Sodium Chloride Near Vale

NAME | OLD NAMES | NaCl Brine PRINCIPAL ORE | MINOR MINERALS

17 S T | 45 E R | 8 S

Malheur ..... COUNTY

Unclassified ..... AREA

2500 ..... ELEVATION

6.5 access road from U.S. 28 ..... ROAD OR HIGHWAY

13 miles to Vale ..... DISTANCE TO SHIPPING POINT

PUBLISHED REFERENCES

MISCELLANEOUS RECORDS

PRESENT LEGAL OWNER (S) .....

.....

.....

.....

Address .....

.....

.....

.....

OPERATOR .....

.....

Name of claims	Area	Pat.	Unpat.

Name of claims	Area	Pat.	Unpat.

EQUIPMENT ON PROPERTY

State Department of Geology and Mineral Industries

702 Woodlark Building
Portland, Oregon

Report by N. S. Wagner
Date--Nov. 2, 1946

PRELIMINARY REPORT

Sodium Chloride near Vale — **Malheur County**

FORWARD: This report includes the data obtained from various sources in connection with the running down of a report in a U. S. G. S. News Release, 1931 which stated that Na Cl brine, 56,000 parts/1,000,000, existed in a well in T. 18 S., R. 45 E., Sec. 8, Malheur County, Oregon. The occurrence found, however, is in T. 17 S., R. 45 E., Sec. 8.

OWNERS: The County Assessors records show the following people as the present land owners in Sec. 8, T 18 S, R 45 E.

August R. Kochsmeier	$N\frac{1}{2}$ $NW\frac{1}{4}$
Emil Henke	$S\frac{1}{2}$ $NW\frac{1}{4}$, $N\frac{1}{2}$ $SW\frac{1}{4}$
J. A. Jennison	$W\frac{1}{2}$ $E\frac{1}{2}$, $S\frac{1}{2}$ $SW\frac{1}{4}$
E. F. Harrison, etux.	$NE\frac{1}{4}$ $NE\frac{1}{4}$
Orin A. McClellan, etux.	$SE\frac{1}{4}$ $NE\frac{1}{4}$, $E\frac{1}{2}$ $SE\frac{1}{4}$

Of these owners Kochsmeier is the oldest from the standpoint of duration of residence. The Jennison and Harrison tracts are occupied by new tenants.

Kochsmeier and Henke were interviewed. Both said that this section was sage-brush land and not settled till the spring of 1937. Neither knew of any wells in the section drilled prior to that nor had either heard of any brine well. However, these and other farmers from the Malheur Butte in S 10, T 18 S, R 46 E west to Vale report salts of all kinds in their wells, as well as Sulphur and Arsenic. Reportedly many wells in this belt are unfit for either domestic and stock use, and reportedly also, that the water conditions are very unpridicatable with fresh and "salt" wells being encountered side by side and at variable depths, up to 300-400 feet.

GENERAL: Other "tips" picked up in the course of making this investigation let to confirmation of the existence of what is known as Alkali Springs. The location of these springs is in Sec. 8, T. 17 S., R. 45 E. These springs reportedly do contain notably large quanties of Na Cl brine. Thus, it is possible that this is the occurrence reported in the U. S. G. S. News Release.

Mr. Edwin Johnson, former County Surveyor now deceased, tried to develop the occurrence around 1920. According to Mrs. Johnson, his work demonstrated the availability of brine over a large area.

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Some salt was produced experimentally but no large development was ever tried. Johnsons obtained his brine from wells about 20 to 25 feet deep. One such well was cased and is now capped.

Mr. Johson's son, Virgil E. Johnson, Civil Engineer, 215 McCarty Bldg, Boise, Idaho, possesses what records and analyses as are available, and is intimately acquainted with the occurrence and his fathers work thereon.

State Department of Geology and Mineral Industries

702 Woodlark Building
Portland, Oregon

SODIUM CHLORIDE BRINE OCCURRENCE FROM NEAR VALE, OREGON MALHEUR COUNTY

Forward:

Sodium chloride brine with a concentration of 56,000 parts per million was reported[1] to have been obtained from a well situated in T 18 S; R 45 E; S 8, which is near Vale, Malheur County. An investigation made by this department during the Fall of 1946 disclosed no known brine well in this location. Numerous reports, however, were heard about early day attempts to commercialize a sodium chloride brine occurrence near Alkali Springs. Subsequent investigation, an account of which follows, led to the confirmation of these reports.

Location:

Alkali Springs is situated in T 17 S; R 45 E; S 8. This is the same range and setion as given in the above reported location, but the adjoining township. It would thus appear that this is the same occurrence as referred to in the report and that the location given there-in is in error with regards to the township. Access to the springs is by 6.5 miles of road which turns off to the north of U. S. Highway 28 at a point 6.4 miles west of Vale. A small portion of the side road is lightly gravelled but the bulk of it is an unimproved, dry-weather, stockmens access road.

History:[2]

The circumstances surrounding the original discovery of the brine is not

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1 U. S. Geological Survey--- News Release, 1931.

2 Informants include: Messers. V. E. Johnson, C. E.; Irwin Troxell, County Commissioner; Homer King & O. E. Clark, ranchers.

known, but the discovery was presumably made by some homesteader or rancher who was attempting to develop water. The attempted commercialization of the brine is more fully known. This was done by a Mr. Johnson of Vale during the early 1929's. Johnson's work consisted of the drilling (auger) of numerous, but shallow, holes, and also the sinking of a few pits. A 50 x 50 foot concrete evaporating tank was constructed adjacent to one of these pits. It is also reported that attempts at evaporation were made utilizing metal tanks and sagebrush fuel. Although the experimental production made by this work did serve to focus local attention upon the occurrence, no more comprehensive development of the occurrence ever materialized, nor did the discovery command widespread noteriety.

Area:

Alkali Springs are a group of springs controlled by the U. S. Grazing Service. They occur in a relatively flat valley which lies to the west, and southwest of a pronounced range of hills. Elevation of the Springs is about 2500 feet. Drainage by an unnamed and essentially dry creek is to Willow Creek to the south.

The precise location of the Johnson wells is not known excepting for two pits found close by the remains of the concrete evaporating tank. This tank is adjacent to the access road about 2000 feet to the southwest of the Springs, and in the west half of the section (8). This half section is owned by Otto Broweleit, Rt. #3, Kearney, Nebraska.

As the above mentioned pits are themselves just sluffed in "relics", and as no other means of sampling existed, this department drilled[3] several holes to confirm the occurrence. The area covered by this drilling is set forth on the map accompanying this report (Plate 1.). The first hole was drilled within a few feet of the concrete tank on the presumption that this tank was

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3 Permission for drilling granted by Mr. Broweleit.

located on one of Johnson's most promising test hole sites. Likewise the second departmental hole was located to the east of the first on the strength of the other Johnson shaft situated nearby. For want of addition knowledge concerning the extent of the brine area the remaining departmental holes were located arbitrarily on a grid pattern. Grid intervals used approximated 500 and 1000 feet but these distances were "adjusted" with respect to favorable topographic and drilling conditions.

Proceedures followed in the field:

Drilling was done by hand auger supplemented in the case of the deeper # 1 hole by a tripod[4]. Three inch augers were used for the most part, although on occassion difficult drilling made the use of a 2" auger expedient. The nature of the strata encountered frequently necessitated a "preconditioning" of the ground before the conventional auger would function efficiently. This was accomplished by the use of a chopping bar or by a coal auger. Drilling was supervised by R. S. Mason.

A total of nine holes were sunk for an aggregate depth of 148 feet 4 inches. Excepting for one dry hole which was abandonned because of excessively difficult drilling conditions, water was encountered at depths ranging between 8 feet 9 inches and 14 feet.

The first hole dug was sunk to a depth of 31 feet. This gave a penetration of 19 feet 4 inches below the horizon at which water was first encountered. The sinking of this hole to this depth was done by way of determining if any significant increase in flow or salinity would be disclosed by depth. A slight increase in flow was noted as was to be expected, but no positive or significant increase in salinity was observed in this distance. Since appreciably deeper drilling was indicated for a test of these factors,

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[4] Auger-hole Prospecting, R. S. Mason, Ore-Bin, Vol. 6 #12, December 1944.

and since the objective of this project was merely to confirm the reported existence of the sodium chloride brines here at this time, it was deemed best to sink as many holes as possible within the time available in order to give some idea of the extent of the area underlain by brine. Therefore subsequent holes were sunk only a sufficient distance below the water horizon to permit the taking of a sample.

Large samples were taken and allowed to settle before bottling. The clear solution was siphoned off. Cutings samples were saved from only a few of the holes as the material encountered in all holes proved to be very similar.

The sodium chloride content of the brine for each hole appears on the map (Plate 1). A more complete record of the analyses showing associated compounds, etc, is set forth in chart form in Table I.

Geology:

The northeastern portion of Malheur County is occupied largely by lacustrine and fluviatile sediments of the Payette formation. These sediments have been classified as being of fresh water origin. The composition of the formation varies widely and includes the extensive diatomite deposits in the Harper and other Harney County areas to the west. The clastic portion of the formation is composed chiefly of clays, sands and conglomerates. In the Harper, and other more western areas where the formation has been mapped, Moore[5] describes the clastics as being primarily water reworked materials of volcanic origin such as tuffs, ashes, etc. In the Vale to Payette (Idaho) area Washburne[6] points out that while the coarser water rounded

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5 Moore - Non-Metallic Mineral Resources of Eastern Oregon. U.S.G.S. Bulletin 875.

6 Washburne - Gas & Oil Near Vale, Oregon & Payette, Idaho - U.S.G.S. Bulletin 431, Part II.

pebbles appear abundant on the surface, deep well logs show the formation to be composed predominately of clays. Buwalda[7] expresses the opinion that these beds are not true lakebeds, but instead, largely river flood plain and waste slope deposits laid down only in part in lakes. While strata of Pliocene (and possibly Pliestocene[7]) age have been recognized and included in the Payette, the bulk of the formation is generally regarded as being of Miocene age.

Basalt and vitrophyre flows of a younger, or Pliocene and possibly Pliestocene age according to Moore, and Washburne, constitute the next most abundant formation to be seen in the area.

So thoroughly do the Payette sediments blanket the area in general, that little is known concerning the identity of the underlying formations over a wide area. In his report on Gas and Oil Near Vale, Oregon and Payette, Idaho, Washburne goes into this aspect of the geology to a considerable extent. Established formations of pre-Miocene age include such formations as the Cretaceous granitics of the mountains exposed 20 miles east of Payette; other igneous rocks and Paleozoic-Triassic metamorphics (shists, limestones and slates) in the Burnt River and Morman Basin areas 20 to 25 miles or so to the north and northwest of Vale; rhyolitic and other igneous rocks in the Owyhee Range 25 miles south of Nyssa. The foregoing sentence is but a rough and incomplete summary of Washburne's observations, but it is sufficient to give the picture---especially so since no geologic mapping having a direct bearing on the subject has been published covering this portion of Oregon since Washburne's report.

Little data exists at this time on which to base conclusive statements

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7 Buwalda, Report on Oil & Gas Possibilities of Eastern Oregon - Oregon Bureau of Mines & Geology, Vol. 3, No. 2.

concerning the origin of the salt brine found. Accordingly, only a discussion of such observations and data as seem pertinent to the subject, will be given here.

Saline waters are not uncommon. They range in age from present day saline lakes to brines associated with formations of almost all geologic ages. Divers opinions exist concerning origin, especially so in the case of the older brines. Some of these saline waters are regarded as connate, or original sea water trapped in sedimentary formations of marine origin. Others clearly originate from the solution of salt deposits contained in sedimentary formations. Still other saline waters associated with igneous and volcanic rocks, are believed to originate from volcanic sources.

Saline beds of the type normally associated with the evaporation of saline lakes have not been described as being integral to the Payette sedimentaries, nor is a connate origin compatible with the fresh water classification of the formation.

Washburne mentions reported finds of rock salt (small fragments from unspecified depths) in two different oil well holes, and even states that one dome near Vale "bears some resemblence to those in other oil field that have cores of salt, gypsum, dolomite or basalt". This necessitates consideration of the possibility that the underlying formations may contain rock salt deposits. None of the underlying formations are known to contain such deposits although the Triassic sedimentaries could possibly be regarded as a potential host formation.

One horizon of this formation is known as the "Gypsum formation"[8] because of contained gypsum deposits.

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8 Livingstone - A Geologic Reconnaissance of the Mineral & Cuddy Mountain Mining District, Washington & Adams Counties, Idaho, Pamplet No. 13, Bureau of Mines and Geology, Idaho.

This horizon is characterized by red and green shales and conglomerates. If the contained gypsum of this formation is of sedimentary origin, it would not be unwarranted to suspect that the formation might also contain beds of salt as the two minerals are commongly found together. In this respect, however, and from an examination of the old gypsum mine, near Huntington, Oregon[9] it is the writer's belief that the gypsum (of this particular deposit, at least) is of secondary origin and the result of the reaction of sulphur-bearing waters on contained limestone lenses as the gypsum is closely associated with an area of sulphide mineralization and faults; as the gypsum gives way progressively to limestone with distance from the faults; as other nearby limestone lenses in the formation show no alteration. Whether this origin for this deposit is an exception, or the rule, would necessitate study of the formation at large and of the other known gypsum occurrences therin in Idaho. Of interest is the fact that the writer has traced this "Gypsum formation" in Oregon to a point on Durbin Creek about 18 miles to the north or north northwest of the Vale salt brine area under discussion. At this point the "Gypsum formation" is exposed as a window of only a few acres in area in a region occupied predominently by lake beds and basalts. The occurrence of this formation here shows its trend to be towards the salt area in general. Whether or not it continues its trend in this direction, and whether or not it does contain rock salt beds in that area is something that cannot be answered with the data at hand. The question of whether or not the brine could originate from the solution of salt beds thus remains problematical.

A volcanic origin for the brine is also a possibility as an association of saline waters of various types with volcanic rocks and volcanic activity, has been noted the world over. Such waters are believed to have been con-

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9 Wagner - Gypsum Mine of the Snake River Below Huntington, unpublished report.

tributed from primary volcanic sources in some cases, while in other cases their mineral content has undoubtedly been derived in a secondary manner by widespread leaching or dissolving of soluble salts from such volcanic materials as contain them. Very likely the mineral content of saline waters found in volcanic areas includes components derived from both primary and secondary sources.

In considering the origin of the brines under discussion here, it must be noted that thermal waters are common in the Vale area. Washburne makes special comment on the wide variations prevailing in both physical and chemical properties of some of the waters to be encountered there. Likewise, it must be noted that volcanic rocks of both acid and basic types, and ranging from early Tertiary to recent in age, are widespread in southeastern Oregon at large. Further, a study of nitrate occurrences in this part of the state has shown that other salts, namely sulphates and chlorides of magnesium, potassium, sodium and calcium, are not uncommon. While neither the nitrates nor the other salts occur in commercial amounts, their study has led to several observations which may prove pertinent to any consideration of the origin of the Vale brines.

The salts have been established as accumulations resulting from the evaporation of underground waters where such are exposed to the surface climatic conditions by virtue or erosion or structural agency. They are to be found only in selected places where they are protected from being re-dissolved by rainfall or other surface waters. Furthermore, Williams[10] reports that they are associated almost exclusively with rhyolitic rocks.

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10 Williams - Report on Nitrate Deposits of Southeastern Oregon, Oregon Bureau of Mines & Geology, 1918.

While various of the "nitrate" occurrences are many miles distant from the Vale brine area, some of them are situated near Vale. Their origin is of significance, as from a geologic standpoint, the Vale brine area is an integral part or the same geologic province as a whole. While no direct evidence is at hand to conclusively support any contention that the Vale brines represent concentrations of salts derived either directly or indirectly from volcanic sources, the weight of available evidence strongly suggests such an origin to be the case.

Discussion of drill hole data:

While the drilling done has confirmed the reported occurrence of sodium chloride brine here, neither the nature or scope of this drilling permits the making of any specific evaluation of the occurrence along economic lines at this time. Such conclusions as can be made follow.

An examination of Table I shows that two types of brines were encountered. Both contain NaCl as the chief constituent. The significant difference is that in one brine the associated compounds are predominently sulphates as compared to the other in which the associated compounds are predominently chlorides. This will be more clearly seen if only the average of the fractional samples for hole # 1 be considered in comparison whith the brines from the other holes. Predominancy, as reckoned by the writer, consisted of comparing the sum of the parts per million of sulphate compounds against the sum of the chloride figures with only the associated compounds (not NaCl) being considered. Whichever was greater was considered as predominent.

A distinct segragation or zoning of these sulphate and chloride brines is apparent when they are entered on the map. The sulphate bearing brines occupy the northwest portion of the map, or holes numbered 1, 6, 7, 8, 9, and include also Alkali Springs. The brines in which chlorides predominate

originated from holes numbered 2, 3, and 4. A marked decrease in NaCl content is to be noted as existing with the sulphate brines. The brine from hole # 1 is the only exception.

The value of saline brines depends not only on a high concentration of a marketable compound, but also upon the nature of associated brines and the ability to effect a separation within commercial cost limits. Since a variation in brine types to be had here is indicated, it is possible that a more extensive prospect development program might disclose not only areas of higher grade NaCl brine, but also areas in which some of the present associated compounds may occur in significantly greater amounts. In regards to value of saline brines, it is also to be noted that minor constituents such as bromine and iodine sometimes occur in commercially important concentrations. Tests for these should not be overlooked.

From the foregoing it is apparent that any prospect development program would have to be extensive, not alone for the purpose of proving a large area to be underlain by brine, but also for the purpose of determining the existent type and grade of brine.

Flow encountered in the holes sunk was negligible from a commercial standpoint. Drilling at depth will be necessary to reveal the amount of flow that may be had.

Conclusions:

The brines recovered from the holes drilled confirm the reported occurence of such brine in the area, which confirmation was the objective of the drilling project described. The geologic nature of the brine occurrence from the standpoint of origin is uncertain but probably represents concentrations of soluble salts derived from volcanic agencies, although a possibility exists that the brine could be derived from the solution of saline deposits

contained in Triassic sedimentary rocks burried beneath the Payette formation. Additional drilling, so conducted as to increase present knowledge concerning the area underlain by brines, the nature and grade of the brines, and the existence of a potential flow of same, will have to be made before any consideration of commercial value for the occurrence is warranted.

Report By:

N. S. Wagner, September 18, 1947

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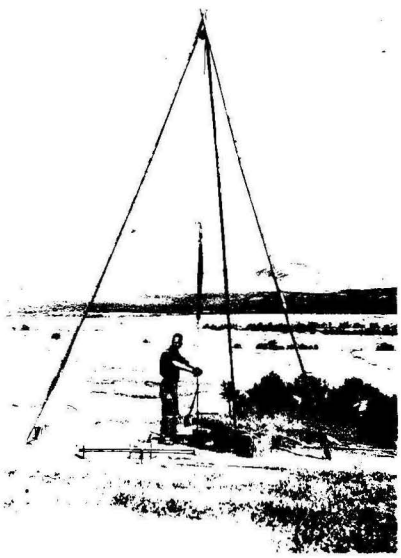
TABLE I - TABULATION BY COMPOUNDS - VALE BRINE SAMPLES

(All results given in parts per million)

HOLE	WATER-BEARING SECTION SAMPLED	TOTAL SOLIDS	SULPHATE COMPOUNDS			CHLORIDE COMPOUNDS			
			$CaSO_4$	$MgSO_4$	Na_2SO_4	$CaCl_2$	$MgCl_2$	KCl	NaCl
# 1	11'8" to 14'0"	55,300	5,110	1,540	1,160			205	44,600
# 1	11'8" to 19'0"	57,100	4,750	1,440	2,475			565	45,900
# 1	11'8" to 27'4"	55,100	4,900	1,480	1,950			325	44,000
# 1	11'8" to 31'0"	56,500	5,510	1,530	1,380			420	44,500
# 1	Average of above fractional samples	55,750	5,067	1,497	1,741			379	44,750
# 2	14'0" to 17'4"	70,100	3,525			5,900	2,990	290	51,500
# 3	14'0" to 17'0"	65,600	2,960			7,390	3,150	520	48,000
# 4	14'0" to 17'6"	65,600	5,500			3,990	2,870	290	47,800
# 6	10'0" to 14'0"	43,000	2,340	770	11,400			140	26,000
# 7	13'0" to 17'0"	44,200	4,850	1,860			580	210	34,600
# 8	11'3" to 15'3"	25,800	1,940	590	1,470			160	20,150
# 9	8'9" to 13'4"	49,400	690	600	8,880			250	36,200
Alkali Springs		1,200	22	20	120			14	910

View of Vale Salt Brine Area showing the old concrete evaporating tank. Hole #1 is situated between the tank and the photographer. Alkalli Springs is located at the foot of the hills in the center of the picture.



Picture of the tripod set-up on hole #1

STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
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SODIUM CHLORIDE BRINE OCCURRENCE NEAR VALE, OREGON

By
Norman S. Wagner[1]

Introduction:

Sodium chloride brine with a concentration of 56,000 parts per million was reported[2] to have been obtained from a well situated in sec. 8, T. 18 S., R. 45 E., which is near Vale, Malheur County. An investigation made by this department during the Fall of 1946 disclosed no known brine well in this location. Numerous reports, however, were heard about early-day attempts to commercialize a sodium chloride brine occurrence near Alkali Springs. Subsequent investigation, an account of which follows, led to the confirmation of these reports.

Location:

Alkali Springs is situated in sec. 8, T. 17 S., R. 45 E. This is the same range and section as given in the above reported location, but in the adjoining township. It would thus appear that this is the same occurrence as referred to in the U.S. Geological Survey report[3] and that the township location given in the report is in error. Access to the springs is by 6.5 miles of road which turns off to the north of U.S. Highway 28 at a point 6.4 miles northwest of Vale. A small portion of the side road is lightly graveled but the bulk of it is an unimproved, dry-weather, stockmen's access road.

History:[4]

The circumstances surrounding the original discovery of the brine are not known, but the discovery was presumably made by some homesteader or rancher who was attempting to develop water. The attempted commercialization of the brine is more fully known. This was done by a Mr. Johnson of Vale during the early 1920's. Johnson's work consisted of the drilling (auger) of numerous but shallow holes, and also the sinking of a few pits. A 50 ft. x 50 ft. concrete evaporating tank was constructed adjacent to one of these pits for solar evaporation. It is also reported that attempts to effect evaporation were made, utilizing metal tanks and sagebrush fuel. Although the experimental production made by this work did serve to focus local attention upon the occurrence, no further development of the occurrence ever materialized.

Area:

Alkali Springs is a group of springs controlled by the U.S. Grazing Service. They occur in a relatively flat valley which lies to the west, and southwest of a pronounced range of hills. Elevation of the springs is about 2500 feet. Drainage by an unnamed and usually dry creek is to Willow Creek to the south.

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[1]Field Geologist, State Department of Geology and Mineral Industries, Baker, Oregon.
[2]U.S. Geol. Survey News Release, 1931.
[3]U.S.G.S., op. cit.
[4]Informants include: Messrs. V.E.Johnson, Civil Engineer; Irwin Troxell, County Judge, Malheur County; Homer King and O.E.Clark, ranchers.

The precise location of the Johnson wells is not known except that there are two pits found close to the remains of the concrete evaporating tank. This tank is adjacent to the access road about 2000 feet to the southwest of the springs, and in the west half of the section (8). This half section is owned by Otto Broweleit, Route 3, Kearney, Nebraska.

As the above mentioned pits are themselves just stuffed-in "relics," and as no other means of sampling existed, the department drilled[5] several holes to confirm the occurrence. The area covered by this drilling is set forth on the map accompanying this report. The first hole was drilled within a few feet of the concrete tank on the presumption that this tank was located on one of Johnson's most promising test hole sites. Likewise the second departmental hole was located to the east of the first hole on the strength of the other Johnson shaft situated nearby. For want of additional knowledge concerning the extent of the brine area, the remaining departmental holes were located arbitrarily on a grid pattern. Grid intervals used approximated 500 and 1000 feet but these distances were "adjusted" with respect to favorable topographic and drilling conditions.

Procedures followed in the field:

Drilling was done by hand auger supplemented in the case of the deeper no. 1 hole by a tripod (Mason, 1944). Three-inch augers were used for the most part although, on occasion, difficult drilling made the use of a 2-inch auger expedient. The nature of the strata encountered frequently necessitated a "preconditioning" of the ground before the conventional auger would function efficiently. This was accomplished by the use of a chopping bit or by a coal auger. Drilling was supervised by Ralph S. Mason, department engineer.

A total of nine holes was sunk for an aggregate depth of 148 feet 4 inches. Excepting for one dry hole which was abandoned because of excessively difficult drilling conditions, water was encountered at depths ranging between 8 feet 9 inches and 14 feet.

The first hole was sunk to a depth of 31 feet. This gave a penetration of 19 feet 4 inches below the horizon at which water was first encountered. Sinking the hole to this depth was done to determine if there was significant increase in flow or salinity at depth. A slight increase in flow was noted as was to be expected, but no positive or significant increase in salinity was observed in this distance. Since appreciably deeper drilling was indicated for a test of these factors, and since the objective of this project was merely to confirm the reported existence of the sodium chloride brines here at this time, it was thought best to sink as many holes as possible within the time available in order to give some idea of the extent of the area underlain by brine. Therefore subsequent holes were sunk only a sufficient distance below the water horizon to permit sampling.

Large samples were taken and allowed to settle before bottling. The clear solution was siphoned off. Samples of cuttings were saved from only a few of the holes as the material encountered in all holes proved to be similar.

The sodium chloride content of the brine for each hole appears on the map. A more complete tabulation of the analyses showing associated compounds, etc., is set forth in the accompanying table.

Geology:

The northeastern portion of Malheur County is occupied largely by lacustrine and fluviatile sediments of the Payette formation. These sediments have been classified (Lindgren, 1898) as being of fresh water origin. The composition of the formation varies widely and includes the extensive diatomite deposits in the Harper and other Harney County areas to the west. The clastic portion of the formation is composed chiefly of clays, sands, and conglomerates. In the Harper and other more western areas where the formation has been mapped, Moore (1937) describes the clastics as being primarily water reworked materials of volcanic origin such as tuffs, ashes, etc. In the Vale to Payette (Idaho) area, Washburne (1910) points out that while the coarser water-rounded pebbles appear

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[5] Permission for drilling granted by Mr. Broweleit.

TABULATION BY COMPOUNDS - VALE BRINE SAMPLES
(All results given in parts per million)

Hole no.	Water-bearing section sampled	Total solids	Sulphate compounds			Chloride compounds			
			$CaSO_4$	$MgSO_4$	Na_2SO_4	$CaCl_2$	$MgCl_2$	KCl	NaCl
1	11'8" to 14'0"	55,300	5,110	1,540	1,160			205	44,600
1	11'8" to 19'0"	57,100	4,750	1,440	2,475			565	45,900
1	11'8" to 27'4"	55,100	4,900	1,480	1,950			325	44,000
1	11'8" to 31'0"	55,500	5,510	1,530	1,380			420	44,500
1	Average of above fractional samples	55,750	5,067	1,497	1,741			379	44,750
2	14'0" to 17'4"	70,100	3,525			5,900	2,990	290	51,500
3	14'0" to 17'0"	65,600	2,960			7,390	3,150	520	46,000
4	14'0" to 17'6"	65,600	5,500			3,990	2,870	290	47,800
6	10'0" to 14'0"	43,000	2,340	770	11,400			140	26,000
7	13'0" to 17'0"	44,200	4,850	1,860			580	210	34,600
8	11'3" to 15'3"	25,800	1,940	590	1,470			160	20,150
9	8'9" to 13'4"	49,400	690	600	8,880			250	36,200
Alkali Springs		1,200	22	20	120			14	910

No bromine or iodine was found in the samples.

abundant on the surface, deep well logs show the formation to be composed predominantly of clays. Buwalda (1921) expresses the opinion that these beds are not true lakebeds but, instead, largely river flood-plain and waste-slope deposits laid down only in part in lakes; while strata of Pliocene (and possibly Pleistocene) age have been recognized and included in the Payette, the bulk of the formation is generally regarded as being of Miocene age.

Basalt and vitrophyre flows of a younger or Pliocene and possibly Pleistocene age, according to Moore (1937) and Washburne (1910), constitute the next most abundant formation to be seen in the area.

So thoroughly do the Payette sediments blanket the area in general, that little is known concerning the identity of the underlying formations over a wide area. In his report, Washburne goes into this aspect of the geology to a considerable extent. Established formations of pre-Miocene age include Cretaceous granitics exposed 20 miles east of Payette; other igneous rocks and Paleozoic-Triassic metamorphics (schists, limestones, and slates) in the Burnt River and Mormon Basin areas 20 to 25 miles or so to the north and northwest of Vale; and rhyolitic and other igneous rocks in the Owyhee Range, 23 miles south of Nyssa. The foregoing is only a rough and incomplete summary of Washburne's observations, but it is sufficient to give the picture - especially so since no geologic mapping having a direct bearing on the subject has been published covering this portion of Oregon since Washburne's report.

Insufficient data exist at this time on which to base conclusive statements concerning the origin of the salt brine found. Accordingly, only a discussion of such observations and data as seem pertinent to the subject will be given here.

Saline waters are not uncommon. They range in age from present day saline lakes to brines associated with formations of almost all geologic ages. Various theories concerning origin have been advanced, especially in the case of the older brines. Some of these saline waters are regarded as connate, or original sea water trapped in sedimentary formations of marine origin. Others clearly originate from the solution of salt deposits contained in sedimentary formations. Still other saline waters associated with igneous and volcanic rocks are believed to originate from volcanic sources.

Saline beds of the type normally associated with the evaporation of saline lakes have not been described as being integral to the Payette sedimentaries, nor is a connate origin compatible with the fresh water classification of the formation.

Washburne mentions reported finds of rock salt (small fragments from unspecified depths) in two different oil well tests, and even states that one dome near Vale "bears some resemblance to those in other oil fields that have cores of salt, dolomite, or basalt." This brings up the possibility that the underlying formations may contain rock salt deposits. None of the underlying formations is known to contain such deposits although the Triassic sedimentaries could possibly be regarded as a potential host formation.

One horizon of this formation is known as the "Gypsum formation" (Livingstone, 1925) because of contained gypsum deposits.

This horizon is characterized by red and green shales and conglomerates. If the contained gypsum of this formation is of sedimentary origin, it would not be unwarranted to suspect that the formation might also contain beds of salt as the two minerals are commonly found together. It is the writer's belief, however, that the gypsum is of secondary origin, the result of the reaction of sulphur-bearing waters on contained limestone lenses. In the old gypsum mine near Huntington, Oregon (Wagner, 1946), the gypsum is closely associated with an area of sulphide mineralization and faults. The gypsum gives way progressively to limestone with distance from the faults whereas nearby limestone lenses in the formation show no alteration. Whether this origin for this deposit is an exception would necessitate study of the formation at large and of the other known gypsum occurrences in the formation in Idaho. Of interest is the fact that the writer has traced this "Gypsum

formation" in Oregon to a point on Durbin Creek about 18 miles to the north or north-northwest of the Vale salt brine area under discussion. At this point the "Gypsum formation" is exposed as a "window" of only a few acres in area in a region occupied predominantly by lake beds and basalts. The occurrence of this formation here shows its trend to be towards the salt area in general. Whether or not it continues its trend in this direction, and whether or not it does contain rock salt beds in that area is something that cannot be answered with the data at hand. Whether or not the brine originates from the solution of salt beds thus remains problematical.

A volcanic origin for the brine is also a possibility, as an association of saline waters of various types with volcanic rocks and volcanic activity has been noted the world over. Such waters are believed to have been contributed from primary volcanic sources in some instances while, in others, their mineral content has undoubtedly been derived in a secondary manner by widespread leaching or dissolving of soluble salts from such volcanic materials as contain them. Very likely the mineral content of saline waters found in volcanic areas includes components derived from both primary and secondary sources.

In considering the origin of the brines under discussion here, it must be noted that thermal waters are common in the Vale area. Washburne makes special comment on the wide variations prevailing in both physical and chemical properties of some of the waters to be encountered there. Likewise, it must be noted that volcanic rocks of both acid and basic types, and ranging from early Tertiary to Recent in age, are widespread in southeastern Oregon. Further, a study of nitrate occurrences in this part of the State has shown that other salts, such as sulphates and chlorides of magnesium, potassium, sodium, and calcium, are not uncommon. Although neither the nitrates nor the other salts occur in commercial amounts, their study has led to several observations which may prove pertinent to any consideration of the origin of the Vale brines.

The salts have been established as accumulations resulting from the evaporation of underground waters where such are exposed to the surface climatic conditions because of erosion or structural agency. They are to be found only in selected places where they are protected from being re-dissolved by rainfall or other surface waters. Furthermore, Williams (1918) reports that they are associated almost exclusively with rhyolitic rocks.

Although several of the "nitrate" occurrences are many miles distant from the Vale brine area, some of them are situated near Vale. Their origin is of significance as, from a geologic standpoint, the Vale brine area is an integral part of the same geologic province as a whole. No direct evidence is at hand to prove that the Vale brines represent concentrations of salts derived either directly or indirectly from volcanic sources, but the weight of available evidence strongly suggests such an origin for these brines.

Discussion of drill hole data:

While the drilling done has confirmed the reported occurrence of sodium chloride brine here, neither the nature nor scope of this drilling permits an economic evaluation of the occurrence. Such conclusions as can be made follow.

An examination of the tabulation (opposite page 71) shows that two types of brines were encountered. Both contain NaCl as the chief constituent. The significant difference is that in one brine the associated compounds are predominantly sulphates as compared to the other in which the associated compounds are predominantly chlorides. This will be more clearly seen if only the average of the fractional samples for hole no. 1 be considered in comparison with the brines from the other holes. Predominancy, as estimated by the writer, consisted of comparing the sum of the parts per million of sulphate compounds with the sum of the chloride figures with only the associated compounds (not NaCl) being considered. Whichever was greater was considered as predominant.

A distinct segregation or zoning of these sulphate and chloride brines is apparent when they are entered on the map. The sulphate bearing brines occupy the northwest portion of the map, or in holes numbered 1, 6, 7, 8, 9, and also includes Alkali Springs.

The brines in which chlorides predominate originated from holes 2, 3, and 4. A marked decrease in NaCl content is to be noted as existing with the sulphate brines. The brine from hole no. 1 is the only exception.

The value of saline brines depends not only on a high concentration of a marketable compound, but also upon the nature of associated brines and the ability to effect a separation within commercial cost limits. Since a variation in brine types to be had here is indicated, it is possible that a more extensive exploration program might disclose not only areas of higher grade NaCl brine, but also areas in which some of the present associated compounds may occur in significantly greater amounts.

From the foregoing it is apparent that any exploration program would have to be extensive, not alone for the purpose of proving a large area to be underlain by brine, but also for the purpose of determining the type and grade of brine.

Flow encountered in the holes sunk was negligible from a commercial standpoint. Drilling at depth will be necessary to reveal the amount of flow that may be had.

Conclusions:

The brines recovered from the holes drilled confirm the reported occurrence of such brine in the area, and this confirmation was the objective of the drilling project described. The geologic nature of the brine occurrence from the standpoint of origin is uncertain but probably represents concentrations of soluble salts derived from volcanic agencies, although a possibility exists that the brine could be derived from the solution of saline deposits contained in Triassic sedimentary rocks buried beneath the Payette formation. Additional drilling, so conducted as to increase present knowledge concerning the area underlain by brines, the nature and grade of the brines, and the quantity available, will have to be done before any consideration of commercial value for the occurrence is warranted.

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INTERIM COMMITTEE HEARINGS ON DREDGING

The legislative Interim Committee, set up to study the effects of dredging on agricultural land in the state, held meetings in John Day, Sumpter, and Baker on September 8, 9, and 10 respectively. The committee is composed of Senators Ellis (Chairman), Dunn, and Patterson and Representatives Dickson, Kimberling, and Wilcox.

In John Day the testimony was nearly all by farmers who were opposed to dredging in agricultural land unless it be recoiled. Testimony was presented to the committee purporting to show the amount of farm land dredged in Grant County, the evils of tearing up land, and the lack of anything to compensate for the loss of such land. Questions were asked by members of the committee in regard to land destroyed by improper farming methods, by over grazing, and concerning the proportions of unproductive to productive land said to have been destroyed by dredging. The committee also brought up for discussion the possibility of regulating dredging by "zoning" as has been attempted in some counties in California.

In Sumpter the committee members inspected the operations of the Sumpter Valley Dredging Co.

On the 10th the committee held a hearing at the Baker Hotel in Baker attended by both farming and mining interests. Members of the grange testified concerning the amount of farm land destroyed in the Sumpter Valley and the value of such land for raising hay. As in John Day the statements by farmers were against dredging of farm land unless it could be recoiled. Mr. Clayton Jones of the Sumpter Valley Dredging Co. and Mr. Robert Porter of Porter & Co. made statements as to the value of dredging to the community and as to the impracticability of recoiling on most types of dredgable ground. Members of the committee attempted to obtain a figure representative of the cost of recoiling after dredging but witnesses testified that so many variables entered into the cost that a single figure would mean little and a range of costs would mean less. Witnesses stated that each project would have to be judged by itself.

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OREGON MUSEUM FOUNDATION LECTURES

Co-sponsored by the Oregon Museum Foundation, Inc., and the Oregon Audubon Society, a series of illustrated lectures called Audubon Screen Tours will be given in Portland during the coming fall and winter season. "Fun with Birds," the first of these lectures, will be on Friday, October 3, 1947, at 8:00 p.m. at the Benson High School auditorium. The speaker, Mrs. Laurel Reynolds, is an expert in nature photography and an authority on bird life.

The Audubon Screen Tours lectures are part of an intensified campaign by the Museum Foundation to enlist support in its campaign for construction of a suitable museum building where exhibits of great educational value, including minerals, rocks, fossils, and many other natural wonders will be housed. Admittance to the lectures will be a membership card in the Museum Foundation.

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STAFF SCIENTIST ON TRAINING DUTY

Mr. Thomas C. Matthews, spectroscopist for the Department, has gone to the Naval Ordnance Test Station at Inyokern, California, for a tour of training duty in connection with guided missiles. Mr. Matthews, a lieutenant in the Naval Reserve, was engaged in this type of work while in the Navy during the war.

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MINERAL MARKETS

As of the middle of September the market prices for metals show very little change except in price of quicksilver which had declined about $2.00 per flask. The weakness in the domestic quicksilver market was, as could be expected, the result of offerings of metal from foreign sources. The condition of the copper market is complicated by inability of foreign countries to obtain dollar exchange. There is a large unsatisfied demand for copper but there is also the inability to pay in dollars for the metal. The domestic price remains at 21½ cents. Demand for lead continues strong and the price has remained at 15 cents at New York. The zinc market has been quiet, with the price remaining at 10½ cents, East St. Louis. The price of platinum has dropped $2.00 an ounce to $64.00 for wholesale lots and $67.00 for sales to consumers. Silver has been somewhat stronger at 70½ cents an ounce. This price, of course, does not apply to silver mined in the United States. Following is a list of market prices of selected metals as given by Engineering and Mining Journal Metal and Mineral Markets, September 18:

Aluminum	ingot 15 cents and pig 14 cents per pound.
Antimony	boxed, New York, 35.9 cents; bulk, Laredo, 33 cents
Bismuth	in ton lots$2.00 per pound.
Cadmium	wholesale quantities, $1.75 per pound.
Iridium	$85.00 to $90.00 per troy ounce.
Magnesium	20½ cents per pound in car lots.
Nickel	35 cents per pound.
Osmium	$100 per ounce.
Palladium	$24 per ounce.
Tin	80 cents per pound.

Prices for metallic ores are quoted as follows:

Antimony ore	50 to 55 percent, $4.30 to $4.40 per unit of antimony contained.
Beryllium ore . . .	$14 to $16 per unit of BeO in 10 to 12 percent ore.
Chrome ore	per long dry ton, 48 percent Cr_2O_3, 3:1 chrome-iron ratio, $39.00 f.o.b. nearest shipping point.

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CONTINUED SHIPMENTS FROM BUFFALO MINE

A carload of gold-silver concentrates was shipped from Baker on September 2 by the Buffalo Mine, located near Granite, Eastern Grant County, according to the Record-Courier, Baker. The mine owned by Kissock and Ramsey, and managed by R. G. Amidon, has been making shipments each month during the summer.

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PUBLIC LANDS

Following are extracts from a report by Senator Guy Cordon of Oregon on hearings conducted by a subcommittee of the Senate Public Lands Committee on the subject of Federal fiscal responsibility to local governments because of ownership of Federal properties within the boundaries of such local governments.

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The testimony established beyond doubt the dire need for immediate legislation to relieve local governments from an excessive and inequitable tax burden.

Many facts established at this hearing should be brought to the attention of the Members of the Congress.

It was found that the total land area of the continental United States is 1,900,000,000 acres and of this acreage, in 1943, in excess of 455,000,000 acres were owned by the Federal Government, this being in excess of 24 percent of the total land area of the United States.

This property owned by the Federal Government is not subject to taxation by the taxing agencies of local government except in rare instances where a special Federal statute makes some provision for a payment to local government by the agency administering the federally owned property.

* * * * * * *

Your committee finds that there is a different policy from that which was originally intended and under which different policy all of the States of the United States are losing taxable lands by reason of unprecedented acquisitions by the various boards, bureaus, and departments of the Federal Government. Testimony established the fact that within the past 10 years the Federal Government had acquired from the tax rolls of the Nation in excess of 16,000,000 acres of lands. This inordinate and unnatural growth at the expense of the normal tax base of local government has been the cause of undue hardship.

Withdrawals and purchases are being made by the various departments of the Federal Government in certain areas without first taking into consideration previous withdrawals and purchases in those areas by other departments, to the end that some counties have been made to supply large tracts for as many as six different activities. The burden of Federal ownership is not being spread in an equitable manner.

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Your committee finds the Federal Government has abandoned any theory which holds that the public domain lands of the United States were to be held in trust to be utilized for the growth of the several States of the United States.

The total area of unappropriated and unreserved lands owned by the United States as of June 30, 1944, totaled 168,236,447 acres. Until 1934 many of these public lands were available for homestead. In that year the President withdrew from settlement, sales, or entry and reserved for classification the unreserved and unappropriated public lands in the following 12 Western States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, and Wyoming.

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NEW DREDGE

The El Rio Dredging Company of Los Angeles, with Frederick Reed, consulting engineer, in charge, is setting up on the South Fork of the Illinois River in the Takilma area, Josephine County, about 40 miles southwest of Grants Pass. The company is also operating in the Sutter Creek and Ione areas of California. Besides Mr. Reed, Fred C. Stillwell and Walter G. Bergeron are owners of the company.

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CLEARING HOUSE

CH-97: For sale: Lode gold property known as Lone Wolf group consisting of 4 unpatented mining claims located 3 miles northwest of Marial in northeastern Curry County, two 50-foot tunnels, two shafts, and several open cuts. For information write Hill H. Smith, Box 145, Gold Beach, Oregon.

CH-98: For sale: Assembled in kit form, gold testing outfit for use in field. Furnished with instructions at price of $5.00 by Walter J. Robertson, 627 N. Lillian Avenue, Stockton, California.

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PUBLICATIONS

State Department of Geology and Mineral Industries, 702 Woodlark Building, Portland 5, Oregon

BULLETINS

		Price postp
1.	Mining laws of Oregon, 1942, rev. ed., contains Federal placer mining regulations	$ 0.20
2.	Progress report on Coos Bay coal field, 1938: F.W.Libbey	0.10
3.	Geology of part of the Wallowa Mountains, 1938: C.P.Ross	0.50
4.	Quicksilver in Oregon, 1938: C.N.Schuette	0.50
5.	Geological report on part of the Clarno Basin, 1938: Donald K. MacKay	(out of pri
6.	Prelim. report on some of the refractory clays of western Oreg., 1938: Wilson & Treasher	(out of pri
7.	The gem minerals of Oregon, 1938: H.C.Dake	(out of pri
8.	Feasibility of steel plant in lower Columbia area, revised edition, 1940: R.M.Miller	0.40
9.	Chromite deposits in Oregon, 1938: John Eliot Allen	0.50
10.	Placer mining on Rogue River in relation to fish and fishing, 1938: H.B.Ward	(out of pri
11.	Geology and mineral resources of Lane County, Oregon, 1938: Warren D. Smith	0.50
12.	Geology and physiography of northern Wallowa Mts., 1941: W.D.Smith, J.E.Allen, et al	0.65
13.	First biennial report of the Department, 1937-38	(out of pri
14.	Oregon metal mines handbook: by the staff	
	A. Baker, Union, and Wallowa counties, 1939	(out of pri
	B. Grant, Morrow, and Umatilla counties, 1941	0.50
	C. Vol. I, Coos, Curry, and Douglas counties, 1941	(out of pri
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	Section 2, Jackson County, 1943	0.75
15.	Geology of Salem Hills and North Santiam river basin, Oreg., 1939: T.P.Thayer (map only)	0.25
16.	Field identification of minerals for Oregon prospectors and collectors, second edition, 1941: compiled by Ray C. Treasher	0.50
17.	Manganese in Oregon, 1942: by the staff	0.45
18.	First aid to fossils, or what to do before the paleontologist comes, 1939: J.E.Allen	0.20
19.	Dredging of farmland in Oregon, 1939: F.W.Libbey	(out of pri
20.	Analyses and other properties of Oregon coals, 1940: H.F.Yancey & M.R.Geer	(out of pri
21.	Second biennial report of the Department, 1939-40	Free
23.	Investigation of reported occurrence of tin at Juniper Ridge, Oreg., 1942: Harrison & Allen	0.40
24.	Origin of the black sands of the coast of southwestern Oregon, 1943: W.H.Twenhofel	0.30
25.	Third biennial report of the Department, 1941-42	Free
26.	Soil: Its origin, destruction, and preservation, 1944: W.H.Twenhofel	0.45
27.	Geology & coal resources of Coos Bay quad., 1944: John Eliot Allen & Ewart M. Baldwin	1.00
28.	Fourth biennial report of the Department, 1943-44	Free
29.	Ferruginous bauxite deposits in N.W.Oregon, 1945: F.W.Libbey, W.D.Lowry, & R.S.Mason	1.00
30.	Mineralogical and physical composition of the sands of the Oregon coast from Coos Bay to the mouth of the Columbia River, 1945: W.H.Twenhofel	0.35
31.	Geology of the St. Helens quadrangle, 1946: W.D.Wilkinson, W.D.Lowry, & E.M.Baldwin	0.45
32.	Fifth biennial report of the Department, 1945-46	Free

G.M.I. SHORT PAPERS

1.	Preliminary report upon Oregon saline lakes, 1939: O.F.Stafford	0.10
2.	Industrial aluminum - a brief survey, 1940: Leslie L. Motz	0.10
3.	Adv. report on some quicksilver prospects in Butte Falls quad., Oreg., 1940: W.D.Wilkinson	(out of pri
4.	Flotation of Oregon limestone, 1940: J.B.Clemmer & B.H.Clemmons	0.10
5.	Survey of nonmetallic mineral production of Oregon for 1940-41: C.P.Holdredge	0.10
6.	Pumice and pumicite, 1941: James A. Adams	(out of pri
7.	Geologic history of the Portland area, 1942: Ray C. Treasher	0.15
8.	Strategic & critical minerals, a guide for Oregon prospectors, 1942: Lloyd W. Staples	(out of pri
9.	Some manganese deposits in the southern Oregon coastal region, 1942: Randall E. Brown	0.10
10.	Investigation of Tyrrell manganese and other nearby deposits, 1943: W.D.Lowry	0.15
11.	Mineral deposits in region of Imnaha and Snake rivers, Oregon, 1943: F.W.Libbey	0.15
12.	Preliminary report on high-alumina iron ores in Washington County, Oregon, 1944: F.W.Libbey, W.D.Lowry, & R.S.Mason	0.15
13.	Antimony in Oregon, 1944: Norman S. Wagner	0.15
14.	Notes on building-block materials of eastern Oregon, 1946: Norman S. Wagner	0.10
15.	Reconnaissance geology of limestone deposits in the Willamette Valley, Oreg., 1946: J.E.Allen	0.15
16.	Perlite deposits near the Deschutes River, southern Wasco County, Oreg., 1946: J.E.Allen	0.15
17.	Sodium salts of Lake County, Oregon, 1947: Ira S. Allison & Ralph S. Mason	0.15