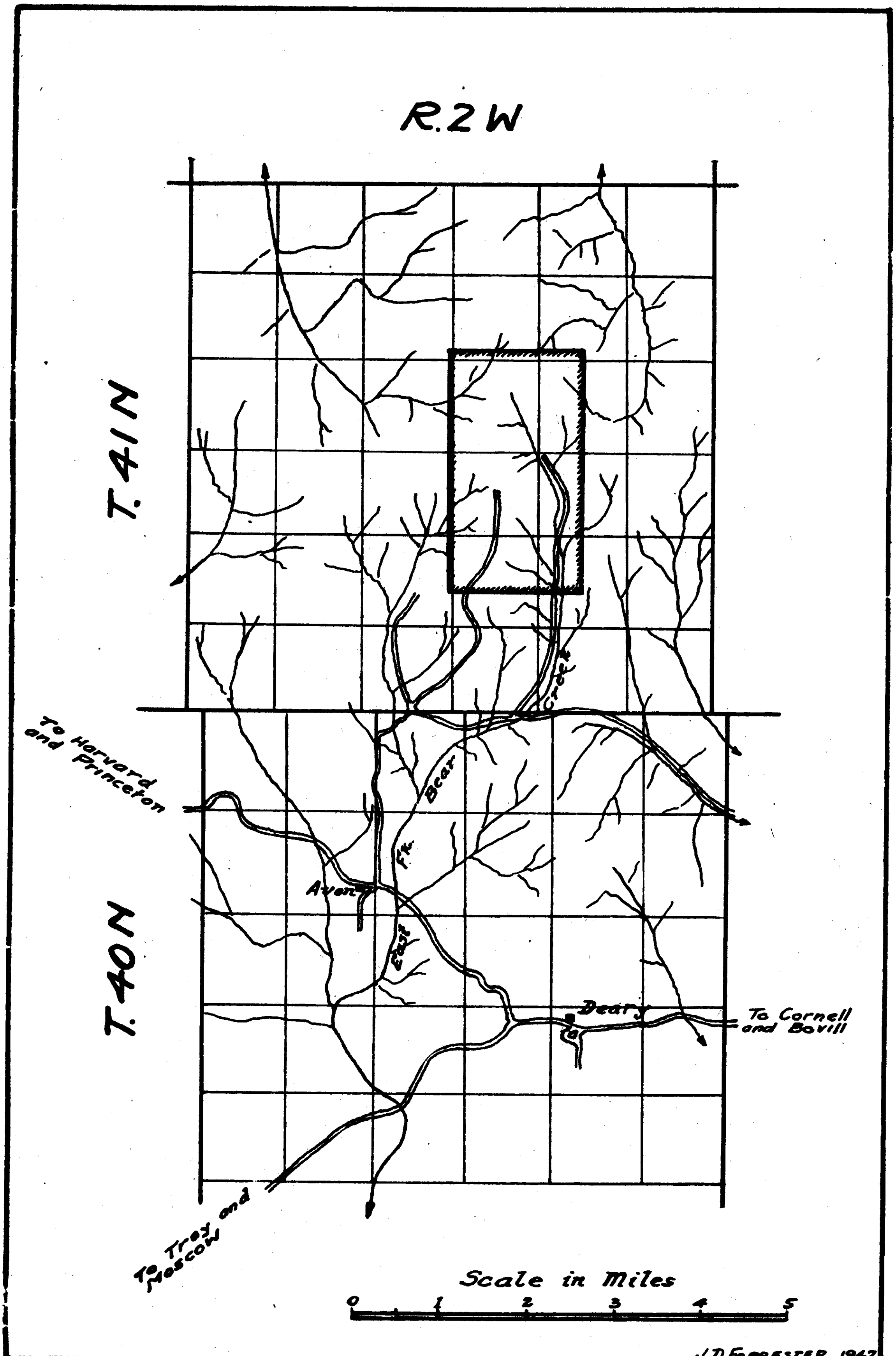
* The reader should refer to page 16 of this report for a bibliographic listing of previous works.

Plate No. 1




# INDEX MAP
# MICA-BERYL EXAMINATION

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of the broader geologic relations.

Specific and reliable data concerning the past production of mineral values and the history of the development of the district are not available. According to Sterrett (5, P.379), the Muscovite Mine Property was first worked in 1888 and the value of mica produced by the year 1910 is said to have totalled at least $80,000.00. The muscovite mica obtained from the work reportedly was of good quality, clear sheets. It is stated that two periods of mining activity ensued and that production for each period was reported to be at least $40,000.00. Anderson (1, P.8) indicates that sporadic mining operations were carried on until about 1918 but that then, because of litigation, etc., the mining activity and interest lapsed. The total value of the mica production by this above date had reached $100,000.00. All of the earlier work, so far as can be determined, was done to secure mica as a marketable mineral. However, about four or five years ago, renewed interest developed in those mineral deposits and beryl was then also recognised by the operators as a potentially valuable mineral substance. Rather extensive mine development work was accomplished but this later period of activity also waned. Since the field work for this pamphlet was undertaken in 1941, a new interest has again led to an attempt to exploit the area and mining operations are presently being furthered.

Sterrett (5, 6) and Anderson (1) have cited the several mining properties, and their descriptions of the development work and mica production are still pertinent inasmuch as the more recent activity has been largely localized to mining on the Muscovite Mine Property. Most of the older tunnels and former open cuts in the district are now caved and sloughed. In many cases, the size and character of the dumps indicate that rather extensive underground openings existed and that the sorting and trimming of mica sheets was a common practice. During this present study, all the accessible underground and surface working places were mapped and were sampled (wherever desirable). These maps are shown in Plates III and IV.

Because of the rather involved and numerous ownerships that now exist in the district, Plate II has been prepared to assist the reader in the orientation and determination of ownership boundaries.

## THE INDUSTRIAL USES AND ECONOMIC FACTORS OF MICA AND BERYL

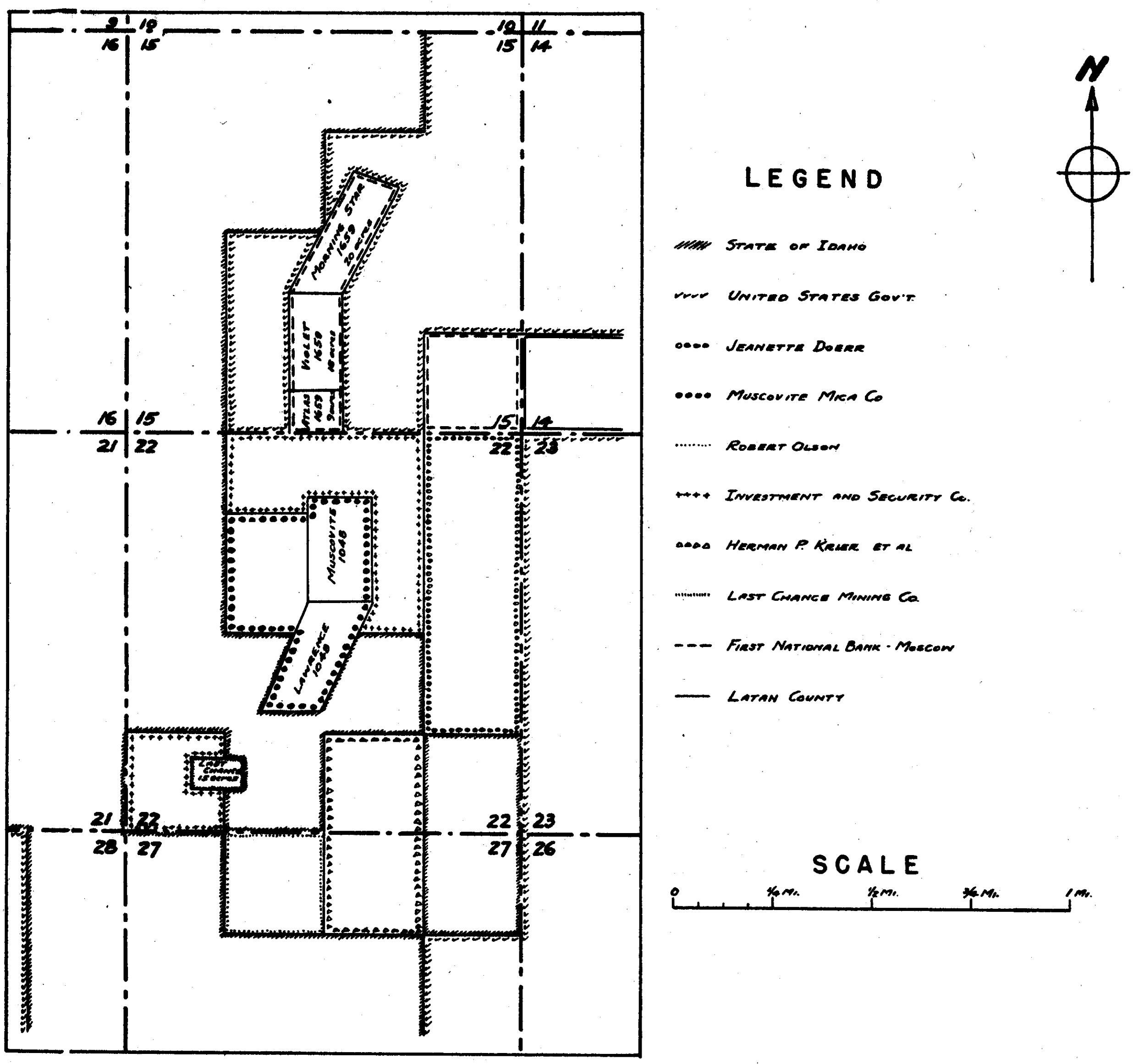
Because the industrial uses and economic factors of mica and beryl are numerous and varied, it is deemed advisable to present a brief analysis of their economic status.

Both of the substances, where noted to occur in this region, are so closely associated in their natural state that a mining venture conducted primarily for either should necessarily, if it is to get maximum yield, attempt the recovery of both.

### Mica

Muscovite mica is practically the only variety of mica that is produced and consumer in large quantities. There is some demand for phlogopite or amber mica, but this type is not generally of major consequence and therefore need not be considered further.

Plate No. 2




**Ownership Data as obtained from Assessor's Office Latah County, Idaho**

**August, 1941**

J.D. FORRESTER 1942

The value of any muscovite mica deposit rests not only upon the relative abundance of the mineral and such similar controlling conditions which must be considered during the analysis of any mineral occurrence, but it also depends largely upon other specific, pertinent factors. For example, certain physical characteristics such as the size of sheets, clearness of color, absence of breaks and flaws, flexibility, electrical and heat resistance, etc., must all be evaluated in judging a deposit. Because the consuming industry thus places rigid specifications upon the mica product, there is a wide range of types and products offered by the mica producers. The relative value of each type rests largely upon how it meets such controlling factors as given above. The chief varieties marketed in this country are: (1) sheet mica (the value varies as the size of sheet); (2) Condenser mica (a special strictly specified sheet product); (3) Punch and circle mica (sheets between one square inch and two square inches --used for making washers and small radio stampings); (4) Scrap mica, including ground mica. Thus, it is evident that unmanufactured mica is marketed in a wide variety of qualities and sizes that range in price from a fraction of a cent per pound for scrap materials to $20.00 or more per pound for clear, large, flat sheets.

The apparent consumption of sheet mica in the United States during 1940 (9, pp. 1357-1368) exceeded all previous records and there does not appear to be any reason why this trend should not continue, at least during the present war effort. Domestic production experienced an increase in 1940 of over 100 per cent above that of 1939. This production, however, was still less than it had been in 1937 and earlier boom years.

"Built-up" mica is made by pasting tissue-thin splittings of mica together. This industry reached an all-time record in 1940 and was working to full capacity toward the end of the year. The consumption of mica splittings for use as "built-up" stock was 44 per cent greater than in 1939.

The consumption of scrap in the United States and the production of ground mica failed to establish new yearly records in 1940 but even this phase of the general mica industry was quite active nevertheless. In fact, by far the largest tonnage of mica used in this country is scrap. Much ground mica is obtained as a by-product from micaceous and kaolin schists and from the mines and cutting plants of sheet mica. It appears that the United States could supply its entire demand of scrap by domestic production, although considerable tonnages are still imported from British India.

It is doubtful if the United States can supply all of its sheet mica needs even under the stimuli of war conditions. The dearth of resources, together with exceedingly cheap labor in India, Madagascar and Ceylon, make it a difficult problem to overcome. It is particularly pertinent to note that a trade prejudice seems to exist among many consumers in favor of foreign sheet mica. There is, however, no geologic nor mineralogic reason why domestic mica should be less desirable than foreign materials of similar chemical and physical characteristics.

Our domestic mines furnish almost enough punch and circle sizes for home consumption, but more than two-thirds of our requirements of larger sizes have been imported from foreign sources. Most of the highly choice "condenser" mica has come in the past from British India, but more recently South America has been supplying some to us.

The uses of mica are numerous but it serves most widely as an insulating medium of heat and electricity. Other quite important commercial uses are in the manufacture of wallpaper, rubber, paints, and plastic specialties. It is difficult to distinguish the purely civilian from the military uses of mica because many of the ordinary industrial uses of mica in electrical machinery, communications, automobiles, and trucks are also essential to a war program. A greatly increased consumption of high-grade sheet mica and splittings for built-up mica has developed for use directly in aircraft, tanks, and other military equipment.

The average prices per pound for clear, desirable mica in December 1940 were as follows:

| | |
|---|---|
| Punch | $ 0.087 |
| Circle | 0.109 |
| Sheets, 1-1/2" x 2" | 0.429 |
| 2" x 2" | 0.780 |
| 2" x 3" | 1.182 |
| 3" x 3" | 1.582 |
| 3" x 4" | 1.925 |
| 3" x 5" | 2.750 |
| 4" x 6" | 3.372 |
| 6" x 8" | 4.817 |
| 8" x 10" | 10.284 |
| Splittings for built-up mica | 1.30 |

The average price in 1940 of domestic uncut sheet and punch mica which was sold or used by producers was $0.18 per pound. In this same year, 27,984 short tons of ground mica, valued at $1, 016,628.00, was sold.

<u>Beryl</u>

The growth of beryllium production in the United States appeared to be phenomenal in 1940 (9, Pp.743-746). Although statistics of domestic production and consumption of beryllium cannot be published, available information indicates that the United States' production of beryl has ranged in recent years from less than 100 tons to a maximum of not more than 200 tons annually. The 1940 domestic beryl production was certainly greater than the above maximum estimate and there is a steadily rising trend of imports as well. In fact, a new record was established during 1940 when 805 short tons were brought in. They were valued at a total of $23,865.00, and came from Argentina (422 short tons), Brazil (377 short tons), and from South Africa (6 short tons).

From 50 to 100 tons of beryl are ground and used in certain kinds of super-refractory pottery and ceramic wares each year, but by far the most important industrial use is, as before noted, that of an alloying medium. The chief consumption of beryllium is in a copper alloy although beryllium nickel and beryllium aluminum are also being investigated. The effect of these alloys is, it seems, to greatly increase the strength and hardness of the product without seriously reducing the conductivity.

Great strength combined with good electrical and heat resistivity, high resistance to wear, good fatigue resistance, and other special properties, have led to the rather extensive use of beryllium copper in many industries. The surface of the alloy materials seems quite permanent (non-oxidizing) and this factor, combined with a high elastic modulus and at least a fair conductivity to both heat and electricity, contributes to its very desirable use in delicate precision instruments.

Most of the metal is now produced commercially in the United States as a 4 per cent master alloy with copper and is sold in this form at $15.00 per pound of beryllium content. This is a cost of somewhat less than one-half of what was formerly charged for German-produced metal of less purity.

Wrought beryllium alloys are made by remelting the master alloy and these, when ready for fabrication, range from 0.1 per cent to 2.25 per cent in beryllium content. The best known and most commonly used of such products is that which contains from 2 to 2.5 per cent in beryllium content. The price for fabricated strip of this type is $0.98 per pound when copper is quoted at $0.12 a pound. The price varies as the price of copper. Cobalt, if added in a quantity of about 0.25 per cent, seems to stabilize the desirable properties of the alloy. In fact, the beryllium content can then be reduced without appreciably weakening the material.

One particular alloy on the market contains approximately 0.5 per cent beryllium and 2.6 per cent cobalt, and there is also another alloy with only 0.1 per cent beryllium and 0.5 per cent chromium. The remainder of the substance is copper in each case.

Beryllium-alluminum alloy products are reported to be excellent for aircraft metal. They are as strong as steel, noncorrosive and are lighter than aluminum. Relatively pure beryllium metal is also being treated and processed in the United States for use in instruments where a high velocity of sound waves is desired.

A beryllium acetate bath process is now being used in England to manufacture a new rayon-like fabric from sea weed.

It would appear that one of the chief deterrents to the more rapid industrial expansion in the use of beryllium has been the doubt among manufacturers as to the adequacy of beryllium ore supplies to sustain a steady production. The price of the material has also, of course, been a governing factor but it is probably a pertinent factor, largely by virtue of the former condition. That is, if sufficient resources of beryllium are developed, the price should be expected to decrease somewhat.

Some of the more common uses of beryllium alloys are as springs and in business machines, as fuse springs in large ammunition, as solderless connectors and spring terminals, and as sparkless safety tools.

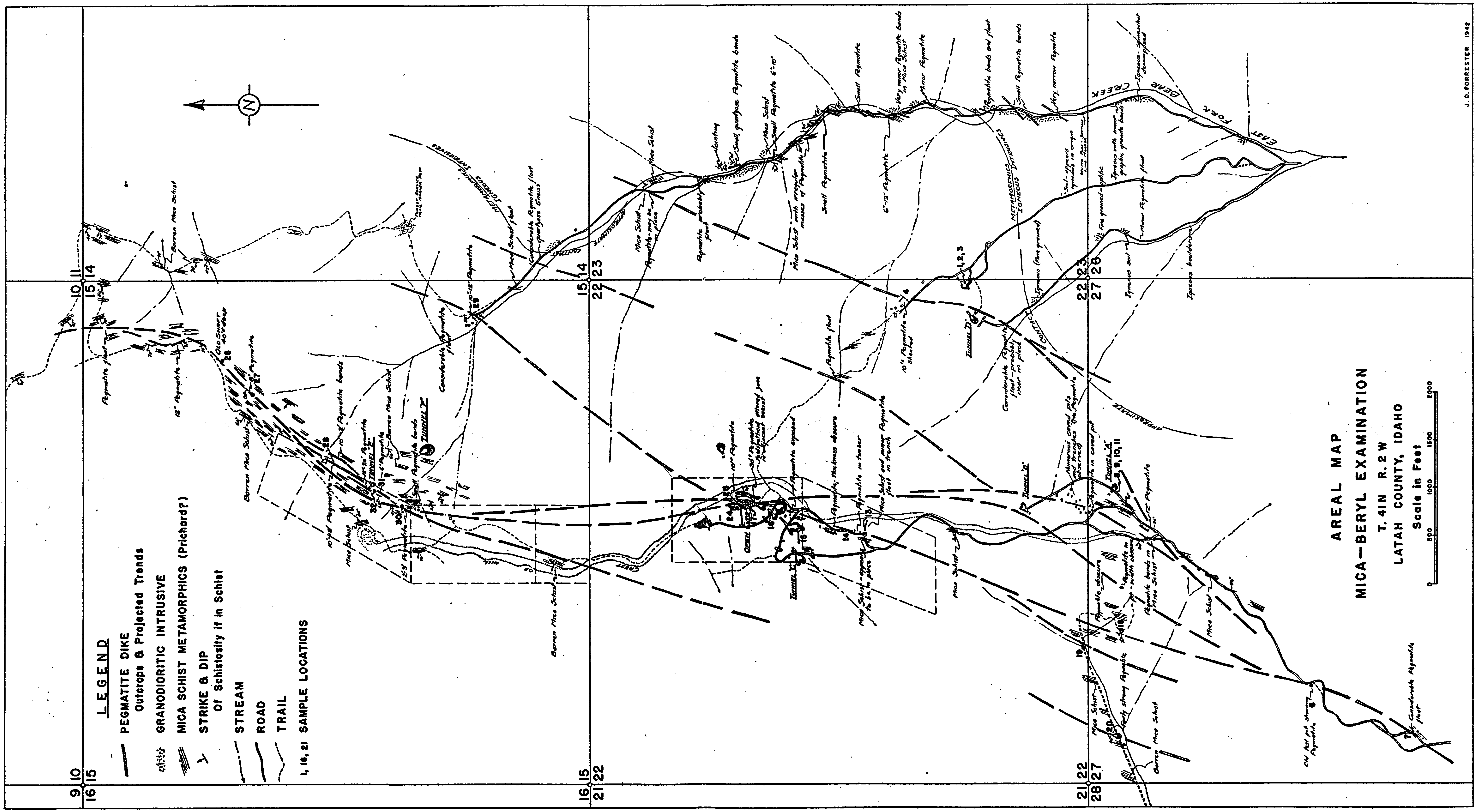
From the above statistics, it is evident that commercial trends will undoubtedly require that beryllium products be used more and more extensively in the future.

## PHYSICAL FEATURES

### Location and Accessibility

The mica-beryl bearing region under consideration is approximately five miles northeast of Avon, Idaho, and is in the east central part of Latah County. More specifically, it encompasses an area of about three square miles and extends over portions of Sections 15, 22, 23, and 27 of Township 41 North, Range 2 west; Boise Principal Meridian. (Plates I and III). The section lines as shown on

Plate No. 3


AREAL MAP
MICA—BERYL EXAMINATION
T. 41N R. 2W
LATAH COUNTY, IDAHO
Scale in Feet
0 500 1000 1500 2000
LEGEND
PEGMATITE DIKE
Outcrops & Projected Trends
GRANODIORITIC INTRUSIVE
MICA SCHIST METAMORPHICS (Prichard?)
STRIKE & DIP
Of Schistosity if in Schist
STREAM
ROAD
TRAIL
1, 16, 21 SAMPLE LOCATIONS
EAST FORK BEAR CREEK
J. D. FORRESTER 1942

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Plates I, II, and III, are unsurveyed. That is, common section corners were found in a few instances in the field and were, therefore, used as points of origin and control for the traverse which was run. The majority of the section boundaries have been, however, adapted from Forest Service plots and markers. The boundaries are shown primarily for purposes of orientation and for presentation of reasonably accurate limiting features.

Avon and Deary, a neighboring town to the east, are both readily accessible by improved graveled highways but the roads northward into the mica-beryl area are generally poor and often impassible to automobile travel. This is particularly true of the territory immediately adjacent to and through the mineralized zone. Most of the roads shown on Plate III as traversing the tract are in fact now quite extensively overgrown with brush and trees and, in addition, are sloughed on the road shoulders and are eroded and washed as the result of heavy rains. They are shown because it is along such routes that easiest access can be gained to various points and also because they offer usable future grades if further development work is undertaken in the area. Even if the roads are improved in the future, it appears that entry to, and haulage from the mines by vehicles would be best accomplished by high-powered trucks, tractors or horses. A branch railroad from main-line connecting points into Deary affords rail haulage and transportation from that point.

## Topography, Climate, and Vegetation

The area is situated on the crest of a mountain spur that has constituted, in this vicinity, the highland tract against which the lava flows of the Columbia Lava Field were abutted at the time of their extrusion.

Surface drainage is to both the north and south away from this mountain eminence (plate I). The Palouse and Potlatch Rivers are the major streams whereby surface run-off reaches an eventual confluence with the master Snake River, and thence flows to the Columbia River and on into the Pacific Ocean. Most of the smaller streams are intermittent in character and, therefore, do not yield a sustained flow of surface water throughout the year. Many of the gulches and canyons do not offer sufficient water to be considered as potential water resource sites. Taken all in all, it does not appear that enough surface water exists in the immediate vicinity for the demands that an extensive development of a mineral industry would require.

The mean elevation of the district is roughly 4000 feet above sea level. Dense stands of white pine, tamarack, red fir, cedar, and a few other tree species occur in the region and very heavy second growths of various shrubs and grasses have sprung up. This dense vegetation cover, together with the pervasive and very deep development of a soil mantle, has tended to largely obscure the subsurface geology. The unusually thick soil mantle is thought to have resulted from a combination of several of the circumstances given above. For example, extensive erosion does not ensue because of the dense vegetation and because of the mature erosion stage of the topography. This, in turn, tends to support a more rank vegetation and to retard run-off and thus to contribute to further mineral decomposition and soil development. There is sufficient timber in the near-by area for all mining requirements.

## GEOLOGY

### General Geology

The general geology of the region, as a whole, is briefly as follows: Pre-Cambrian metamorphic rocks have been intruded by late cretaceous or early Tertiary acidic igneous materials. These above rock types were then covered, in part at least, and after considerable erosion, by extrusive basic lava flows during middle and late Tertiary time. The pegmatitic differentiates in which the mica and beryl, with other rock-forming minerals, occur are, therefore, intrusives that have penetrated the host rocks (pre-Cambrian) and have subsequently been exposed by erosion. The pegmatites are genetically associated with somewhat more basic (granodioritic) phases of the major intrusive mass in that they represent the precipitates of differential juices given off from the original source magma.

### Detailed Geology

In greater detail than above, it is evident that the predominant rock types of the region under consideration are Lower Belt Series, probably Prichard age, metamorphic schists and micaceous quartzites. These Belt Series rocks have undergone considerable warping as is evidenced by the prevalent schistosity and similar allied features. The attitude and alignment of the imposed structures are quite uniform and persistent and, where measured in several localities, are recorded on Plate III. The mean strike is roughly N 10° E and the dip varies between 50°-75° W. The schists undoubtedly were sediments prior to their metamorphism and it appears that the original bedding, although now quite widely obscured, is essentially parallel to the schistose cleavage. The above structural conditions signify that the area is on the flank of a major north-south trending fold, which was probably developed before the emplacement of the batholithic intrusives. Generally, the schistosity has resulted from dynamic metamorphic warping although in the proximity of pegmatitic injections and near the border of the grandodioritic intrusives, the relations have been also somewhat further complicated by hydrothermal alteration and by contact metamorphism.

Anderson (1, P.5) has stated the outstanding mineralogic characteristics of the schists and gneisses as follows:

> "In the typical schist the component minerals are muscovite and biotite micas and quartz, with small crystals of garnet and tourmaline as local accessories. Muscovite and biotite are usually both present and intergrown with one another in regular bands which alternate with others of quartz. In some places quartz is the dominant mineral and the rock is a quartz schist. The color of the rock varies between silvery white, when muscovite is the dominant mineral, and dark gray or black, when biotite is the more plentiful."

In several places, along a border zone near the granodiorite intrusive and usually in the proximity of the pegmatite dikes, the Belt Series rocks have been subjected to contact metamorphism and to hydrothermal alteration. This has commonly resulted in the formation of garnetiferous zones and in the development of extensively tourmalinized tracts. In addition, there appears to have been a tendency for gneissic banding to form near the major intrusive mass and also for feldspathoid, schistose zones to be localized adjacent to the pegmatites. Although such metamorphic and alteration effects are not always observable near the pegmatite masses in the field, it is suggested that they may be used as criteria to judge the proximity of pegmatites and allied phenomena when and if they are encountered during prospecting or mine development work.

The pegmatite dikes, which occur in tabular zones and lens-like forms within the major metamorphic rock mass have resulted from the differential cooling, as before noted, of the main "mother" magma. This magma has also yielded granodioritic and monzonitic variations as may be observed in the southeastern portion of the area under consideration. It is thought that similar materials also underlie the entire region, probably at relatively shallow depths (1000 feet, more or less). That is, the rocks of the Belt Series, as now exposed on the mountain spur, are resting upon an intrusive rock "footing" and thus do not extend to great depths below the present erosion surface.

Gradational segregations of the intrusive masses have occurred and may be noted in several localities. For instance, cases of definite, clear-cut pegmatite dikes are common; likewise, there are occurrences of graphic, granular intrusive rock zones which are aplitic in character. The typical granodiorite also exists as a differential rock type product. The aplite rocks represent, in the writer's opinion, the cooled equivalent of an intermediate phase between the true dioritic magma and the pegmatite-forming solutions. Basic, fine-grained dikes were noted in two localities but they are not considered to be of importance so far as this analysis of the mica-beryl situation is concerned.

The pegmatite structures have been injected along zones that are roughly parallel to the schistosity and relict bedding of the older rocks. The beryl and commercial muscovite occur within the pegmatites and hence, the discovery and development of those desired substances rests largely upon the recognition and exploitation of the pegmatite zones. In addition to muscovite and beryl, quartz, albite, tourmaline, garnet, and apatite, also are usually present as component minerals of the dikes. In fact, of the several substances listed above, beryl is the least abundant, and in many cases it is conspicuous by its absence. Some dike structures are characteristically mica dikes, that is, mica may predominate to the relative exclusion of most of the other minerals; some dikes are, in turn, composed largely of quartz and/or of feldspar etc. Anderson (2) has given an excellent description of the mineral relationships in the pegmatite dikes.

The beryl is usually pale yellow-green and the crystals may range from those of microscopic dimensions up to particles several inches across. Most frequently, the crystals are from 1/8 inch up to 1/2 inch in cross section.

Although the dikes are often composed of certain dominant minerals, an average proportionate composition of most of the pegmatites is roughly, by volume, as follows: 40 - 50% quartz, 40 - 50% feldspar, and 0 - 20% muscovite. The muscovite distribution is irregular within the altered, lensy dikes and its presence is usually quite localized. Pods and elliptical bands exist, and the mineral may range in character from large, excellent mica-book accumulations to small segregations contaminated by other associated minerals. The amount of suitable sheet mica that can be obtained from any given pegmatite occurrence may vary from practically zero up to as much as 10 to 12% of the mica content of the rock. Sheet sizes which could most frequently be realized, range from 2 inches to 6 inches by 6 inches, after trimming, with the smaller dimensioned sheets by far the most numerous. The color of the material in "book" form is wine-yellow or rum, but when the books are split into commercial sheets it is uniformly clear and free from stain. However, the sheets very commonly evidence the presence of physical imperfections such as wedge, tangle-foot, and ruled structures. These features will contribute to undesirable splitting treatments and to high reject proportions when sheet sizing procedures are attempted.

The feldspar and quartz content of the pegmatites is such that they too might constitute economically valuable mineral products if they could be satisfactorily recovered and concentrated by a beneficiating treatment process.

The component pegmatite minerals occur in close association but there does not seem to be any rule whereby individual mineral localizations may be determined. In other words, there is no prevalent zoning of characteristic mineral sequences which might be applied to assist in selective mining operations within the pegmatites. This condition would induce rather expensive mining development costs per ton of desired yield inasmuch as no plan seems extensively applicable whereby the relative mineral content may be anticipated. This factor is particularly pertinent because, in addition, the pegmatite structures are themselves quite lensy and do not maintain appreciable continuity. This presents a mining hazard which would be continually present during prospecting and development operations.

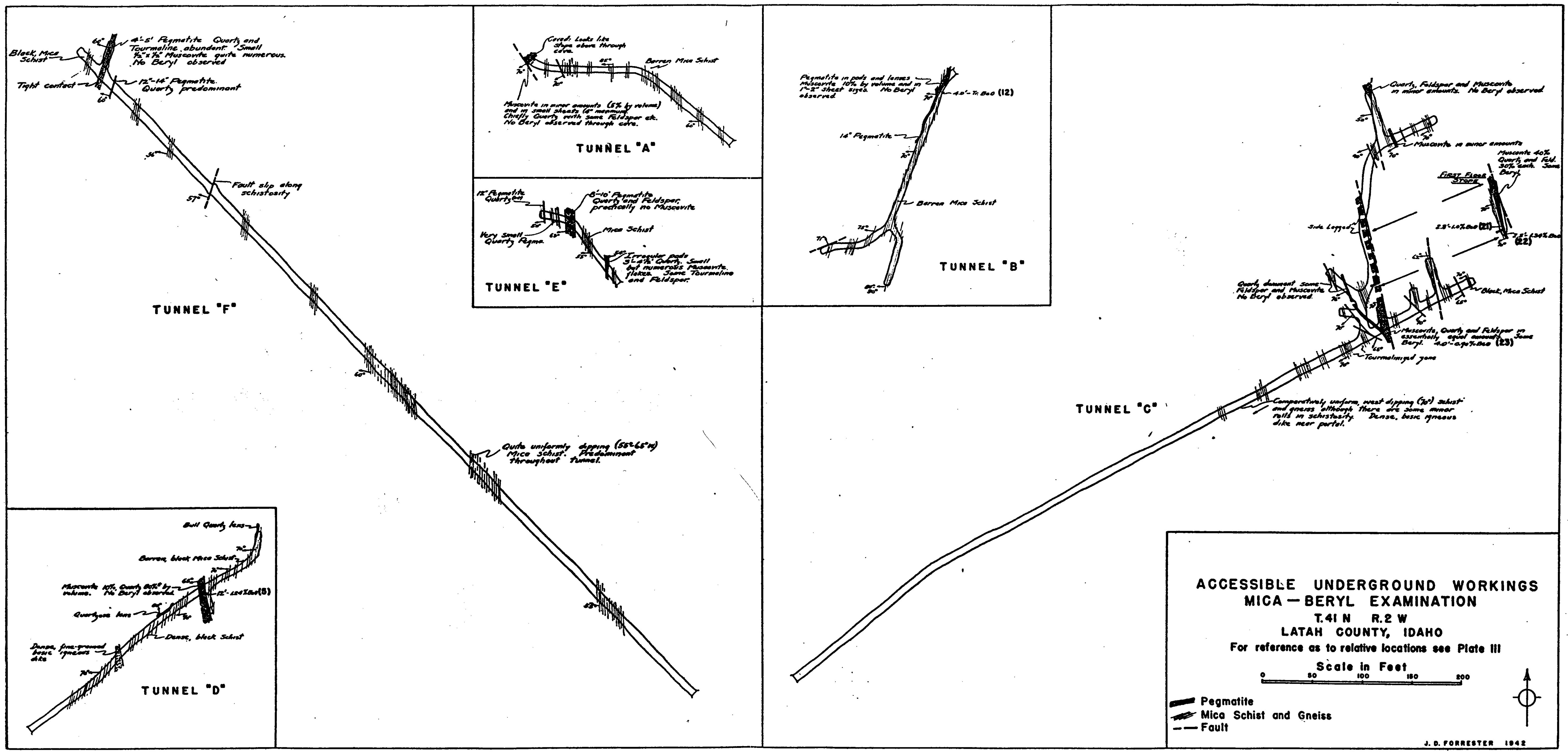
The reader will observe on Plate III that rather sweeping trends and projections have been shown for the pegmatite structures. This effort has been indulged in primarily to delineate the probable manner of occurrence and to thus attempt some assistance for the future prospector. They are merely, on the basis of rather limited field exposures, reasonable structure projections and probably are subject to correction or modification because the inherently lensy nature of the pegmatite dikes and the presence of the extensive soil mantle may have obscured the true relations. The widths of the pegmatite dikes are exceedingly variable and often range from 20 or 30 feet to only a few inches in short distances.

Unfortunately, the method which necessarily was used in depicting the conditions on the finished maps did not offer complete facility to present all details as noted in the field. The claim lines and corner monuments have become obscured during the past several years and this feature, together with the rather involved nature of the ownerships which have transpired, does not lend itself to ready comprehensive descriptions of the area by means of the ownership subdivisions. Sterrett (5, 6) and Anderson (1) have both noted the several mining properties and such relationships have likewise been shown wherever feasible on the maps of this report. The claim boundaries were not surveyed, as before mentioned, during the examination and are, therefore, approximated from previously compiled data.

Tunnels "A" and "B" (Plate IV) are probably on the old Levi Anderson holdings; Tunnel "C" is situated at the Moscovite claim; Tunnel "D" has been driven on the Bentz property; and Tunnels "E" and "F" have apparently been driven as development of the Morning Star claim. The other controls of land units and their relation to the geologic situation may be ascertained by cross reference to Plates II and III.

Analyses of Samples. The field locations of the materials upon which the following sample analyses are based are shown on Plates III and IV.

Plate No. 4


4'-5' Pegmatite Quartz and Tourmaline abundant. Small ½"x½" Muscovite quite numerous. No Beryl observed
Black, Mica Schist
Tight contact
12"-14" Pegmatite. Quartz predominant
Fault slip along schistosity
TUNNEL "F"
Quite uniformly dipping (55°-65° W) Mica Schist. Predominant throughout tunnel.
Cored: Looks like stope above through core.
Barren Mica Schist
Muscovite in minor amounts (5% by volume) and in small sheets (6" maximum). Chiefly Quartz with some Feldspar etc. No Beryl observed through core.
TUNNEL "A"
12" Pegmatite Quartz
8'-10' Pegmatite Quartz and Feldspar, practically no Muscovite
Very Small Quartz Pegma.
Mica Schist
Irregular pods 3'-4½' Quartz. Small but numerous Muscovite flakes. Some Tourmaline and Feldspar.
TUNNEL "E"
Pegmatite in pods and lenses Muscovite 10% by volume and in 1"-2" sheet sizes. No Beryl observed.
4.0'-Tr. BeO (12)
14" Pegmatite
Barren Mica Schist
TUNNEL "B"
Bull Quartz lens
Barren, black Mica Schist
Muscovite 10%, Quartz 80% by volume. No Beryl observed.
12'-.124% BeO (5)
Quartzose lens
Dense, black Schist
Dense, fine-grained basic igneous dike
TUNNEL "D"
Quartz, Feldspar and Muscovite in minor amounts. No Beryl observed
Muscovite in minor amounts
Muscovite 40% Quartz and Feld. 30% each. Some Beryl.
FIRST FLOOR STOPE
Side Lagged
2.5'-1.0% BeO (21)
(22)
Quartz dominant some Feldspar and Muscovite. No Beryl observed.
Black, Mica Schist
Muscovite, Quartz and Feldspar in essentially equal amounts. Some Beryl. 4.0'-0.90% BeO (23)
Tourmalinized zone
Comparatively uniform, west dipping (70°) schist and gneiss although there are some minor rolls in schistosity. Dense, basic igneous dike near portal.
TUNNEL "C"
ACCESSIBLE UNDERGROUND WORKINGS
MICA — BERYL EXAMINATION
T.41 N R.2 W
LATAH COUNTY, IDAHO
For reference as to relative locations see Plate III
Scale in Feet
0 50 100 150 200
Pegmatite
Mica Schist and Gneiss
Fault
J. D. FORRESTER 1942

## MICA - BERYL SAMPLE ANALYSES

| Sample Assay No. | Description of Sample | % BeO* | % $PO_4$ | % Fe | Remarks |
|---|---|---|---|---|---|
| 1 | Muscovite specimen sample from Bentz stock pile. Stock pile of 2 tons Plate 3 | --- | --- | --- | Muscovite books average about 3" x 4" in sheet dimension. Good quality. |
| 2 | Grab sample of pegmatite Stock pile on Bentz dump Plate 3 | Trace | Nil | ** | Sample composed primarily of quartz, hornblende, and feldspar. Muscovite present in rather small and disoriented booklets. Some graphic granite in sample |
| 3 | Selected grab sample of pegmatite on Bentz dump Plate 3 | Trace | Nil | ** | Sample is similar to #2 except that quartz content appears higher and there is less feldspar present |
| 4 | Chip sample of pegmatite exposed in pits and on outcrop. Outcrop looks sheared. Plate 3 | Trace | Nil | ** | Sample composed of 15-20% small book mica (1½" x 1") ave., balance of materials are quartz and feldspar. Muscovite has pronounced crenulations and tangle-foot and "A" structure imperfections. |
| 5 | 12 ft. width Pegmatite in tunnel Plate 4 | 1.24 | ** | ** | Sample of pegmatite in place. Appears to be composed dominantly of quartz, some apatite and tourmaline also present |
| 6 | Selected grab sample of pegmatite from dump of old test pit Plate 3 | Trace | Nil | ** | Sample is composed of 5-15% small tangle-foot muscovite. Sheet size about (1" x 1½"). Balance of material is quartz (dominant), and feldspar (abundant). |
| 7 | Chip sample from outcrop? Width 3' - 4' Plate 3 | Trace | Nil | ** | Dominantly quartz and feldspar. Muscovite very minor and in small, disoriented booklets |
| 8 | Muscovite specimen sample from stock pile on dump. Stock pile is small. Plate 3 | --- | --- | --- | Muscovite is best grade on Levi Anderson dump. 2" x 5" sheet sizes. Good, clear material |

| Sample Assay No. | Description of Sample | % BeO | % $PO_4$ | % Fe | Remarks |
|---|---|---|---|---|---|
| 9 | Muscovite specimen sample from dump<br>Plate 3 | --- | --- | --- | Muscovite is probably comparable to second grade mine run from Levi Anderson tunnel Wedge structures and "A" and tangle-foot imperfections common (1½" x 2"). |
| 10 | Selected grab sample of pegmatite and $MnO_2$? on Levi Anderson? dump<br>Plate 3 | Trace | ** | ** | Sample is chiefly quartz, apatite and hornblende with considerable $MnO_2$. Some small disoriented muscovite sheets are also present. |
| 11 | Selected grab sample of pegmatite on Levi Anderson? dump<br>Plate 3 | Trace | ** | ** | Sample is composed of about 70% quartz, 15% feldspar and 10% hornblende. About 5% muscovite in small, disoriented booklets |
| 12 | 4' width pegmatite in tunnel.<br>Plate 4 | Trace | ** | ** | Sample is 4' cut of pegmatite. Quartz and feldspar are dominant, feldspar somewhat kaolinized. Muscovite about 10 - 15% of volume but in small (1" x1½") sizes and with "A" structure imperfections. |
| 13 | Grab sample from weak showing of pegmatite along trench<br>Plate 3 | Trace | ** | ** | Sample is dominantly bull quartz. |
| 14 | Chip sample from pegmatite outcrop 4' - 5'<br>Plate 3 | Trace | ** | ** | Sample is of quartz and apatite in graphic granite with about 5% muscovite in volume. Mica is small (½" x ½") and disoriented. |
| 15 | Selected sample of pegmatitic material from ore bin<br>Plate 3 | Trace | ** | ** | Grab sample of selected fine and coarse pegmatite material. Some hornblende present and Beryl? |
| 16 | Muscovite specimen sample from stock pile<br>Plate 3 | --- | --- | --- | Appears to be a fair grade of muscovite altho there are some imperfections and "A" structures present. Rum-colored iron stained. 6" x 8" sheet sizes |

| Sample Assay No. | Description of Sample | % BeO | % $PO_4$ | % Fe | Remarks |
|---|---|---|---|---|---|
| 17 | 30' Sample from north face of main open cut. Muscovite mine<br><br>Plate 3 | Trace | ** | ** | Sample is slightly contaminated by soil and dust carried in from rim of quarry onto pegmatite zone. Muscovite in minor amounts present |
| 18 | Selected grab sample from dump. Maybe mine?<br><br>Plate 3 | Trace | ** | ** | Small muscovite sheets in minor quantities in pegmatitic quartz and feldspar. Feldspar is present in much less quantity than quartz. |
| 19 | Grab sample of pegmatite on dump. Maybe Mine?<br><br>Plate 3 | Trace | ** | Trace | Sample is chiefly quartz with lesser quantities of feldspar and hornblende. Some free book muscovite of fair quality and size (4" x 4") also on dump |
| 20 | Grab sample of pegmatite on dump<br><br>Plate 3 | Trace | ** | Trace | Sample is similar to #19 altho associated mica sheets are somewhat smaller (1½" x 2"). Muscovite quality is good. |
| 21 | 2.8' width pegmatite in stope.<br>Muscovite Mine<br>Plate 4 | 1.0 | ** | Trace | Quartz, apatite, hornblende and tourmaline associated with Beryl. |
| 22 | 2.5 width in stope<br>Muscovite Mine<br>Plate 4 | 1.34 | ** | Trace | Looks fairly high grade. Beryl crystals well defined throughout sample width. |
| 23 | 4.0 width pegmatite<br>Muscovite Mine<br><br>Plate 4 | 0.90 | ** | Trace | Muscovite, quartz, and feldspar in essentially equal amounts. Some beryl is present. |
| 24 | 10.0' width pegmatite outcrop in north open cut<br>Muscovite Mine<br>Plate 3 | 0.12 | ** | Trace | Quartz, feldspar, muscovite bearing pegmatite |
| 25 | 30.0' strike sample along east wall of north open cut. Muscovite Mine<br>Plate 3 | 0.13 | ** | Trace | Quartz, apatite and muscovite bearing pegmatite. Muscovite in relatively minor amounts. |

| Sample Assay No. | Description of Sample | % BeO | % $PO_4$ | % Fe | Remarks |
|---|---|---|---|---|---|
| 26 | Grab sample of pegmatite on dump of test trench Sunshine property? Plate 3 | Trace | ** | Trace | Chiefly quartz and some feldspar associated with fairly abundant but very small and disoriented muscovite booklets. |
| 27 | 8' width of pegmatite outcrop Plate 3 | Trace | ** | Trace | Chiefly quartz with some feldspar and hornblende. Has a semi-graphic granite structure. Very minor muscovite flakes. |
| 28 | Chip sample from pegmatite outcrop 15' wide. Plate 3 | 0.6 | ** | ** | Chiefly quartz with some feldspar and hornblende. Muscovite present is in small, disoriented flakes |
| 29 | 10' sample from cut at Munro Camp Plate 3 | Trace | ** | ** | Dominantly quartz with some feldspar and about 10% imperfect muscovite. Size averages approximately 1½" x 2½". |
| 30 | 3' sample from pegmatite outcrop Plate 3 | Trace | ** | ** | Chiefly quartz and feldspar With some hornblende and minor quantities of poor quality muscovite present (½" - 1") sizes |
| 31 | 6' width pegmatite outcrop Plate 3 | Trace | ** | ** | Muscovite, quartz, and feldspar intimately mixed. Mica is in small minor-sized disoriented flakes and booklets |
| 32 | Chip sample of 18" - 20" pegmatite outcrop Plate 3 | Trace | ** | Trace | Chiefly quartz intimately mixed with muscovite (2" x 2"). Sample is about 20% mica |

* Beryllium oxide (BeO) is the commercial unit whereby a beryllium content is expressed.

** Signifies that a rather appreciable, although unmeasured, quantity of the substance is present.

The assay procedure for the determination of the beryllium content of a sample is long and complex. It involves several sequences of precipitation and, as a final end product, quantities of material too small to measure and absolutely identify may accrue. This accounts for the rather constant "trace" values as reported for BeO in the above chart.

# SUMMARY

Beryl and muscovite mica, which are strategically important industrial substances, particularly at this time, occur as variable and sporadic constituent minerals of certain pegmatite dikes in Sections 15, 22, 23, and 27, T. 41N., R. 2W., Latah County, Idaho. The occurrences are situated on and near the crest of a mountain spur and access may be gained to them over unimproved, steep roads from Avon, Idaho. A railroad route runs into Deary, Idaho, three miles southeast of Avon. There is ample timber for mining requirements but the possibility of sufficient water resources in the immediate region is unassured.

The pegmatite dikes have invaded micaceous schists and gneisses of the Belt Series (pre-Cambrian) and are roughly parallel in trend and attitude to the schistosity and relict bedding. They strike about N10°E and have a prevailing dip to the west of roughly 70°. The pegmatites are differentiates of a source magma which intruded the blanketing schists in late Cretaceous or early Tertiary time. There have been exposed subsequently by erosion, and other igneous rock intrusives from the same magma are also revealed on the surface in the southeastern portion of the area. The most common constituent minerals of the pegmatite dikes, in addition to the muscovite mica, are quartz and feldspar (albite). Beryl and other less important substances appear to occur only sparingly.

In the writer's opinion, the muscovite mica can best be exploited for use as punch and circle mica. There are generally too many internal structural imperfections in the sheets for the appreciable production of "splittings" and the sheets are, on the average, too small for large, highly desirable dimension materials to be obtained in extensive quantities. Likewise, the mica is usually disseminated and distributed as pods throughout the pegmatites, and thus appears to be in such relative meager amounts, as compared to the other component minerals which would also have to be mined, that the exploitation primarily for scrap mica does not seem feasible. This is particularly true when it is noted that the prices for scrap are very low and that the domestic United States production is presently sufficient for all consumer requirements. On the basis of chemical and physical characteristics, the muscovite of these deposits can compete favorably with foreign materials, at least as punch and circle mica. There has existed an unfounded prejudice among consumers in favor of foreign materials. Perhaps this factor is not so pertinent now as in former peace times and the present emergency may succeed in breaking this barrier down.

As demonstrated by the foregoing sample analyses, the beryllium content of the pegmatites, as now exposed, is largely restricted to the major dike structures of the Muscovite Mine property, and then is in relatively minor amounts. However, the beryl and also the feldspar and quartz materials probably would prove to be recoverable minerals during any mining operations and should, therefore, be recognized as potential resource materials. Sterrett (5, 6) has mentioned that beryl is also present on the Levi Anderson property but this statement of the occurrence could not be verified by the writer because of the inaccessible character of the pegmatite exposures in the mine workings. Selected dump samples of the pegmatite do not indicate a very high beryllium content of the structures even though beryl may occur there.

The probable existence of beryllium at the Bentz Mine is indicated by the assay analysis of one sample.

No beryl of gem stone quality was encountered during this study nor has any been previously cited from the district. Beryl is known to also occur in pegmatites near Orofino, Idaho, and has been reported from the Priest Lake region in the extreme northern section of the state.

## BIBLIOGRAPHY

1. Anderson, A. L., Mica deposits of Latah County, Idaho, Idaho Bureau of Mines and Geology, Pamphlet No. 14.

2. Anderson, A. L., Genesis of Mica Pegmatite Deposits, Latah County, Idaho. Economic Geol. Vol. 28, No. 1, Pp. 41-58 (Feb. 1933)

3. Anonymous, Idaho Beryl Deposits found Important., Ceramic Age, Vol. 21, No. 5, P. 141 (May, 1933)

4. Chowdhury, R. R., Handbook of Mica, Chemical Publishing Company, Brooklyn, New York (1941)

5. Sterrett, D. B., Mica in Idaho, New Mexico, and Colorado., U. S. Geol. Survey Bul. 530, Pp. 375-390 (1913)

6. Sterrett, D. B., Mica Deposits of the United States., U. S. Geol. Survey Bul. 740, Pp. 86-93 (1923)

7. Tullis, E. L., The Geology and Petrography of Latah County, Idaho., Unpublished manuscript, (June, 1940)

8. Tyler, Paul M. and Bowles, Oliver, Nonmetallic Industrial Minerals, Mining and Metallurgy, (A.I.M.E.) Vol. 23, No. 422, P. 85 (Feb. 1942)

9. Tyler, Paul M. and Warner, K. G., Mica; Minerals Yearbook, Review of 1940, U. S. Bureau of Mines, Pp. 743-746 and 1356-1368 (1941).