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OREGON'S MINERAL INDUSTRY ZOOMS UPWARD

By Ralph S. Mason*

With a 19.4 percent increase in the value of minerals produced compared to 1962, Oregon mineral production rocketed to an all-time high of $62, 700,000 in 1963. As usual, industrial minerals accounted for the bulk of the state's mineral wealth, with stone and sand and gravel representing nearly 69 percent of the total. The vast increase in production value resulted primarily from the mining of increased quantities of raw matérials, plus small increases in the unit values of the commodities. The low values placed on stone ($1.20 per ton) and sand and gravel ($1.22 per ton) in the U.S. Bureau of Mines canvass (see table 1) are typical of those used in computing the state total. Employment and payrolls in the state's mineral industries showed impressive gains over last year. Payrolls totalled $71,354,000 up 7.25 percent over 1962. Employment increased 3.17 percent for a total of 10,592 employees (see table 2).

Oregon's mineral industry permeates every segment of the state, and contributes importantly to the local economies of many counties. The distribution of the mineral industry by counties is shown on the accompanying map. The rapid growth of the industry in Oregon is clearly shown in table 3, which depicts the relative rank of the 19 counties which have produced more than $1 million during one or more years in the period from 1954 to 1963. During this time the yearly number of counties has doubled, from 6 in 1954 to 12 in 1963. Douglas County, largely through the efforts of Hanna Nickel Smelting at Riddle, pushed into first place for the first time in 1963. The county had been in second place for the preceding 7 years, with either Lane or Clackamas Counties in the top spot. This year for the first time Gilliam and Klamath Counties became members of the million-dollar club. Wasco and Sherman Counties, included this year, have each been members once before in the 10-year period. The 6 counties of Baker,

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TABLE 1. Mineral Production in Oregon, 1962 - 1963 1/

Mineral		1962 Short tons (unless otherwise stated)	1962 Value (thousands)	1963 Short tons (unless otherwise stated)	1963 Value (thousands)
Clays	thousand short tons	249	$ 305	279	330
Copper (recoverable content of ores, etc.	short tons	2/	2/	17	10
Diatomite	short tons	50	2	150	3
Gold (recoverable content of ores, etc.)	troy ounces	822	29	1,809	63
Lime	thousand short tons	78	1,514	90	1,835
Mercury	76-pound flasks	2/	2/	4	1
Nickel (content of ore and concentrate)	short tons	13,110	2/	13,394	2/
Perlite	short tons	3	3/	- -	- -
Pumice and volcanic cinder	thousand short tons	2/	2/	422	664
Sand and gravel	thousand short tons	14,869	14,556	15,715	18,850
Silver (recoverable content of ores, etc.)	troy ounces	6,047	7	58,234	74
Stone	thousand short tons	18,258	20,977	19,692	24,197
Uranium ore	short tons	2,722	112	1,763	45
Value of items that cannot be disclosed: Asbestos (1962), cement, gem stones, iron ore (includes pigment material), lead, zinc, and values indicated by footnote 2/			14,956		16,621
Total			52,458		62,693

Note

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Figure withheld to avoid disclosing individual company confidential data.

3/ Less than $500.

TABLE 2. Oregon Mineral Industry Employment and Payrolls*

	1962 Employment	1962 Payrolls	1963 Employment	1963 Payrolls	Percent Change Employment	Percent Change Payrolls
1. Mining	1,263	$ 7,272,000	1,335	$ 8,667,000	+ 5.7	+19.2
2. Mineral Manufacturing	2,820	17,589,000	3,080	20,268,000	+ 9.2	+15.2
3. Primary metals	5,405	36,521,000	5,348	36,979,000	- 1.07	+ 1.25
4. Miscellaneous	352	2,190,000	407	2,316,000	+15.6	+ 5.75
	10,267	$66,535,000	10,592	$71,354,000	+ 3.17	+ 7.25

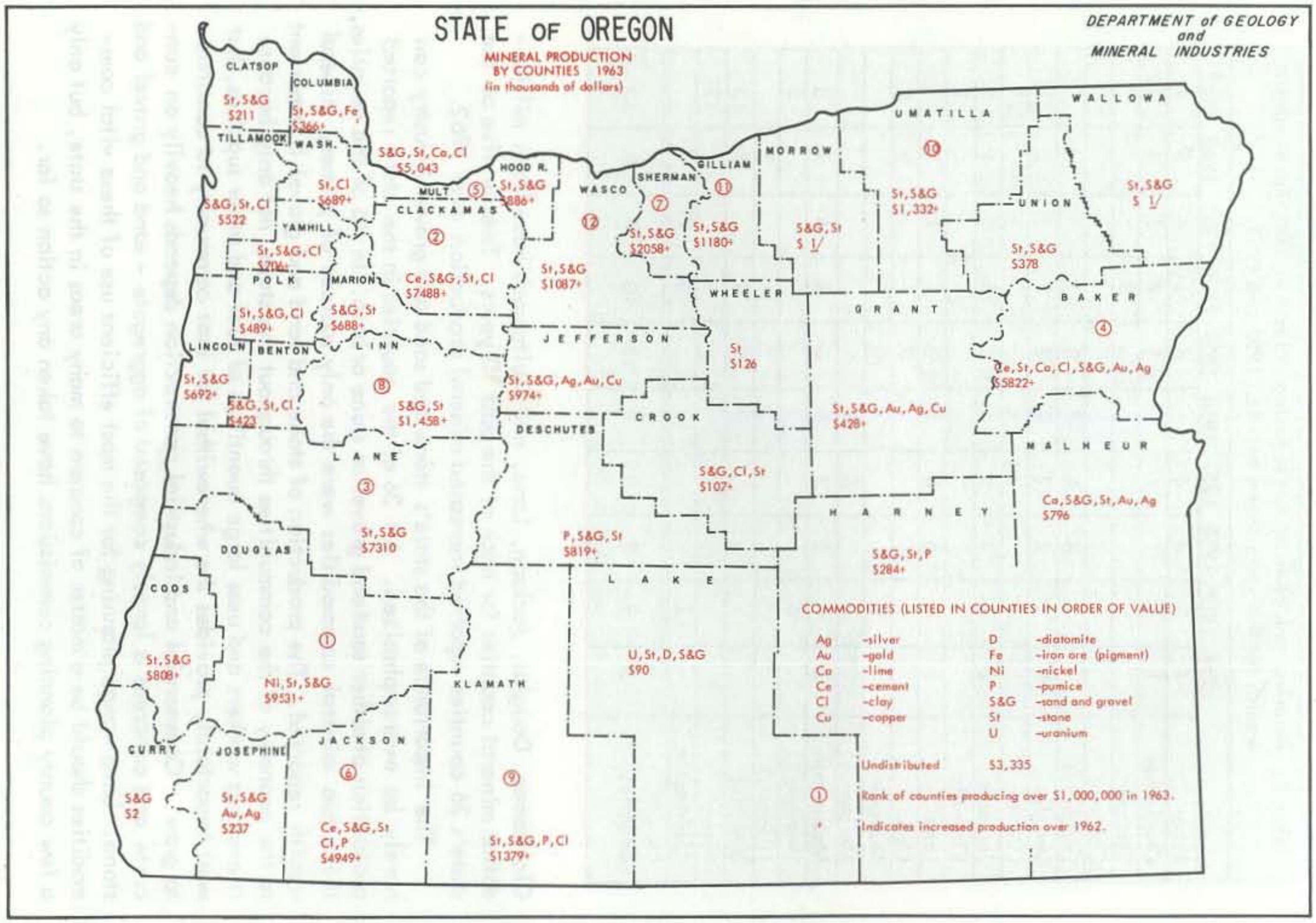
* Oregon State Employment Department figures. Percentages added.

Table 3. Relative rank of counties producing at least $1,000,000 of mineral wealth for the years shown between 1954 and 1963.

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Baker	4	3	4	4	4	4	3	4	5	4
Clackamas	1	1	1	1	1	1	4	3	3	2
Clatsop							8			
Coos			7							
Deschutes			8	9	7	8	7			
Douglas	6	5	2	2	2	2	2	2	2	1
Gilliam										11
Jackson	2	2	3	5	5	5	6	5	4	6
Klamath										9
Lane	5	6	6	6	3	3	1	1	1	3
Linn						7			8	8
Malheur		9				10				
Marion				8	8					
Multnomah	3	4	5	3	6	6	5	6	6	5
Sherman		8								7
Tillamook									9	
Umatilla					9	9	9		7	10
Wasco				7						12
Washington		7					10	7		
No. of Counties	6	9	8	9	9	10	10	7	9	12

Clackamas, Douglas, Jackson, Lane, and Multnomah have been million-dollar mineral counties for each of the past 10 years. Twenty-five of the state's 36 counties reported increased mineral production over 1962.

The importance of the state's stone and sand and gravel industry can hardly be overemphasized. All 36 of the counties in the state reported production of either sand and gravel or stone or both. In 16 of the counties, these two mineral commodities were the only sources of primary mineral wealth reported. The production of stone and sand and gravel is important to the economy of the communities throughout the state, not only because it employs workers and uses large quantities of fuel and other supplies, but most importantly provides the wherewithal for that community to continue to grow. Commercial and industrial construction depends heavily on concrete and concrete is largely composed of aggregate - sand and gravel and stone. Long-range planning for the most efficient use of these vital commodities should be a matter of concern to many areas in the state, but only a few county planning commissions have taken any action so far.


STATE OF OREGON
MINERAL PRODUCTION BY COUNTIES 1963 (in thousands of dollars)
DEPARTMENT of GEOLOGY and MINERAL INDUSTRIES
CLATSOP
St, S&G $211
COLUMBIA
St, S&G, Fe $266+
TILLAMOOK
S&G, St, Cl $522
WASH.
St, Cl $689+
S&G, St, Ca, Cl $5,043
MULT
CLACKAMAS
YAMHILL
St, S&G, Cl $706+
POLK
St, S&G, Cl $489+
MARION
S&G, St $688+
Ce, S&G, St, Cl $7488+
LINCOLN
St, S&G $692+
BENTON
S&G, St, Cl $423
LINN
S&G, St $1,458+
HOOD R.
St, S&G $886+
WASCO
St, S&G $1087+
SHERMAN
St, S&G $2058+
GILLIAM
St, S&G $1180+
MORROW
S&G, St $ 1/
UMATILLA
St, S&G $1,332+
WALLOWA
St, S&G $ 1/
UNION
St, S&G $378
BAKER
Ce, St, Ca, Cl, S&G, Au, Ag $5822+
WHEELER
St $126
GRANT
St, S&G, Au, Ag, Cu $428+
JEFFERSON
St, S&G, Ag, Au, Cu $974+
DESCHUTES
CROOK
S&G, Cl, St $107+
LANE
St, S&G $7310
P, S&G, St $819+
HARNEY
S&G, St, P $284+
MALHEUR
Ca, S&G, St, Au, Ag $796
DOUGLAS
Ni, St, S&G $9531+
COOS
St, S&G $808+
LAKE
U, St, D, S&G $90
KLAMATH
St, S&G, P, Cl $1379+
CURRY
S&G $2
JOSEPHINE
St, S&G Au, Ag $237
JACKSON
Ce, S&G, St Cl, P $4949+
COMMODITIES (LISTED IN COUNTIES IN ORDER OF VALUE)
Ag -silver
Au -gold
Ca -lime
Ce -cement
Cl -clay
Cu -copper
D -diatomite
Fe -iron ore (pigment)
Ni -nickel
P -pumice
S&G -sand and gravel
St -stone
U -uranium
Undistributed $3,335
① Rank of counties producing over $1,000,000 in 1963.
+ Indicates increased production over 1962.

COMPARISON OF 1962-63 MINERAL PRODUCTION IN THE 13 WESTERN STATES

State	1962	1963*	Percent Change	Productive Rank
Alaska	$ 54,196,000	$ 67,840,000	+25.20	11
Arizona	474,131,000	481,392,000	+1.54	4
California	1,467,340,000	1,525,359,000	+3.95	1
Colorado	308,164,000	318,608,000	+3.42	6
Hawaii	14,800,000	15,300,000	+0.34	13
Idaho	82,614,000	82,787,000	+0.21	9
Montana	190,657,000	187,002,000	-1.95	7
New Mexico	675,814,000	687,825,000	+1.75	2
Nevada	83,074,000	85,441,000	+2.90	8
Oregon	52,458,000	62,693,000	+19.40	12
Utah	410,590,000	402,281,000	-2.09	5
Washington	68,478,000	71,462,000	+4.36	10
Wyoming	462,570,000	504,633,000	+9.08	3

* Some figures are preliminary estimates. Source, U.S. Bureau of Mines

Of the 13 western states, Oregon ranks 12th in value of mineral production. This is only part of the picture, however. Last year Oregon was next to the top of the list in the increase in production over 1962. Oregon showed a 19.4 percent increase, second only to the slightly higher figure of 25.2 percent turned in by Alaska.

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CRACK-IN-THE-GROUND, LAKE COUNTY, OREGON

By

Norman V. Peterson* and Edward A. Groh**

Open cracks or fissures in the earth's surface are not uncommon; they occur fairly often as a result of earthquakes or volcanic activity, but they usually become filled with rock rubble or lava and disappear in a very short time. A large fissure that stays open for hundreds of years is, therefore, a rare feature. Such a fissure occurs in a remote part of central Oregon. It is a deep, narrow rift about 2 miles long, and it has remained open for perhaps a thousand years. For lack of any official name for it, the feature is referred to simply as "Crack-in-the-Ground."

Location and History

Crack-in-the-Ground is situated in northern Lake County in T.26 S., R. 17 E. As shown on the accompanying geologic sketch map (plate 1), it can be traced from the southwest edge of the Four Craters lava field diagonally to the southeast until it disappears in lake sediments that mark the north shoreline of prehistoric Christmas Lake.

The feature can be reached by road, but the last few miles are not suitable for cars with low road clearance. The route starts from the east side of Silver Lake on Oregon Highway 31. From this point the course leads 19 miles northeast on a paved road to Christmas Valley Lodge, then east on a graveled road 1 mile and north on a graded dirt road 4 miles. At this mileage a rough, bouldery road branches off to the left and winds northwesterly through the sagebrush. It approximately parallels the west side of the fissure for 2 miles and then skirts the western edge of Four Craters lava field (see map). This road passes within 150 yards of the northern end of Crack-in-the-Ground, where lava has flowed into the fissure and filled it.

Homesteaders in the area have known about this giant fissure for many years. Reuben Long of Fort Rock, Oregon, reports (written communication,

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** Private geologist, Portland, Oregon.

Figure 1. Aerial view of Crack-in-the-Ground looking north-northwest. Four Craters lava field in the background. Road shows in upper left corner.

Figure 2. Looking down on a portion of Crack-in-the-Ground. The fissure has been filled and bridged over in the center of the picture.

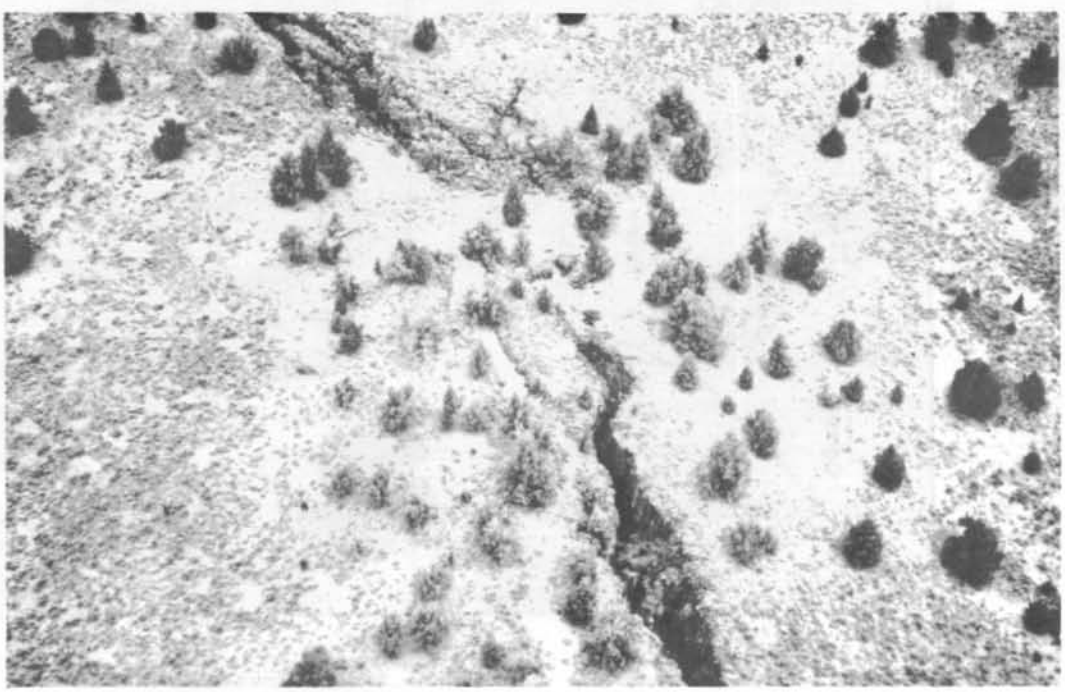
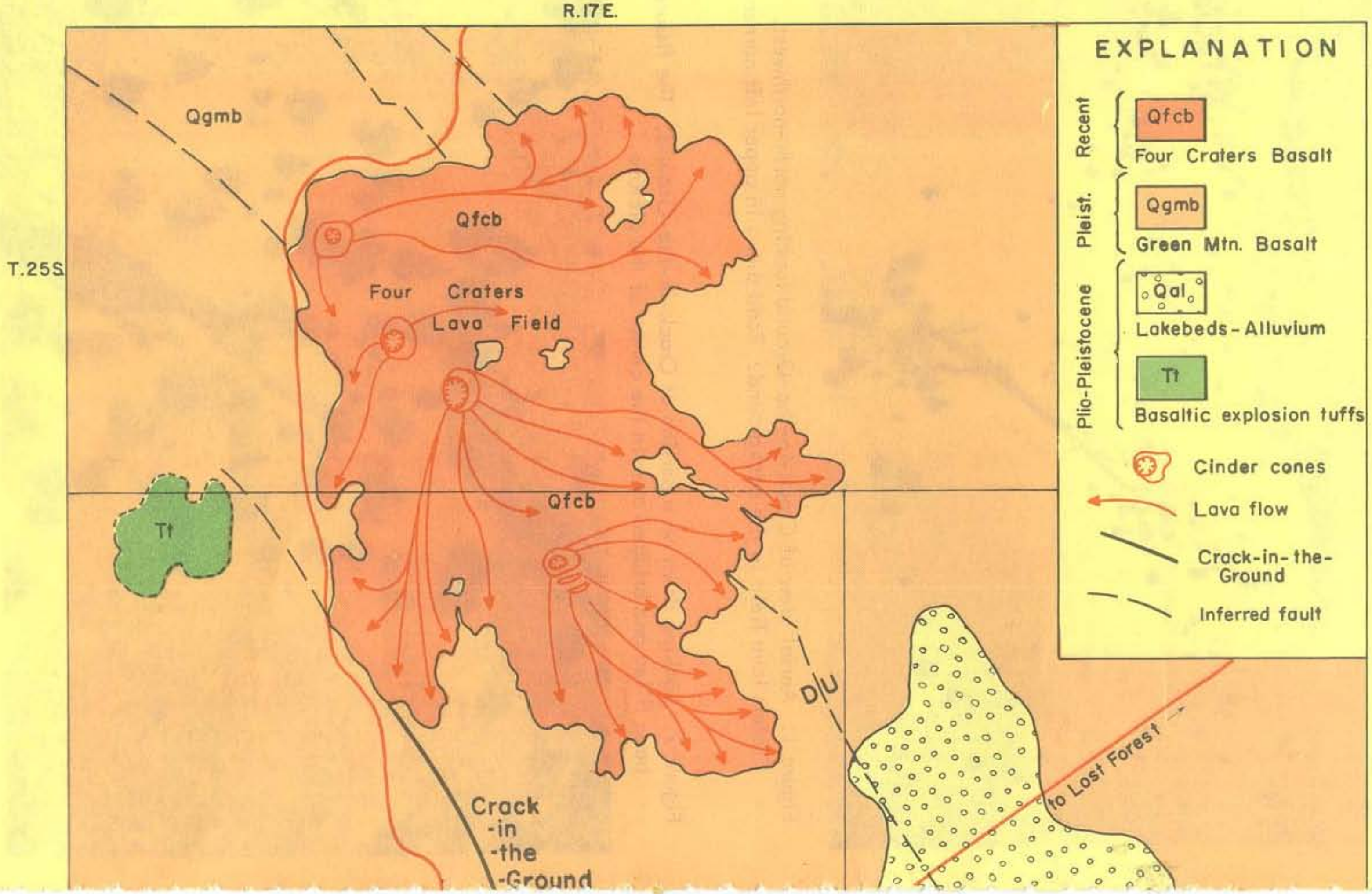
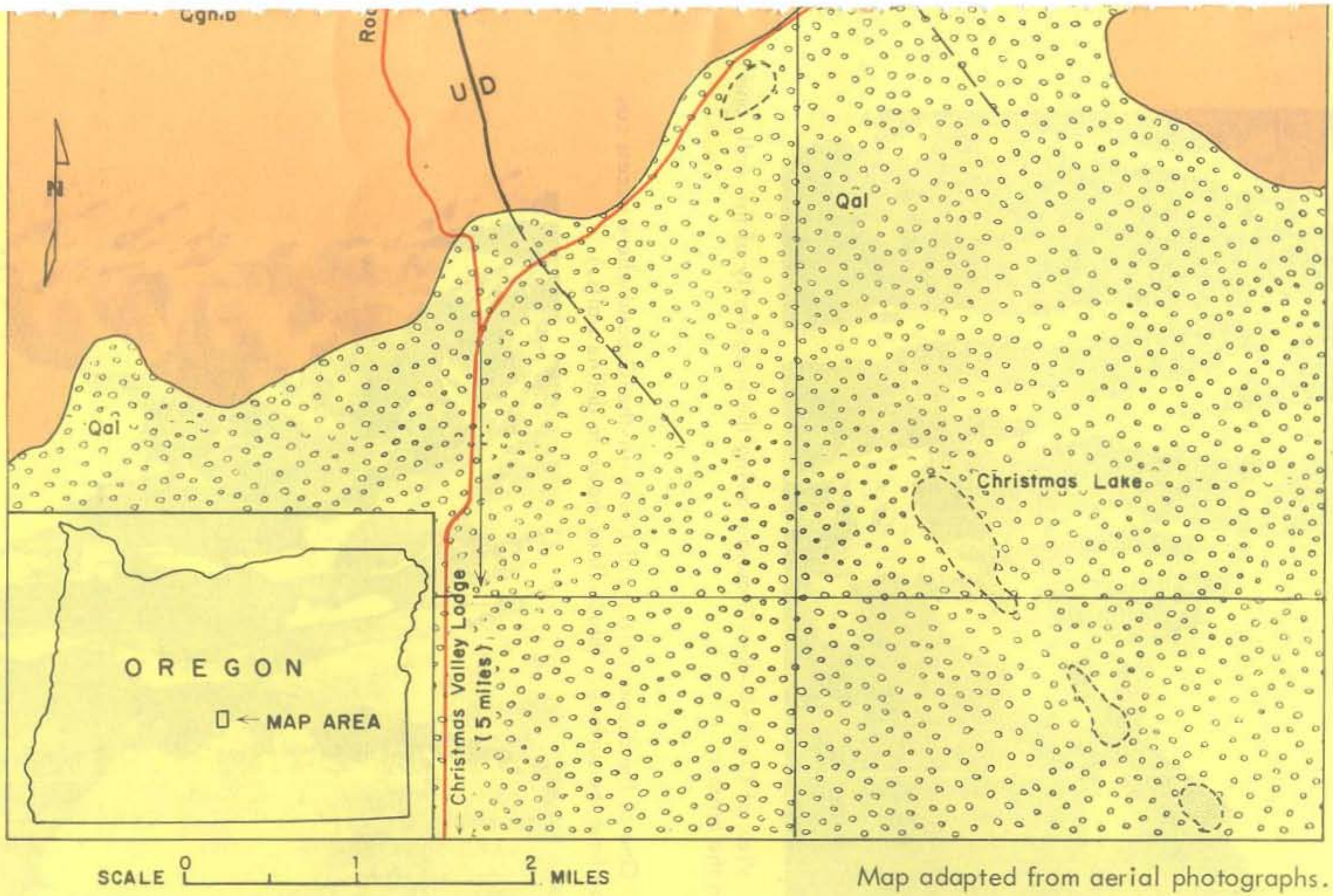


Plate 1. Geologic Sketch Map of the Crack-in-the-Ground Area.





Map adapted from aerial photographs.

Map prepared by
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

Figure 3. View of Crack-in-the-Ground showing the irregularity of the walls and fill in the bottom.

Figure 4. One of the deeper portions of Crack-in-the-Ground where access can be had from the surface. (Black lines drawn to define walls.)

1964) that when he lived at Christmas Lake as a boy he used to explore "The Crack," as it was called locally. He remembers that the homesteaders went there to hold picnics and make ice cream, using ice they found in caves in the chasm.

Description

Crack-in-the-Ground is a tension fracture in basalt. The walls are rough and irregular and show no lateral and but very slight vertical movement. The crack is open for a distance of more than 2 miles, but continues to the northwest and southeast as a trace which, although not visible on the ground, is revealed on aerial photographs. Where best developed, the fissure is from 10 to 15 feet wide at the top, narrowing downward. The depth varies, but is as much as 70 feet in some places. Figures 1 and 2 are aerial views of the crack and figures 3 and 4 are closeups.

Erosion and weathering have been at a minimum in this desert climate of northern Lake County, but over the many years that Crack-in-the-Ground has existed, some rock has sloughed off the walls and sand has blown or washed in to fill the bottom. At several places the walls have slumped, thus bridging the gap and allowing access to the deeper parts of the fissure. Winter ice is sometimes preserved during the summer in the deeper, more cavernous places where cold air is trapped.

Geologic Setting

Crack-in-the-Ground is closely related to the Four Craters lava field, one of the many isolated centers of recent volcanic activity within the high lava plains of central Oregon. Older rocks in the map area which pre-date the breach but which are broken by it include several ages of volcanic rocks and lake-bed sediments as described below.

Lake beds and alluvium

Large, shallow lakes filled the broad Fort Rock-Christmas Lake Valley beginning in late Pliocene time and continuing intermittently through the Pleistocene. During the Recent epoch, these lakes gradually shrank to small, brackish potholes and irregularly shaped saline pools. Lake beds, alluvium, and wind-blown materials of varying thicknesses mantle the floor of the basin, and wave-cut terraces around the rims represent various levels of the ancient lakes.

Explosion tuffs

The oldest volcanic rocks exposed in the area are erosional remnants of maars or tuff rings of late Pliocene to Pleistocene age. The remains of a maar just west of the Four Craters lava field is shown on plate 1. This mass of yellow-brown basaltic tuff and breccia is similar in composition and layering to Fort Rock and other remnants of maars and tuff rings, which were once numerous and widely distributed in and around the edges of the large lake basins of central Oregon (Peterson and Groh, 1963-b).

Green Mountain basalt

Surrounding the basaltic tuff remnants are younger basaltic lava flows that originated from Green Mountain, an eruptive center immediately to the northwest of the map area. The Green Mountain lavas form a low shield some 10 to 12 miles in diameter. The flows on the southern edge encroached on the pluvial lake that then filled the Fort Rock-Christmas Lake Valley and became the northern shore line. These lavas are of the pahoehoe type. Where they are exposed in the walls of Crack-in-the-Ground there are two or more flows with an overall thickness of at least 70 feet. Their surface is masked with a thin layer of soil composed mainly of fine pumice, windblown sand, and silt from lake beds in the adjacent Fort Rock-Christmas Lake Valley. Tumuli and other flow-surface features are present. Several small cinder cones near the summit of the Green Mountain shield still retain most of their initial characteristics even though they are covered by vegetation. From these observations, the Green Mountain lava is believed to be of late Pleistocene age.

Four Craters basalt

The Four Craters lava field, named in an earlier report (Peterson and Groh, 1963-a), formed from basaltic lava that flowed mainly south and east from centers along a fissure trending N. 30° W. The sluggish flows piled up a hummocky layer of black, spiny aa lava on the slightly sloping Green Mountain lava surface. Four cinder cones aligned along the fissure rise from 250 to 400 feet above the lava surface. The distance from the northernmost cone to the southernmost is roughly 2¼ miles. The southernmost cone is especially interesting, because several sectors of it were rafted off to the southeast on a slightly later lava flow. The freshness of the lava and lack of soil and vegetation on the surface indicate a Recent age for this field.

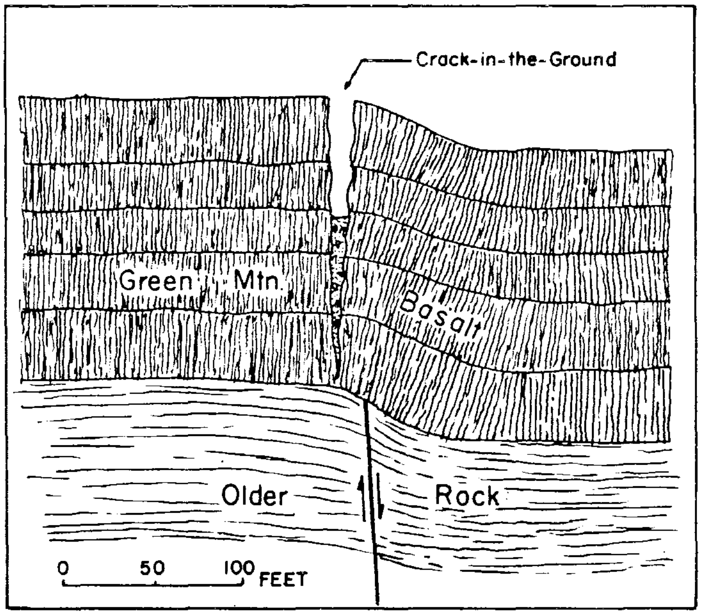


Figure 5. Generalized geologic cross section of Crack-in-the-Ground.

Origin of Crack-in-the-Ground

The eruptions from the Four Craters were accompanied by a slight sinking of the older rock surface to the southeast. This shallow, graben-like sink is about 2 miles wide and extends to the south into the old lake basin. Crack-in-the-Ground marks the western edge of this small, volcano-tectonic depression and parallels a zone of weakness concealed beneath the Pleistocene Green Mountain lava flows. The fracture is the result of rupture from simple tension along a hingeline produced by the draping of the Green Mountain flows over the edge of the upthrown side of the concealed fault zone (figure 5). The initial fracturing was probably propagated rather quickly over its length as the central block began to sink to form the shallow graben. Vertical displacement of the graben is no more than 30 feet and it diminishes to the southeast. There is the suggestion that the shallow graben continues on into the old lake basin and acts as a sump for present-day Christmas Lake and other ephemeral ponds and potholes. The sinking of the graben block and the accompanying rift on its western edge probably began with the first eruptions of the Four Craters. Crack-in-the-Ground opened before the last volcanic activity, and at its northwest end a tongue of lava piled up, tumbled into, filled, and buried the chasm for several hundred yards.

Conclusion

The eruption of the Four Craters Lava, the accompanying subsidence, and the opening of the Crack-in-the-Ground fracture probably took place no more than 1,000 years ago. Even though some filling by soil wash and windblown material has taken place, and some slumping of blocks from the walls has occurred, the crack is a relatively fresh geologic feature. This stark freshness is partly the result of subdued chemical weathering in the arid climate and a lack of any recent violent earth movements or renewed volcanic activity in the immediate area.

A system of tension fissures similar to Crack-in-the-Ground has been previously reported in the Diamond Craters by Peterson and Groh (1964), but none of these has as great a length or depth. Another fault-fissure zone that trends northwest from Newberry Volcano to Lava Butte south of Bend, Oregon, has been studied by Nichols and Stearns (1938). This fissure is associated with the recent volcanism of the area and stands open in several places.

Further investigations in the field, together with study of aerial photographs, may reveal the existence of other interesting cracks in remote parts of Oregon where volcanism and faulting have occurred.

References

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Peterson, N. V., and Groh, E. A., 1963-a, Recent volcanic landforms in central Oregon: The Ore Bin, vol. 25, no. 3, p. 33-45.

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DUNE SANDS TESTED FOR GLASS USES

A recent report by the U.S. Bureau of Mines reveals that Oregon dune sand can be used as glass sand. Tests were run on samples taken from 13 dune localities between Fort Stevens and Coos Bay. Sands between the Umpqua River and Coos Bay proved more satisfactory than those in the area between Fort Stevens and the Umpqua River where there was a higher percent of Fe_2O_3. Test results indicated that high-intensity magnetic separation followed by acid leaching would produce a product that could be used in amber and clear container-glass batches.

Report of Investigations 6484, "Beneficiation studies of the Oregon coastal dune sands for use as glass sand," is by George J. Carter, Henry M. Harris, and Karle G. Strandberg of the Bureau's Albany laboratories. It may be obtained free of charge from: Publications Distribution Section, Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, Pa., 15213.

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NEW EDITION OF OREGON GEOLOGY

"Geology of Oregon" by Ewart M. Baldwin, professor of geology at the University of Oregon, has been republished. The first edition, issued in 1959, was in great demand and was soon out of print. The new edition of 165 pages has been enlarged in order to include more text and some new photographs and charts. Added to the text are some of the new concepts on stratigraphy and offshore geology. Paper-back copies may be obtained from the University of Oregon Cooperative Bookstore, Eugene, Oregon, for $2.65 plus 20 cents for mailing costs. A hard-back edition will be sold for $3.95 plus 20 cents for mailing. Local bookstores are also selling the new book.

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DRILLING RECORDS RELEASED

Records of the drilling done by Humble Oil and Refining Co. in sec. 10; T. 10 S., R. 3 W., Linn County, Oregon, were released from the confidential files by the Department on August 30, 1964. Oregon statutes require that the records be held in closed files for a 2-year period following abandonment or completion. Humble "Miller 1" was located approximately 7 miles north of Albany. Total depth reached was 4,951 feet. Reproductions of the "Miller 1" records can be obtained through the Department.

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OFFSHORE LEASING PLANS DISCLOSED BY LAND BOARD

After considering the evidence presented at a public hearing in Coos Bay July 28, 1964, the State Land Board approved leasing of 136,300 acres of tide and submerged lands owned by the state. Being offered are submerged lands bordering the coast between Bandon and Florence and bottom of waters at the mouth of the Umpqua River and in Coos Bay (see map in February, 1964, ORE BIN). The Land Board set royalty at 12 percent and rental at $1.00 per acre for this sale. No minimum bonus bid limitation was specified. The leases will be awarded to the bidder offering the highest cash bonus. Sealed bids are to be in the hands of the State Land Board by 10:00 a.m. October 22, 1964. They will be opened at 11:00 o'clock the same morning in the Board of Control Room, State Capitol Building, Salem. The meeting will be open to the public.

Opening of bids by the State Land Board will follow a similar procedure carried out by the U.S. Bureau of Land Management in Los Angeles on October 1, 1964, at which time Federal outer continental lands bordering Oregon and Washington will be leased.

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STATE TO LOSE MORE MINING RIGHTS

A proposed withdrawal by the Bureau of Land Management of 5,195 acres in Curry County from mineral entry has been protested by the Oregon State Department of Geology and Mineral Industries. The Bureau gives as its reason for this action "public enjoyment" of the rugged, untamed beauty of the lower Rogue River. If adopted, the 5,195 acres would be removed permanently from any possible economic benefit to the area.

Other BLM proposed withdrawals include: 320 acres in Clackamas County for seed production (in this case the BLM fears that the seeds will be "disturbed" by prospectors and miners); 360 acres in three scattered parcels in Lane, Coos, and Curry Counties "to protect material sources needed for jetty construction and surfacing BLM and private roads"; and 42 acres near Riddle to "protect gravel deposits" needed for BLM roads. The "protection" in the last two instances appears to be from some possible operation by private, tax-paying companies.

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KENNETH O. WATKINS

Kenneth O. Watkins, well-known mining engineer of Corvallis, Oregon, died July 25, 1964. Mr. Watkins, member of AIME, was long active in mine development and production in the Bohemia Mining District.

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