Table 1

Data from Crump Geyser

Depth of well	1684'
Type Rig	Rotary
Size of hole	$12\frac{1}{2}$" to 355' 8 3/4" 355' to 1684'
Casing	15 feet of 20" casing
Height of eruption	150 to 200 feet
Velocity of flow	Average - 67 feet/sec.
Water temperature at edge of casing	200 f.
Water flow	400 to 600 gal/min.
Radioactivity	U_3O_8 - trace (determination by Lakeview Mining Co.)

Water Analysis - See separate sheet....

see letter

"Vandalism Kills Crump Geyser"

The Crump Continuous "geyser" (Ore-Bin, Sept. 1959) which had a ~~spectacular~~ beginning on July 1, 1959 is now inactive.

~~Vandals succeeded in obstructing the flow the "geyser" flowed continuously until about~~

Vandals succeeded in plugging the geyser in February and again in March by piling large boulders in and around the casing of the well.

Despite the obstructions lodged in the casing ~~and hole~~, the "geyser" sported continuously until about ~~the~~ June 1. ~~It~~ then became a true geyser erupting for about 30 seconds every 2 minutes. This period ~~gradually~~ steadily increased and on July 5 was about 1 hour. ~~and~~ By July 15 eruptions had ceased. Now the only activity is the rumbling of boiling water down in the hole.

The hot spring ~~activity~~ activity has increased in the parts of this area and the original Crump Geyser (a 100 foot deep well) just to the north ~~is again sporting~~ has blown the debris from its orifice and is again sporting at intervals of about 12 hours for 5 minutes.

The Crump Continuous Geyser which had a spectacular beginning on July 1, 1959 is now inactive due to Vandalism.

The "geyser" flowed continously until about May 15 of this year despite being damaged by vandals in February and again in March. The flow was temporarily stopped when the 8 foot deep well around the 20" casing was completely filled with large boulders and other debris. Some of this material was removed and the geyser resumed spouting but only to a height of 40 to 50 feet in the air much of the water & steam was diverted by ~~obstruction~~ rocks lodged in the hole & casing.

About June 1 the well became a true geyser - at first the period was only 2 or 3 minutes with an active period of about 30 seconds. By July 5 the period had increased to about 1 hour and daily became longer until about ~~the 15th~~ July 15 the geyser became inactive. Now the rumbling of boiling water can be heard deep in the hole.

As the activity of the large well decreased other hot springs in the area were observed to start again and finally the Crump Geyser #1 that has been a true geyser since 1955 again began activity. This geyser has now started to spout for 5 minutes at interval of about 12 hours. ~~for a 5 minute length~~

Mr. Charles Crump who owns the ~~property~~ hot spring area is planning to determine the depth of the obstruction in the large well and the feasibility of removing it.

the land where it was first established in 1896

Plush – named for a local Indian celebrity – The Indian received the name "Plush" because of a card game in which he was dealt a flush and could not pronounce it —

Crump Lake – Crump family early homesteaders in Warner Valley —

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66. Thermal Springs in the U.S.

Quote from Clarke, in The Data of Geochemistry 1924 – USGS Bull 770

– – – – Vadose waters or waters of infiltration, are characterized by fluctuations in composition, concentration, and rate of flow, depending upon local and variable conditions, such as abundant rain or drought. They also contain, as a rule, carbonates of lime or magnesia, chlorides or sulfate. Virgin or juvenile waters, on the contrary, are fairly constant in all essential particulars and carry sodium bicarbonate, alkaline silicates, heavy metals, etc, as their constituents, with chloride or sulfates only as accessories, and practically no carbonates of the alkaline earths.

Hague writing on Yellowstone – conclude that the waters of hot springs and geysers are essentially meteoric waters that have penetrated downward a sufficient distance to attain an increased temperature and have been forced to the surface again by ascending currents – (steam pressure?)

Day and Allen on Lassen Park area concluded that the hot springs of Lassen Volcanic Nat Park are fed chiefly by surface water that drains the basin in which they occ, but that a probably smaller portion of the water is derived from an underlying magma or batholith.

The magmatic water rises in the form of steam along with other

steam gases through clefts in the rocks, is condensed, ~~by~~ the ground water and becomes mingled with it.

67

At least part of the water of many thermal springs is of magmatic origin

In many places large bodies of hot rock lie at shallow depths but do not give off appreciable quantities of magmatic waters

268

At Klamath Falls, Oregon it is a common practise to drill shallow holes to the hot rock and insert coils through which water is circulated for heating. These holes do not steam, and yet surface water introduced into them is promptly heated and returned by convection to the surface. The major part of the discharge of hot springs near Klamath Falls is doubtless meteoric water circulating through cracks in a similar way.

Sources of Heat

1. From the natural increase of temperature with depth.
2. From an underlying body of hot or possibly molten rock.
3. From zones where there has been faulting with resultant development of heat (friction).
4. Chemical reactions beneath the surface.
5. ~~Radioactivity~~

1. Normal increase of temperature with depth is about 1°F. for every 40 to 98 feet increase in depth

2. Heat surely is generated during crushing and shearing by movement of large bodies of rock. This may be the heat source of some thermal springs. There is also the possibility that this crushing and shearing allows the upward escape of heated water from considerable depths.

Encyclopedia Britannica

Geysir - Icelandic - gusher or rager

Iver -

Iceland, New Zealand, Yellowstone Park.

The name geyser is from the Great Geyser 30 mi northwest of Hekla (100 hot springs in an area 2 mi diameter).

Great Geyser occupies a pool 60' diameter 4' deep basin on the summit of a mound of dilicious sinter.

6 hour period of quiescence - 5 min. eruption — as high as 212'

The great geyser district of New Zaland is situated in the south of the provinde of Auckland to the northeast of Lake Taupo - a bewildering profusion of boiling springs steam jets and mud volcanoes - fantastic effect produced on the rocks, by the silicous deposits and by the action of boiling water. In 1880 the geysers were not active but subsequent to the Tarawera eruption of 1886 - seven giant geysers came into being, water, steam, mud, and stone were discharged to a height of 600 to 800 feet.

Yellowstone Park — there are about 100 geysers.

Eruptive action of geysers —

1- Pipe like conduit - far down in this pipe the temperature is much above the boiling point in open air and the temperature is constantly increasing owing to volcanic heat below the vapour pressure of the steam also increases until eventually it exceeds the pressure from the water above. The water at this point passes suddenly into steam which by expanding raise

~~64315~~

64264

OSC

66613 -

Arthur S. King Sand + water

M. G. Hubert Ag. Engineering

Sources of Heat for the water for a Geyser —

1. Contact of hot rocks at depth } Subsurface water
2. Hot gases (fumaroles)

Hot springs are fed chiefly by ground water that has been heated by magmatic steam.

If the descending ground water that enters the fumarole fissure is too abundant for the heat supplied to vaporize it, the fumarole becomes a hot spring.

The hot springs in Lassen Volcanic National Park and Yellowstone National Park are estimated to consist of 10 percent of magmatic water and 90 percent of water of surface origin.

That magmatic steam has contributed to the hot springs of volcanic areas is indicated by the presence of such substances as arsenic, boric acid, and other constituents in quantities and under conditions that show they could not have been dissolved from the surrounding rocks.

The water of the hot springs of Yellowstone Park is largely of surface origin (90%) which becomes heated at depth by the condensation of magmatic steam in it and returns in this heated condition to the Earth's surface.

Geyser. A geyser

60-100 – clastic - fragments mostly medium grained tuffaceous sediment - cementing agent ? – fragments sub-rounded to rounded.

105-140 – uniform - cemented lake seds (?) - clastic tuffaceous seds - greenish color - epidote –

140-170 – mixture of the above material - with fine grained dark gray basalt fragments - the ba frags. are rounded to sub-angular but probably not from solid rock. - fragment of calcite and zolites.

170-185 – loss of circulation - highest temperature at 185'

200 to 240 – cutting very fine - dark greenish black clayey material – difficult to identify.

310-340 – more reddish fragments - appears to be mainly clastic tuff-seds but the possibility of the rock being highly altered and or basalt feldspars appear fresh with chlorite (?) green (?) abundant. - some micro breccia - possibly – fault gouge –

350-400 – more light red material here - the red colored material is clay that surrounds mainly ~~clastic~~ fragments of clastic material.

405-425 – loss of circulation indicated by straw - cellophane material appears to be very similar to that from 350-400

430-450 – gray to cream colored tuff - a minor amount with the gray fine tuffaceous sedimentary (?) rock. - Still question whether it is a fine grained igneous rock.

470-490 – fragments of the medium-grained tuff. sed.(?) surrounded by a reddish brown clay matrix – some fragments of black-basalt.

505-570 – Mainly fine grained clayey buff tuff – with some frags. of the black to gray medium grained basalt(?)

580-640 – tan to brown tuff – clayey with assorted rock frags – some vesicular basalt.

650-700 – fine-grained dark gray igneous fragments – possibly from an agglomerate or volcanic breccia

740-800 – same as above – except a little coarser grained with red + green alteration – a few frags of clayey tuff. – High olivine content

810-850 – mainly – dark colored – medium grained igneous rock very possibly a basalt now altered beyond recognition

900-1000 – same as above – fine to medium grained fairly dense – sometimes slightly vesicular and amygdaloidal

1100-1120 – Coarser and darker green – but apparently the same rock – Medium grained – highly altered – olivine to copper colored mineral feldspars to clay(?).

1130-1150 – Same as above with the appearance of a diabasic texture.

1270- See other sheet.

1390-1450 – fairly dense – porphyritic basalt – phenocrysts of plagioclase up to 2cm also the same medium-grained olivine basalt.

1470-1490 – fine grained basalt – dense – black with green fringe

~~1540~~

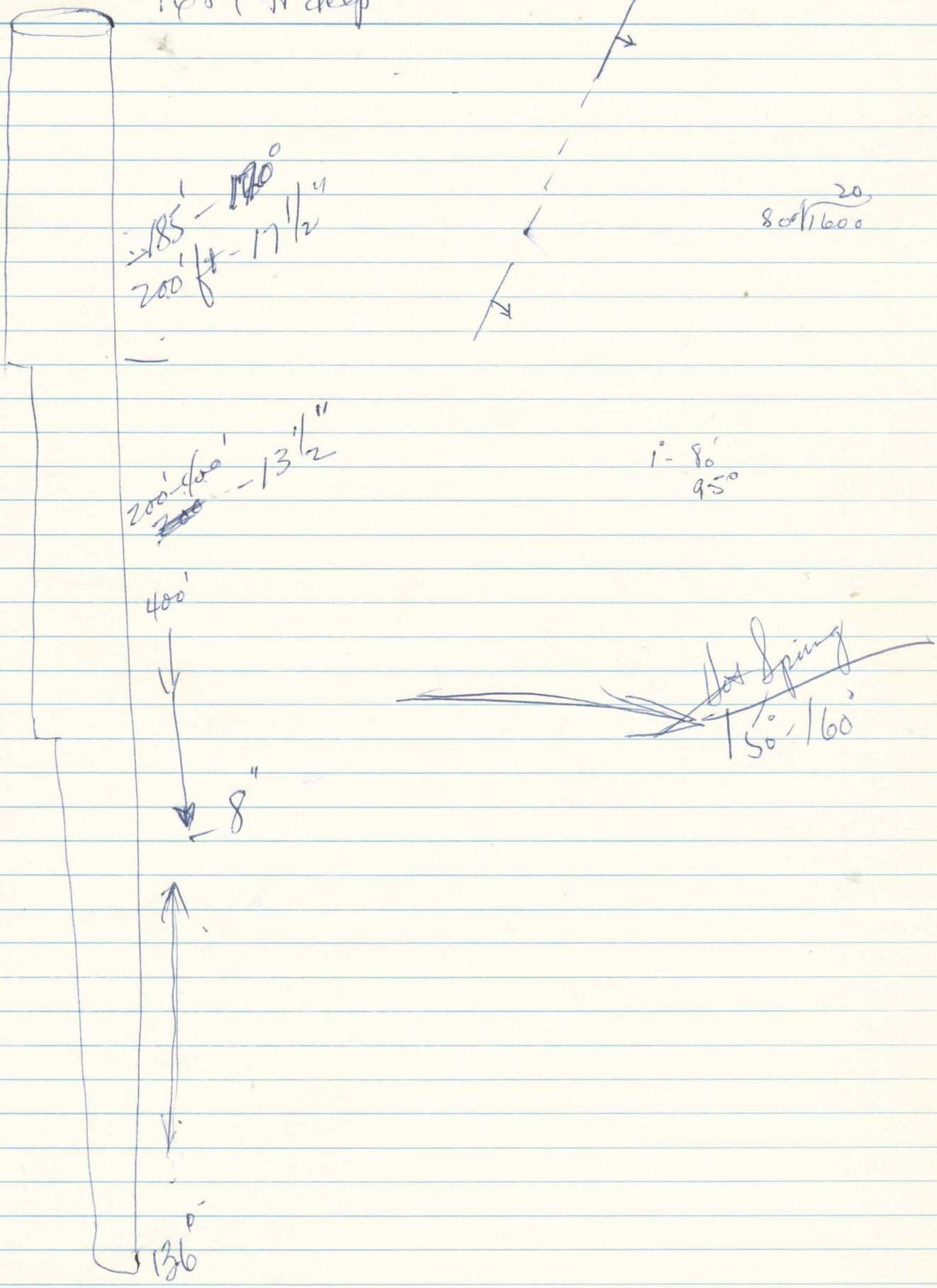
1510-1550 – black-greenish basalt - a few fragments appear fresher - some zeolites

1560-1600 – mixture of medium grained X11in basalt and fresher dense black basalt.

1600-1670 –

Pump Deeper

1684 ft deep



Thursday - Sept. 10
Sample Seint. of drill cuttings -

Started sorting the samples for ident. - Lunch with Charley Crump - checked the temperature of the geyser and found it to be 210° this was a good reading with a good thermometer.

Sampled the water - 2 quarts - send this in for a check for radioactivity and also for safety for human consumption.

Friday - Sept. 11 - Read Donath Thesis

1510 - 1550 -
black basalt - zeolite
phenocryst of feldspar

1300 - 1390 - Material is mainly a dark gray green - was originally a fairly coarse grained basalt alteration prominent - much green chlorite(?) and felds-spars ~~weathered to~~ show alteration - a coppery colored mineral is prominent as - olivine alteration(?)

1250 - 1270 - again Xlline basalt highly altered with some red cindery material

1130 - 1150 - most fragments coarse grained basalt - amygdaloidal greenish color from chlorite (?) - appears the same as 1300 - 1390

Thanksgiving - 1955

Every 3 hours for 1 minute
Within 18 mo's increased to 6 minutes - 8½ hour intervals
Erupted - 150'

100 feet deep -

New Well ~~Started on~~ spudded in → started drilling - June - 21st

Well was abandoned 6:00 o'clock June 29th

The well blew in ~~at~~ about 1:00 clock
while no one was present — 1:15 McCrump arrived 170°
Then at 1:55 the Continuous geyser 185
came into being.

~~2.4 acre feet~~ ~~412~~ 560 gal/min. Measured 136°
2 600 gal/min. Oris Rudd
Tom Crawford measured the flow 180

Magma Power Co.
Nevada Thermal Power Co. } Los Angeles, Calif.
631 South Witmer St.
Los Angeles 17, Calif.

1" = 20,000" .8 inches 1" = 1666'

1666
12 ⟌20,000

340
+1360 × 1
1660
415

24/40 340/415 4/5

2500'

32° sample of material baked on pipe - sent for analysis

6490'

Traverse - East facing scarp - Camp Lake

Start at 4550' elevation - alluvium - soil creep - sock debris. 4350'

Almost due west 300 yards there is a spring - slightly warm at about 4600' elevation. - Developed by a 2½ pipe - runs a trickle. Photo taken from 4800' elev. due west.

Up to 5250' all talus so far - soil mixed with basalt cobbles - boulders - basalt of all composition - reddish vesicular, dikty taxitic - steeno porphyritic. - Rocks in place soon I hope.

5480' - still soil & talus on 32° slope -

5650 - 5700 - Patch of Quaking aspen - at a spring - running very cold barely a trickle. - can see on photo.

6700' to the top of the scarp west of the Geyser - the last 200' are basalt flows that vary from 6' to 50' thick. Some 6 to 8 flows.

6700
4341
2359

On down the scarp - at - 6300' the basalt - dikty sequence is broken by a thin flow of welded taff - appears to be 15' to 20' thick - glassy at the base and becoming less indurated at the top - 2 rock samples.

This welded taff is immediately underlain by a light tan massive ash thickness at least 30' - friable - punky -

Down to 5950' here a thick cindery - roughly columnar jointed flow ash - about 100' thick -

Immediately below this flow is a reddish soil zone - under this is a series of thin vesicular flows.

(pg) At 5850 base of thick flow - strike N-S Dip 5° West.
5700 - thin vesicular - reddish lava - ropy surfaces on flows - also ash - one natural bridge - 1 photo 3.5 f/1.30

Subterranean

March 24 | Feb. & March

— Crump Geyser — Flowed continuously — July 1, 1960

Geyser flowed continuously from — July 1, 1959 to May 15 about —

Vandalism first reported 1 Feb. 1960 —
2nd vandalism early in March —
— flow of geyser 35 - 50' —
March 18 & Continuous at 35' to 50' —

June 9 - 2 minute period for 20 seconds — 100' in the air

July 5 - 50 minute period - 30 seconds. —

July 21 - About July 15 - inactive —

Hot Springs now active —

Old Crump Geyser active again —
period of about 12 hours - height about 100' for 5 minutes.

LAKE COUNTY EXAMINER 10/24/63 COPY

40 YEARS AGO
(Examiner, Oct. 25, 1923)

A third geyser was struck last Saturday at the Hunter Hot Springs about a mile and one-half north of Lakeview. The first geyser developed three weeks ago, as wonderful as it seemed, was nothing in comparison to this mammoth gusher of boiling water. Hundreds of people have visited the grounds since it was struck last Saturday. At a depth of about 12 feet in a hole drilled in the center of the upper boxed spring the first heavy flow of water was struck, forcing the drillers to stop their work Saturday afternoon. This first flow, which later developed into a powerful geyser, spouting into the air about 10 to 12 feet high, varying only slightly in its constant flow. On Monday, when the wind had changed so that the drillers could again work without being scalded by the hot spray, the casing in this well was extended to a depth of 20 feet. In a few minutes after the drills had been removed from the well the geyser shot for the first time. Every 12 to 15 seconds it shot in the same manner and for nearly two days sent its great volume of boiling water from 50 to 75 feet into the air. But now it has again changed its habits and is sending a constant flow into the air about 50 feet high.

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LAKE COUNTY'S NEW CONTINUOUS GEYSER

By
Norman V. Peterson*

Introduction

At 1:55 p.m. on July 1, 1959, a new geologic phenomenon was born in Lake County. A spectacular geyser erupted on land owned by Charles Crump, near the community of Adel in southern Lake County. Since that hour, the geyser has continuously sent a column of steam and water in the air to a height in excess of 150 feet.

By definition this geologic phenomenon is not a true geyser. A geyser is defined as an intermittent eruptive hot spring in which the discharge is caused at more or less frequent intervals by the expansive force of highly heated steam. It perhaps more closely fits the description of smaller continuous eruptions in Yellowstone National Park that Allen and Day (1935) called "perpetual spouters."

The Crump Geyser, as it has been named, resulted from a well drilled by the Nevada Thermal Power Company, the exploratory division of the Magma Power Company of 631 S. Witmer Street, Los Angeles 17, California. This company is conducting a systematic drilling program in Oregon, California, and Nevada in its search for natural superheated steam (300°F.) that may be harnessed for the generation of power.

After drilling to a depth of 1,684 feet and not finding sufficiently hot water, the company abandoned the well on June 29, 1959, and released it to Mr. Crump. The well remained quiet until sometime between 12:00 and 1:15 p.m., July 1. Mr. Crump arrived at the well just after 1:15 and could see that the hole had been cleared of drilling mud and debris by an eruption that had barely ceased. Boiling water was present at the top of the well casing. At 1:55 p.m., as Mr. Crump and a neighbor watched, the geyser erupted again with a terrific rumbling and since then has been continuously active.

Well data

Measurements of the temperature, flow, and velocity of the Crump Geyser have been obtained from the Oregon State Engineer's Office. Analysis of the water was provided by the State Sanitary Authority. Statistics on the well, drilling history, and well cuttings were submitted by the Nevada Thermal Power Company. Some of these data are given as follows:

Depth of well: 1,684 feet.

Type rig: Rotary.

Spud date: 6/21/59. Completion date: 6/29/59.

Size of hole: 12¼ inches to 335-foot depth.
8-3/4 inches to 1,684-foot depth.

Casing: 15 feet of 20-inch casing.

Height of eruption: 150 to 200 feet.

Velocity of flow: Average - 67 ft./sec.

Water temperature at edge of casing: 200°±F.

Water flow: 400 to 600 gal./min.

Radioactivity: U_3O_8 - trace (determination by Lakeview Mining Company).

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* Geologist, State of Oregon Department of Geology and Mineral Industries.

Water analysis: (determination by State Sanitary Authority)

Turbidity	4*
Color	3
Total solids	956
Suspended solids	9
Carbonate alkalinity	30.3
Bicarbonate alkalinity	73.7
Hardness (as $CaCO_3$)	23.2
Chloride (Cl)	235
Sulfate (SO_4)	130
Arsenic	0.5
Copper	1.0
Nitrate nitrogen	0.37
Phosphate (PO_4)	0.58
Iron (Fe)	1.0
Manganese (Mn)	1.0
pH	8.75

* All results except for pH are in parts per million.

Temperature record: (determination by Nevada Thermal Power Company)

Date	Depth	Temperature
6/22/59	40 ft.	170° F.
6/24/59	199	215
6/26/59	660	230-250
6/27/59	1,004	160
6/28/59	1,618	not determined
6/29/59	1,684	hole bridged

Bottom-hole temperatures using maximum recording thermometers.

Additional measurements made on September 10, 1959, show the continuous activity of the "perpetual spouter" to be very much the same as when it began on July 1. The temperature was 210° at the top of the casing, the height of eruption about 195 feet, and the flow of water estimated to be 500 gal./min. A noticeable white siliceous material was beginning to coat boulders and pebbles around the well.

Distribution of hot springs and geysers

The Crump Geyser, located in sec. 34, T. 38 S., R. 24 E., is at the base of the prominent fault scarp along the western edge of Warner Valley between Pelican and Crump lakes. It is 3.8 miles north of Adel and 200 feet west of the Adel-Plush road. Besides this geyser there are several warm and hot springs in the area. They occur in an elongate north-trending zone which is shown on the accompanying geologic map. Extinct hot springs are indicated also by low mounds of calcareous and siliceous tufa, especially at the north edge of Pelican Lake. It is interesting to note that the new geyser has inactivated a hot spring about 100 yards due east and a true geyser about 100 feet to the north.

A group of similar, exceptionally hot springs and man-made geysers occurs just north of Lakeview, 35 miles to the east, at the base of the Goose Lake scarp. Two geysers in this group (Hunters Hot Springs) resulted from shallow wells and are probably "perpetual spouters." "Old Perpetual," a familiar landmark in the Lakeview area, is a 50- to 60-foot spouter. "The Teakettle" to the east at the base of the hill has been controlled for use in heating a housing development.

The association of a narrow thermal-spring belt and a fault scarp is a characteristic pattern for most of the thermal springs in this region including those in the northern parts of California and Nevada (Stearns, Stearns, and Waring, 1935).

Source of thermal waters

The source of heat for thermal springs has been studied in some detail (Sosman and others, 1924) and is generally believed to be from hot igneous rock that lies at a moderate depth beneath the surface. The heat is derived both from contact with the hot rock and from superheated steam and gases that mingle with and heat meteoric water (rain water) which has percolated downward. Still another source of heat is that generated by friction during shearing and crushing in zones of major faults. Chemical reactions and contained radioactivity have been considered as another source but are believed to be minor.

The source of the water if flow is large can be another problem. From studies made in both Yellowstone National Park and at Lassen Volcanic National Park, Allen and Day (1935) and Day and Allen (1925) concluded that the water in hot springs is chiefly from surface water which has percolated downward and returned to the surface, but that a small portion of the water is derived from an underlying magma or batholith in the form of superheated steam and gases.

Geology of the map area

Warner Valley, in which the Crump Geyser and other thermal springs occur, is near the northern limit of the Basin and Range Province, a region of fault block mountains and valleys. This long, undrained basin-type valley has resulted from late Tertiary to Recent block faulting and is bounded on both east and west by large tilted fault blocks. The geology for this report was based on a reconnaissance of the steep east-facing fault scarp along the western edge of the valley. The only significant canyon in the scarp occurs just west of Adel where Deep Creek, which drains the area to the southwest, has cut a deep valley almost at right angles to the rim. The Deep Creek canyon also exposes the same volcanic rock sequence that is found in the escarpment.

All of the rocks exposed in the scarp face are Tertiary volcanics. There are three definite units: a lower sequence of basalt flows; an overlying tuff unit consisting of a thin lapilli tuff layer and a welded tuff flow; and about 400 feet of capping basalt flows. These rocks appear to overlie one another conformably. In general they strike nearly north and dip about 5° to the west.

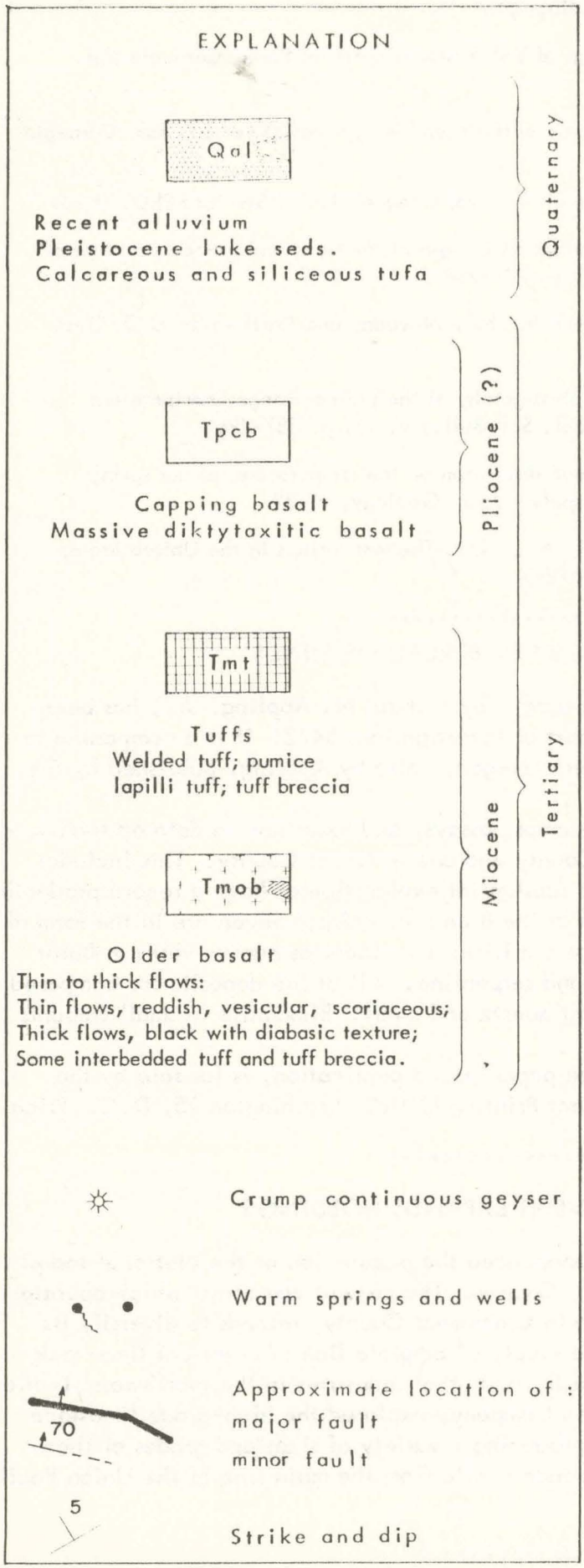
Older basalt: The basalt flows that make up this thick unit crop out from 4,525 feet in elevation on the valley floor to about 6,000 feet in elevation high up on the steep scarp. Massive black, dense, coarse-grained olivine basalt flows make up about 50 percent of this unit. The rock has a diabasic texture and weathers easily to a granular black sand. Interbedded with these flows are thin to thick, dark-gray to reddish vesicular and amygdaloidal flows, many of which are scoriaceous to ropy on flow surfaces. Within the sequence of older basalt there are at least two horizons of pumice lapilli tuff and tuff breccia. From a check of the ditch samples of the Crump well it appears that, except for the first few tens of feet of alluvium and rubble, the entire hole is drilled in rocks similar to the older basalt. This unit may contain as much as 3,000 feet of basalt flows with minor pyroclastic rocks. (See Section A-A'.)

Tuffs: Above the older basalt sequence is a persistent unit comprising a massive light-tan pumice lapilli tuff and an overlying gray welded tuff. The thickness of this unit is variable and from isolated outcrops in the scarp face is estimated to be from 100 to 200 feet thick. In the Deep Creek canyon to the west, however, it appears to thicken considerably. George Walker of the U.S. Geological Survey (personal communication) has reported finding vertebrate fossils from this horizon that have been identified as a Mascall fauna equivalent, making these rocks of probable upper Miocene age.

Capping basalt: Above the tuffs are the cliff-forming capping basalt flows or "rim rocks." These light-gray, massive, olivine basalts make up the topmost 400 feet of the scarp rim. Individual flows vary from 10 to 50 feet in thickness, are vesicular, and have a diktytaxitic texture similar to many of the late Tertiary basalt flows in this part of Oregon. A rude columnar jointing in the thicker flows facilitates breakage of the rocks into large rectangular blocks that form steep talus piles from which some blocks roll all the way to the valley floor. (Early Indians used these large, smooth-surfaced blocks on which to carve their petroglyphs, and many fine examples can be seen along the Hart Lake narrows just north of Crump Lake.)

Quaternary alluvium: Lacustrine sediments that include gravels, sand, and silt cover the floor of Warner Valley. These horizontal beds (from a fraction of an inch to a few feet in thickness) can be seen in road cuts in the vicinity of Adel. The Quaternary lake in which the sediments were deposited was much larger than the small lakes that are now found in the valley. This is shown by former terraces and shorelines as much as 100 feet above the valley floor. No information is available on the thickness of the sands and gravels except that beds totaling at least 60 feet were measured in the vicinity of Adel. Adel, however, is located on the alluvial fan resulting from the entry of Deep Creek into the Warner Valley and the sediments at this point may not be representative of thickness in the whole valley. Former sites of hot springs are indicated by local mounds of white to light-gray siliceous sinter and calcareous-coated pebbles and boulders within the alluvium.

Structure: Tertiary volcanism accompanied by faulting as late as Recent times is responsible for the present topography of the region. There are two predominant fault directions, one trending northwest and the other northeast. Most previous workers in the region, Donath (1958), Nolan (1943), Fuller and Waters (1929), and Russell (1928), have interpreted the faults to be normal high-angle with dominantly dip-slip movement. During the brief reconnaissance for this report, slickensided fault planes were found at two locations about 2 miles apart. At both locations the faults are normal. They strike N. 10° E. and dip from 70° to 75° to the east. The major fault along the western edge of Warner Valley is believed to be a high-angle normal fault and its approximate location as interpreted from topography and aerial photographs is shown on the geologic map.



Origin of Crump Geyser

From a study of the well cuttings and the log of the drilling history of the well it appears that the geyser is just east of the fault zone. Circulation was lost and temperature increased from 180 to 200 feet. This zone was interpreted as the location of the fault at depth. After passing through this fault zone the hole appears to penetrate altered rocks very similar to the older basalt and pyroclastic sequence. A second hot zone which was encountered at 660 feet could be either a scoriaceous or vesicular interbed or possibly another fracture within the complex fault zone. Most of the heat probably originates from a cooling lava mass, and the faulted and sheared zone provides a conduit for superheated water to escape upward from considerable depths. The ropy scoriaceous surfaces of the thin reddish flows within the older basalt should make excellent aquifers through which surface waters could easily percolate. It appears that the volcanic rock sequence east of the fault dips gently to the west beneath Warner Valley and these dipping flows may provide an adequate source of water for the geyser and hot springs.

Future of Crump Geyser

Much has been written about the value of this spectacular geyser as a scenic attraction and, even though it is remote from well-traveled highways (35 miles east of Lakeview), if it continues to spout, its fame should grow. At the present time the runoff water is irrigating a small pasture area before draining into Crump Lake through a system of canals. Further usage of the water for irrigation and domestic animals is being considered by Mr. Crump pending a complete interpretation of the chemical analysis of the water by agricultural experts.

Acknowledgments

Grateful acknowledgment is made to Mr. Charles Crump for his assistance which was given freely and in many ways. Acknowledgment is also made to the State Engineer, Mr. Lewis A. Stanley, and to Mr. Jack Sceva, groundwater geologist on his staff, for their fine cooperation in furnishing well data, advice, and other information.

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NEW MANGANESE REPORT BY BUREAU OF MINES

"Manganese deposits of northeastern Oregon," by Richard N. Appling, Jr., has been published by the U.S. Bureau of Mines as Report of Investigations 5472. It is a companion to R.I. 5369, "Manganese deposits of southwestern Oregon," also by Appling, published by the Bureau in 1958.

The northeastern Oregon report presents maps, assays, and examination data on ten manganese deposits, nine of which are in Baker County and one in Grant County. This includes all deposits in the region that have undergone substantial exploration or have a record production. All of the deposits occur in Pre-Tertiary rocks of the Blue Mountains. Seven are in the form of small, irregular pods or lenses in Elkhorn Ridge argillite; two occur as narrow veins in Burnt River schist; and one deposit is in greenstone and serpentine. All of the deposits are composed of manganese oxides, intermixed with abundant quartz and chert. Rhodonite in small amounts was noted at several occurrences.

Report of Investigations 5472, a 23-page paper-bound publication, is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price is 25 cents.

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OREGON PORTLAND CEMENT EXPANDS HOLDINGS

Oregon Portland Cement Company has announced the acquisition of the National Industrial Products Company operation at Durkee, Baker, County. The cement company, which operates plants at Lime in Baker County and at Oswego in Clackamas County, intends to diversify its production, presently confined to cement, and supply a complete line of chemical lime-rock products for sugar mills, paper plants, steel mills, and other industries in the Northwest. National, a wholly owned subsidiary of Morrison-Knudsen Company, explored the high-grade limestone deposit near Durkee early in 1954 and began producing a variety of sizes and grades of limestone a few months later. The property is less than a mile from the main line of the Union Pacific Railroad and U.S. Highway 30.

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GOVERNOR ENDORSES COMMITTEE'S STUDIES

Governor Mark Hatfield pledged his support of the resolutions and recommendations of his Mining Advisory Committee at a conference in the State Capitol September 22. The resolution and recommendations of the Committee were prepared at a meeting of the Western Governors Mining Advisory Council in Sun Valley July 8 and 9, and put in final form at a second meeting in Denver on September 15. The summary of the resolution, as presented to the Governor, stated:

> BE IT RESOLVED that the maintenance of a healthy metal mining industry in the United States is of the utmost economic importance to the Western States, both for themselves and as major markets for Eastern States' manufacturers, and is as well, of the utmost importance to the national security, and that such a healthy industry may be maintained by joint action of the Administration and the Congress by:
>
> (1) Adopting and implementing without delay an adequate national minerals policy which would assure the maintenance of a healthy domestic mining industry, and
> (2) Taking all steps which may be needed to assure to the domestic mining industry at least one-half of the domestic market, or the present proportion of the domestic market (whichever is higher) either by adequate tariffs, excise taxes, or quotas, or, for the minor metals, allocation of import receipts, or such combination of these as may be most suitable.

Recommendations for 20 domestically mined metals were discussed with Governor Hatfield. Of immediate concern to Oregon's mining industry were the recommendations on quicksilver and chrome. These were:

> Mercury: That an annual quota (or tariff) be imposed on imports to preserve something over one-half of the domestic market.
>
> Chrome: That small excise taxes (or tariffs) be imposed on foreign imports, the proceeds from which should be sufficient when distributed among United States producers to maintain a healthy nucleus of domestic production.

Governor Hatfield was instrumental in convening the meeting of the Western Governors Mining Advisory Council in Sun Valley. In April he addressed a letter to Governor Smylie, Chairman of the Western Governors Conference, suggesting a meeting of the mining people of the western states in order that recommendations could be formulated which might correct the low ebb of mining activity current throughout the West. Appointees to Governor Hatfield's Mining Advisory Committee are: Hollis M. Dole, Chairman, Portland; Harold Banta, Baker; Fayette I. Bristol, Grants Pass; Les Child, Grants Pass; William W. Gardner, Canyon City; Clint P. Haight, Jr., Baker; Pierre R. Hines, Portland; William Kennedy, Portland; Bruce J. Manley, Medford; Earl S. Mollard, Riddle; and Dr. Garth W. Thornburg, Lakeview. Officers of the Western Governors Mining Advisory Council elected at the Denver meeting September 15 are: Chairman Clark L. Wilson, Vice President, New Park Mining Company, Salt Lake City, Utah; Vice Chairman, W. G. Maloney, Manager of the Mining Association of Montana, Butte, Montana; and Sec.-Treas. Frank P. Knight, Director of Department of Mineral Resources, Phoenix, Arizona.

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MIKE BROWN WINS TROPHY

Michael Brown, a senior at Washington High School and a student assistant for the Department, won the Barclay Adult Fossil Trophy at the National Gem Show which was held at the Annual Convention of the American Federation of Mineralogical Societies in the Portland Public Auditorium September 5, 6, and 7. This is the first time the Barclay Adult Trophy has been awarded. Mike, who has won a number of top awards for his fossil displays, qualified for the national competition by winning first place in fossil exhibits at the Northwest Federation of Mineralogical Societies show in Pasco last year. His display at the National Gem Show consisted of vertebrates, invertebrates, and plants.

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GOLD MINERS CAN'T WIN

It will be recalled that the gold miners, after more than ten years in the court, were turned down by the Supreme Court for relief as the result of War Production Board Order L-208 which declared that gold was a nonessential material and therefore not to be mined during World War II. Miners felt that relief was due them, as the closure made it prohibitive to reopen their properties after the war.

Another avenue of attack which might have brought relief to the miners has been traveled by the law firm Seitz, Easley & Whipple, Portland. This firm, under the guidance of attorney Norman L. Easley, has been challenging the legality of the United States Treasury establishing the price of gold at $35 per ounce under the Gold Reserve Act of 1934. Mr. Easley has furnished the Department a brief summary of the actions he has taken in pursuing this legal battle.

> On August 10, 1954, we filed in behalf of Mrs. Gladys Laycock a damage action under the Tucker Act against the United States for damages. The action was filed in Oregon upon an implied contract for compensation for property taken in violation of the due process clause of the United States Constitution. The action was dismissed, an appeal was taken and on June 11, 1956, the Court of Appeals affirmed the dismissal. We thereupon took out a writ of certiorari to the Supreme Court of the United States, without success.
>
> The foregoing action was a damage action at law and the result conclusively showed that plaintiff was without a remedy at law. Thereafter, on June 28, 1956, we filed a declaratory judgment in a suit for injunctive relief against Mr. George Humphrey, Secretary of the Treasury. After having been served in Washington, D. C., Mr. Humphrey refused to make an appearance and therefore we did not have jurisdiction. Thereafter, on August 30, 1956, we filed the same against Mr. Humphrey's representative in Oregon, Frank J. Kenney, asking the court to enjoin him from enforcing the Gold Reserve Act of 1934 and the Gold Regulations issued thereunder. Since an act of Congress was involved, the statute required a three judge court. On April 8, 1957, our motion to convene the three judge court to decide the constitutionality of the Gold Reserve Act was denied. We thereupon applied to the Supreme Court of the United States for a writ of mandamus to enforce the calling of a three judge court. That writ was denied. Thereafter, we amended the complaint against Mr. Kenney, who incidentally is the head of the Secret Service in Oregon, and eliminated any reference to the Gold Reserve Act of 1934. Rather we challenged the constitutionality of the Gold Regulations which are promulgated by the Treasury Department of the United States. Upon exhaustive hearings the motion allowing dismissal of that complaint was entered. Thereafter, we appealed to the Court of Appeals in San Francisco, with the result noted in the news item (see below). It will be our next step to appeal to the Supreme Court in the hope that our justiciable claim will be recognized.

The news item referred to by Mr. Easley is given below. It was an Associated Press dispatch dated September 2, 1959.

> The U.S. Court of Appeals ruled Tuesday that Congress and the secretary of the treasury were acting within constitutional powers in regulating the sale and processing of gold in the United States.
>
> The appeals court's opinion, written by Gilbert H. Jertberg, said Congress acted within its constitutional powers authorizing it to provide a "sound and uniform currency for the country." Mrs. Laycock's allegation "that the price has ruined the gold mining industry, even if true, is beside the point," the appeals court said. "The act was not intended to encourage gold mining; it is concerned only with the monetary system of the United States. Under it the secretary is not required to consider the condition of the gold mining industry in setting the price; he need only be concerned with carrying out the policy of Congress as expressed in the act." The appeals court said that this policy "may be found wanting in a purely political matter, the wisdom of which is not for this court to decide. Our concern ends upon a showing that Congress in adopting a policy acted within its constitutional authority."

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MINERALS RESOLUTION APPROVED

A resolution (House Concurrent Resolution 177) requesting the President to review present government minerals policy and report promptly to Congress on steps he proposes to aid depressed branches of the mining industry, was approved August 26 by the House of Representatives and September 1 by the Senate Interior Committee. Rep. Wayne N. Aspinall (Colorado), the sponsor of the resolution, stated in House debate that the hearings held before his Committee contained statements of 21 members of the House, 2 State Governors, and 67 other persons. (William W. Gardner, President of the Grant County Miners Association, and Hollis M. Dole, Director of the Oregon Department of Geology and Mineral Industries, testified on mineral conditions in Oregon.) The hearings showed, according to Aspinall, that the health of most segments of the mining industry was "desperate." Aspinall said the rising unemployment in mining areas is disturbing and added, "Perhaps more disturbing is the seeming excessiveness to which our government has gone in sacrificing the well-being of our mining and mineral industries and the workers who compromise them to accomplish our foreign policy objectives. When our foreign policy conflicts with our domestic mining policy, it seems that the latter has been sacrificed at times, ruthlessly."

Rep. Al Ullman (Oregon), who testified before the Committee hearings, stated on the House floor:

> As a sponsor of identical legislation and as a member of the Interior and Insular Affairs Committee, I urge prompt enactment of this legislation. It is indeed paradoxical that our mining industry has been allowed to languish at the very time when the mineral needs of the Nation are expanding. Nearly everyone agrees that our country stands on the threshold of an era of unparalled economic expansion. All agree that natural resources will be required for this economic development. Yet, mines continue to close, domestic production continues to fall and chronic unemployment continues as the norm for the Nation's miners. I believe this is a serious situation requiring immediate remedial action. From the standpoint of a sound economy, it is essential that a stable domestic mining industry be fostered; from a standpoint of our national defense, it is equally essential to develop domestic mineral reserves adequate for any foreseeable national emergency. We in the West are proud of the role mining has played in the development of our section of the Nation. We are confident that mining can be of equal importance to our present economy. Rich deposits of mineral wealth exist throughout the West. Small independent mining operators stand ready to insure the proper and expeditious development of these natural resources. All that is lacking is a national policy providing necessary incentives for the expansion of this essential industry. Passage of the legislation now under consideration will effectively declare congressional dissatisfaction with the lack of a mining program and congressional support for a policy of encouragement for the discovery and development of mineral wealth.

Many other Congressmen supported the legislation, among whom was Mr. Simpson of Pennsylvania who stated in part:

> The debate that has occurred in connection with this resolution must point up to each member present that this legislation purports to deal with a very limited field in which the great difficulty confronting the employees in the mining industry finds a similar relationship in many industries in the country. Reference was made to the reciprocal trade agreements program, to which I personally attribute a great many of the ills that are reflected in unemployment in industrial and mining areas of the Nation. With the reciprocal trade agreements program and the so-called commitments we have made under that program, we are limited in the relief which Congress can give to the unemployed miner and to the unemployed worker in many of our industries. While we might want to exercise our jurisdiction as legislators in the Congress of the United States and pass a law directing that this or that be done to help the unemployed miner by safeguarding his job against destructive imports or to help the gentleman who is unemployed in industry because of cheap foreign imports, we find that we cannot do it without paying a penalty through compensatory tariff cuts. Very often we forget that these alleged reciprocal trade agreements in fact have not proved to be reciprocal, and we are the ones who make the sacrifice and the other nation does not abide by its concession made to us. Time after time it has been proved that when these negotiators of ours make their agreements abroad and come back home, we find that unhappily the other country, hardly before the ink is dry on the agreement, through depreciating their currency or voiding the

agreement, have, in effect, wiped out the concession which they made to us. In fact, instances exist where the foreign country raised more barriers against American exports abroad than there were at the time we started with the reciprocal trade agreement program. American manufacturers today cannot ship many American produced articles into Western Europe because quota barriers and other trade restrictions have been raised against our exports. Today Congress is called upon to consider legislation which will authorize American business to send our dollars abroad to build plants, under the promise of preferential tax treatment so that we can service markets from factories we are to build abroad. Under the reciprocal trade agreements program, where we undertake to protect an industry providing domestic jobs, we have to, in effect, obtain permission of the GATT (Geneva Agreement on Tariffs and Trade) member countries and, if a member country asks us to make concessions in some other area as compensation, we have to pay dollar for dollar for the protection we have bought for the American worker. This reciprocal trade program, I repeat, is not reciprocal because we do not get the concessions that are promised. We do not insist on them. We sit back and let the other countries have their way with us. And then if and when - and a case in point is in front of us right now - if and when we want to protect the jobs of our own workers, if we want to reopen certain mines which under the reciprocal trade program are facing unfair competition, we have to pay the other country by making concessions in some other field of industrial output.

Even though Congress approves the resolution, which seems likely, the Administration could continue to take no action. A resolution of this type does not have the force of law. It merely expresses the desire of Congress. Interior Secretary Seaton recently reiterated that the Administration, rebuffed by the House last year when it defeated the Seaton minerals stabilization plan, would let Congress initiate any new minerals program.

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SEPTEMBER LAND WITHDRAWALS

The U.S. Bureau of Land Management has notified the Department of two withdrawals this month. Withdrawal No. 60-1 is an application from the U.S. Forest Service for the withdrawal of 6,470 acres in strips 330 feet each side of the center line of the following highways:

Willamette State Highway 58 - T. 23 S., R. 6 E.; T. 24 S., R. 7 E.; T. 25 S., R. 7 E.; T. 25 S., R. 8 E.; and T. 26 S., R. 8 E.

Fremont State Highway 31 - T. 23 S., R. 11 E.; T. 24 S., R. 11 E.; T. 25 S., R. 12 E.; and T. 25 S., T. 13 E.

Santiam U.S. Highway 20 - T. 13 S., R. 7½ E.; T. 13 S., R. 8 E.; T. 13 S., R. 9 E.; T. 14 S., R. 9 E.; T. 14 S., R. 10 E.; and T. 15 S., R. 10 E.

McKenzie U.S. Highway 126 - T. 14 S., R. 8 E.; T. 14 S., R. 9 E.; T. 15 S., R. 8 E.; T. 15 S., R. 9 E.; and T. 15 S., R. 10 E.

Cascade Lakes Forest Road 46 - T. 18 S., R. 8 E.; T. 18 S., R. 9 E.; T. 18 S., R. 10 E.; and T. 18 S., R. 11 E.

This is the third withdrawal this year by the U.S. Forest Service for roadside zones to "protect and preserve the aesthetic value of the highways." As usual, these withdrawals are subject to valid existing rights but will prevent appropriation under the general mining laws. Total acreage proposed for withdrawal this year by the Forest Service for roadside strips now amounts to 11,591 acres.

The second application for withdrawal (No. 60-2) of land is for 115 acres in T. 11 S., R. 12 E., Jefferson County. This withdrawal notes as an exception the general mining laws and mineral leasing laws. All other forms of land appropriation will be banned.

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STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1069 State Office Building, Portland 1, Oregon

PUBLICATIONS*

BULLETINS**

		Prices (subject to change)
1.	Mining laws of Oregon, 4th revision, 1954, contains Federal placer mining regulations	$ 0.50
2.	Progress report on Coos Bay coal field, 1938: F. W. Libbey	0.15
8.	Feasibility of steel plant in lower Columbia River area, rev. ed., 1940: R. M. Miller	0.40
14.	Oregon metal mines handbooks: by the staff	
	C. Vol. II, Section 1, Josephine County, 1952 (2d Ed.)	1.25
	D. Northwestern Oregon, 1951	1.25
16.	Field identification of minerals for Oregon prospectors and collectors (rev. ed.), 1954: compiled by R. C. Treasher	1.00
26.	Soil: Its origin, destruction, and preservation, 1944: W. H. Twenhofel	0.45
27.	Geology and coal resources of Coos Bay quadrangle, 1944: J. E. Allen and E. M. Baldwin	1.00
33.	Bibliography (supplement) of the geology and mineral resources of Oregon (2d printing) 1958: J. E. Allen	1.00
34.	Mines and prospects of the Mt. Reuben mining district, Josephine County, Oregon, 1947: E. A. Youngberg	0.50
36.	(1st vol.) Five papers on foraminifera from the Tertiary of Western Oregon, 1947: J. A. Cushman, R. E. Stewart, and K. C. Stewart	1.00
	(2d vol.) Two papers on foraminifera from the Tertiary of Western Oregon and Western Washington, 1949: Cushman, Stewart, and Stewart, and one paper on mollusca and microfauna of Wildcat coast section, Humboldt County, California, 1949: Stewart and Stewart	1.25
37.	Geology of the Albany quadrangle, Oregon, 1953: Ira S. Allison	0.75
40.	Preliminary description of the geology of the Kerby quadrangle, Oregon, 1949: Wells, Hotz, and Cater	0.85
41.	Ground-water studies in Umatilla and Morrow counties, 1949: Norman S. Wagner	1.25
44.	Bibliography (2d supplement) of the geology and mineral resources of Oregon, 1953: M. L. Steere	1.00
45.	Ninth biennial report of the Department, 1952-54	Free
46.	Ferruginous bauxite deposits in the Salem Hills, Marion County, Oregon, 1956: R. E. Corcoran and F. W. Libbey	1.25
47.	Tenth Biennial Report of the Department, 1954-1956	Free
49.	Lode mines of the central part of the Granite Mining District, Grant County, Oregon, 1959: Geo. S.Koch, Jr.	1.00
50.	Field guidebook - geologic trips along Oregon highways, 1959: Prepared under direction of W.D.Wilkinson	1.50

SHORT PAPERS

2.	Industrial aluminum - a brief survey, 1940: Leslie L. Motz	0.10
4.	Flotation of Oregon limestone, 1940: J. B. Clemmer and B. H. Clemmons	0.10
7.	Geologic history of the Portland area, 1942: Ray C. Treasher	0.25
13.	Antimony in Oregon, 1944: Norman S. Wagner	0.25
14.	Notes on building-block materials of eastern Oregon, 1946: Norman S. Wagner	0.15
17.	Sodium salts of Lake County, Oregon, 1947: Ira S. Allison and Ralph S. Mason	0.15
18.	Radioactive minerals the prospectors should know (2d rev.) 1955: White and Schafer	0.30
19.	Brick and tile industry in Oregon, 1949: J. E. Allen and R. S. Mason	0.20
20.	Glazes from Oregon volcanic glass, 1950: Charles W. F. Jacobs	0.20
21.	Lightweight aggregate industry in Oregon, 1951: Ralph S. Mason	0.25
22.	Preliminary report on tungsten in Oregon, 1951: Harold D. Wolfe and David J. White	0.35

GEOLOGIC MAPS

Geologic map of the central portion of the Wallowa Mountains, Oregon, 1938: W. D. Smith and others	0.20
Geologic map of the Salem Hills and North Santiam River basin, Oregon, 1939: T. P. Thayer	0.25
Geologic map of the Medford quadrangle, Oregon, 1939: F. G. Wells and others	0.40
Preliminary geologic map of the Sumpter quadrangle, 1941: J. T. Pardee and others	0.40
Geologic map of the Portland area, 1942: Ray C. Treasher	0.25
Geologic map of the St. Helens quadrangle, 1945: Wilkinson, Lowry, and Baldwin (also in Bull. 31)	0.35
Geologic map of the Dallas quadrangle, Oregon, 1947: E. M. Baldwin.	0.25
Geologic map of the Valsetz quadrangle, Oregon, 1947: E. M. Baldwin	0.25
Preliminary geologic map of the Kerby quadrangle, Oregon, 1948: Wells, Hotz, and Cater (also in Bull. 40)	0.80
Geologic map of the Albany quadrangle, Oregon, 1953: Ira S. Allison (also in Bull. 37)	0.50
Geologic map of the Galice quadrangle, Oregon, 1953: F. G. Wells and G. W. Walker	1.00
Reconnaissance geologic map of the Lebanon quadrangle, Oregon, 1956: Ira S. Allison and Wayne M. Felts	0.75
Geologic map of the Coos Bay quadrangle, 1944: J. E. Allen and E. M. Baldwin (sold with Bull. 27).	----
Geologic map of the Bend quadrangle, and reconnaissance geologic map of the central portion of the High Cascade Mountains, Oregon, 1957: Howel Williams	1.00

MISCELLANEOUS PAPERS

1.	A description of some Oregon rocks and minerals (3rd printing), 1956: Hollis M. Dole	0.40
2.	Key to Oregon mineral deposits map (3rd printing), 1957: Ralph S. Mason	0.15
3.	Facts about fossils (Reprints), 1953	0.35
4.	Rules and regulations for the conservation of oil and natural gas, 1954	0.50
5.	Oregon's gold placers (Reprints), (2nd printing) 1957	0.25
6.	Oil and gas exploration in Oregon, 1954: R. E. Stewart	1.00
7.	Bibliography of theses on Oregon geology, 1959: H. G. Schlicker.	0.50

MISCELLANEOUS PUBLICATIONS

The Ore.-Bin. Issued monthly by the staff as medium for news about the Department, mines, and minerals. (Available back issues 5 cents each.) Subscription price per year	0.50
Oregon mineral deposits map (22 x 34 inches) rev., 1958	0.30
Oregon quicksilver localities map (22 x 34 inches) 1946	0.30
Landforms of Oregon: a physiographic sketch (17 x 22 inches) 1941	0.25
Index to topographic mapping in Oregon, 1958	Free
Index to published geologic mapping in Oregon, 1956	Free

* A complete list of publications will be mailed upon request. Please include remittance with order. Postage free.

** Missing report numbers out of print.

7/8/59

Log of Crump Valley #1 Well - Descriptions from an incomplete set of ditch samples obtained from Charles Crump.

Depth

60 - 100 - Medium-grained grayish-green & tuffaceous sediment - some larger clastic fragments - fragments rounded to sub-rounded.

105 - 140 - Uniform gray-green tuffaceous sediment - not too well sorted - some coarse-grained to conglomeratic - abundant calcite as cement also fresh pyrite.

140 - 170 - A mixture of above material that contains fine-grained dark gray basalt fragments. Basalt fragments are rounded to sub-angular. Zeolite material fairly abundant, also crystalline calcite fragments.

170 - 185 - Loss of circulation - no cuttings for this interval.

200 - 240 - Cuttings very fine - dark greenish black clayey material--possibly of basaltic origin.

310 - 340 - Fragments more reddish - appear to be mainly clastic tuffaceous sediments - with the possibility that the material is highly altered andesite or basalt - feldspars appear fresh with abundant green chlorite(?) - some micro-breccia, possibly fault gouge.

350 - 400 - Light reddish material predominant - red color from clay that surrounds clastic fragments.

405 - 425 - Loss of circulation indicated by straw-cellophane in cuttings - clayey clastic volcanic fragments.

430 - 450 - Gray to cream colored tuff in minor amounts with the gray tuffaceous sediment cemented by crystalline calcite and zeolitic material. There is still a question of whether this is an altered amygdaloidal volcanic rock!

470 - 490 -- Fragments of medium-grained gray tuffaceous sediment(?) surrounded by reddish-brown clay matrix - some fragments of black basalt.

505 - 570 - Fine-grained clayey buff tuff - some fragments of black to gray medium-grained basalt.

580 - 640 - Tan to brown tuff - clayey - also assorted volcanic rock fragments including vesicular, amygdaloidal basalt.

650 - 700 - Fine-grained dark gray volcanic fragments, possibly from an agglomerate or breccia.

740 - 800 - Same as above except coarser-grained with red and green alteration products - minor clayey tuff.

Depth

810 - 850 - Mainly dark gray medium-grained volcanic rock - very possibly a basalt - now highly altered.

900 - 1000 - Same as above - fine to medium-grained, fairly dense basalt - slightly vesicular and amygdaloidal.

1100 - 1120 - Coarser and darker green but definitely similar rock, (ba(?), medium-grained, highly altered, feldspars to clay and olivine to a coppery colored mineral (iddingsite(?), also chlorite.

1130 - 1150 - Same as above - diabasic texture conspicuous.

1250 - 1270 - Crystalline - medium-grained basalt highly altered with some cindery red material.

1390 - 1450 - Fairly dense porphyritic basalt, phenocrysts of plagioclase up to 2 cm - also basalt similar to from 1100 to 1150, medium-grained olivine basalt.

9/12/59

N. V. Peterson