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PRELIMINARY REPORT ON THE GEOLOGY OF THE SOUTHERN HALF OF UMATILLA COUNTY, OREGON

By
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Introduction

Past geologic studies have served to provide a fairly well-integrated picture of the broader aspects of the geology of Umatilla County, Oregon. These studies may be summarized by stating that a thick blanket of basaltic lavas of the Columbia River series (Miocene) constitutes the most widespread formation present. Rocks of this series are well exposed from the banks of the Columbia River to the summits of most of the higher peaks in the Blue Mountains, portions of which traverse the southern and eastern sections of the county. Later formations are represented by a veneer of sediments which include Pliocene lake beds and various other Pleistocene sediments. Occurrences of this veneer are, with one exception, localized in the lowlands of the Columbia basin portion of the county. The occurrence of pre-Miocene formations in turn is limited almost exclusively to the mountains in the southern part of the county.

It has been known for a long time that pre-Miocene rocks existed in Umatilla County, but formations of these rocks were never before mapped. The primary objective of this survey was to broaden the geologic picture by mapping and correlating the pre-Miocene formations which were found to occur to a far greater extent than was previously suspected.

Location and Description of Area

The area mapped embraces nearly 1200 square miles. This includes all of Umatilla County south of an east-west line which runs through a point about 2 miles south of the town of Pilot Rock. Also included is a margin of overlap into adjoining counties. A large part of the terrain thus covered consists of the northern portion of the Blue Mountains.

Elevations in the area mapped range from about 1700 feet near Pilot Rock to 6600 feet on the peak of Tower Mountain. In general, the mountains are an elevated plateau which still contains many fairly flat areas despite severe erosion. No topographic maps are available so only estimates can be made, but the elevation for most of these surfaces would fall between 4500 and 5000 feet, although some exceed 5000 feet by a substantial margin. Relief is great, especially in the canyon of the North Fork of the John Day River and along the northern flank of the mountains which are deeply dissected by the many tributaries flowing north to the Columbia River.

Forest land is abundant and a large proportion of the area is within State and National forests. Although the population is sparse, the grazing and lumbering potentialities of the region are of major importance. U.S. Highway 395 is the only paved road. Secondary roads range from forest roads of the most primitive sort to graveled logging arterials, and there are large tracts in which roads of any kind are nonexistent. Ukiah is the only sizable settlement. Major creeks and other pertinent landmarks are indicated on the map (see opposite page 15) and need no additional description. A State park memorializing the site of one of the last Indian engagements fought in the State is situated at Battle Mountain near where the highway crosses the main body of granite in the northern belt of pre-basalt exposures.

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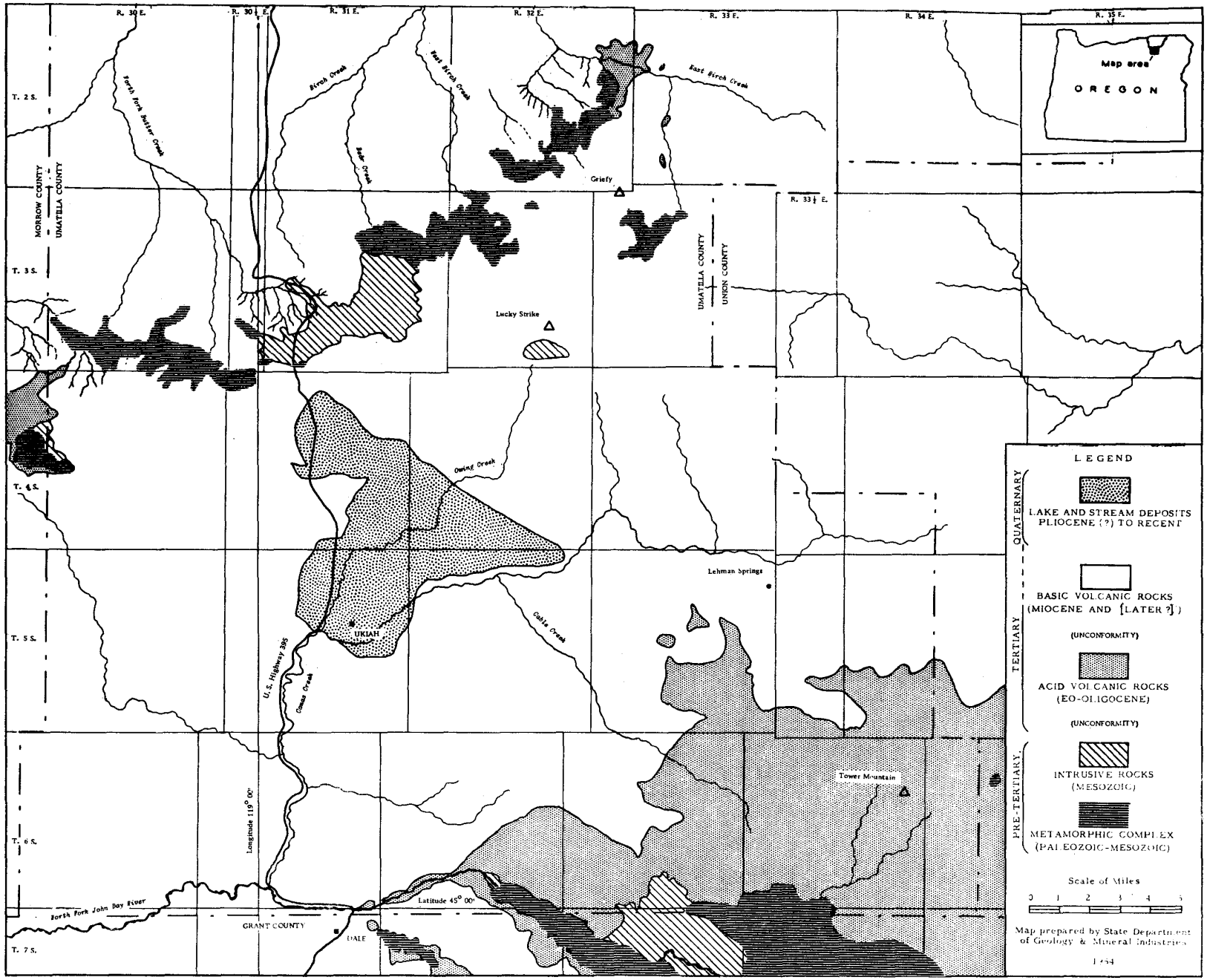

GEOLOGY OF THE SOUTHERN HALF OF UMATILLA COUNTY, OREGON

Field Work and Base Maps

Survey work was begun in the summer of 1951 and continued through the 1952 and 1953 field seasons. The only topographic map available covered a very narrow strip on the southern border of the county that is part of the Dale quadrangle. Most of the mapping was done on a United States Forest Service planimetric base and on aerial photographs. Thanks are due to various members of both the State and Federal Forest Service for a wealth of supplementary data on the location of new logging roads and for many other favors, and to the Harris Pine Mills and Pilot Rock Lumber Company for comparatively unrestricted permission to travel over their holdings. Special thanks are also due to Mr. Beamer of the Production and Marketing Administration office in Pendleton for his cooperation in arranging a gift of aerial photographs covering most of the northern half of the area. These were of invaluable assistance in mapping the exposures of the northern pre-basalt formations.

Geology

General

The pre-Miocene rocks include a series of terrestrial fossiliferous sediments and acidic volcanics of early Tertiary age plus granitic intrusives and a metamorphic complex of pre-Tertiary age. Most of the exposures of these rocks are erosional windows. Great differences in elevations of exposures exist, however, often within very short horizontal distances, and it is clear that some of the higher exposures were originally not covered by more than a very thin skin of basalt, if indeed they were covered by any at all in some places. Since post-basalt faulting is comparatively negligible, it is apparent that the pre-basalt topography was highly dissected and precipitous in nature before the area was covered by the lava flood. The early Tertiary area surrounding Tower Mountain is an example of one of the topographic highs which was apparently never completely covered by the later basalts. The lack of topography on the map makes it impossible to appreciate this third dimensional factor; moreover it is not possible to describe fully the implications imposed thereby in the limited amount of space available. It can be stated, however, that the random and completely unpredictable manner of exposure with respect to elevation made it impossible to project contacts or to anticipate a pattern of emplacement which could be relied upon for any appreciable distance in tracing the pre-Miocene occurrences.

Pre-Tertiary metamorphics

The rocks of this series compare so closely with those mapped by Pardee in the Sumpter quadrangle, by Gilluly in the Baker quadrangle, by Allen in the Morning mine area, and by the writer in the Telocaset quadrangle, that it seems reasonable to correlate them. Individual rock types include argillites, cherts, quartzites, greenstones, gneisses, and schists, together with minor amounts of basic crystallines and occasional pods of limestone. All types have undergone considerable metamorphism.

In some places, especially in the southern portions of the area, individual phases of the metamorphic complex occur in sufficiently distinct and large-sized exposures as to justify subdivisional mapping, but in other places these various rock types are so intimately associated and often so poorly exposed that it is doubtful if they could be mapped satisfactorily even if a good topographic base map were available. Therefore all related rock types were mapped as a unit. The resulting unit compares favorably with the "argillite" series as mapped by Pardee in the Sumpter quadrangle except the small patches of gabbro and metagabbro which are included here but which Pardee was able to map separately. Pardee reports limestones with crinoids suggestive of the Carboniferous period but points out that the series as a whole probably ranges from somewhere in the Paleozoic to well within the Mesozoic. Gilluly has shown some of the greenstones to be Permian.

Pre-Tertiary "granites"

Granite Meadows is the name by which the meadows at the head of Owing Creek have long been known. Actually, however, the "granites" of the area are more nearly a blend of diorite and quartz diorite in which biotite and hornblende are locally very abundant. Like the metamorphic rocks, these intrusives appear to correspond with those which occur in the Elkhorn range of the Blue Mountains. They are considered to belong to the middle or upper Mesozoic.

Early Tertiary volcanics

The rocks of this group consist primarily of rhyolites and related volcanics of acidic composition. Flows probably come first in order of abundance, followed by clastic tuffs and breccias. Some stratified sands and silts occur in association with the volcanics, but these represent an exceedingly small proportion of the group as a whole and they were observed only in the northern portion of the area. The sediments contain leaf fossils and therefore they have had a great deal of attention while the larger volcanic phase of the formation has had virtually none. The fossil leaves are characterized by palms and broad-leafed evergreens which are considered indicative of a Clarno (Eocene) age. A common relationship of unconformity with respect to the underlying pre-Tertiary and the overlying basalts is exhibited in both the northern and southern groups of exposures. This stratigraphic position constitutes supporting evidence of a Clarno age designation as does also a similarity between the volcanic members and other established Clarno volcanics elsewhere in central Oregon. Some of the tuffs in the North Fork of the John Day canyon may possibly be minor phases of the John Day formation. Whether they are or not is something that will require more investigation, but in view of the possibility that they might correlate with the John Day, the formation as mapped here is tentatively classed as of Eo-Oligocene age rather than as Eocene alone.

Reference to the map will show that only two large occurrences of this rock unit are mapped in connection with the northern belt of pre-Miocene exposures. It should be mentioned accordingly that a narrow fringe of exposures actually exists at many places along both flanks of the northern pre-Tertiary belt, especially from the highway westward, but these exposures are for the most part too restricted in their extent to show without distortion on a map of the present scale.

Later Tertiary formations

The Columbia River basalt in the area consists of a thick succession of basic to intermediate lavas. No mappable interbeds were observed and the only overlying material other than soil consists of poorly consolidated lake-bed sediments and bench gravels in the vicinity of Ukiah. The Columbia River basalts have been assigned a mid-Miocene age in the Picture Gorge area of central Oregon. Little question exists that the lava of southern Umatilla County is largely equivalent to that of the Picture Gorge area, but no conclusive evidence was observed to prove the local flows are exclusively Miocene in age. The question of age is therefore left open insofar as the upper limit is concerned.

Structure

All attitudes noted on the pre-Tertiary rocks were recorded on schistosity and foliation. The dips are invariably steep, often vertical, and very likely reflect tight, isoclinal folding. A common trend is roughly east-west. Pre-basalt faulting was undoubtedly great as is indicated by local shearing and a generally high intensity of foliation but no regional pattern was recognized other than that to be inferred from the trend of the northern belt of pre-basalt exposures and its parallelism with the flank of the present mountains. From this there can be little doubt but what this belt of exposures coincides closely with the trend of a major pre-Tertiary fault which may even have had scarp expression in early Tertiary times.

The structure exhibited by the late Tertiary basalts is characterized by a state of light deformation in which gentle folding appears to be more prevalent, or at least more pertinent, than faulting. This is particularly conspicuous along the northern flank of the mountains where the dominant structure is a monoclinal downwarp of the blanketing basalts rather than a fault scarp like those which are so prominent a part of the mountain-valley relationship in so many other places in the Blue Mountains. This monocline starts with dips that are essentially horizontal on the summit and ends with a moderate regional dip to the northwest in the foothill area. Because the axis is breached by erosion the continuity of this structure can be traced without interruption in only a few places where the highest and youngest flows extend from the summit in an unbroken manner. The picture is further complicated by local minor faulting and by local steep dips which are present in the basalts in places where the older flows contact the sloping surfaces of the underlying pre-basalt topography. The lack of widespread faulting together with observations which indicate a state of high relief prior to the period of the basalt flooding tends to suggest that this monoclinal condition may owe its origin more to depositional molding of the basalts over the pre-basalt topography than to later structural uplift.

Summary

At the time field work was started the area was known to contain pre-Tertiary schists and "granite" and fossiliferous sandstones. Beyond this, knowledge concerning the pre-Miocene formations was small and it was as logical to believe as not to believe, that equivalents of the sedimentary Cretaceous of central Oregon, or the serpentine and ultrabasics of the John Day region, might well be represented in the area; likewise for the John Day and Mascall formations which occur even closer to the area. No trace of these formations was recognized, however, except for the possibility that some comparatively minor phases of the John Day formation might be represented. Instead, the pre-Tertiary rocks of this area appear to correlate with the Paleozoic and Mesozoic rocks found farther to the east in the Blue Mountains as described in Pardee's report on the Sumpter quadrangle. Most of the early Tertiary rocks were found to be of volcanic derivation rather than sedimentary as originally supposed and the bulk undoubtedly correlates with the Clarno formation. In any event, the areal extent of both the pre-Tertiary and the early Tertiary formations proved considerably greater than was generally suspected at the outset of the investigation, especially the early Tertiary volcanics of the Tower Mountain region which undoubtedly represent a major center of early Tertiary volcanism.

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COMMERCIAL OIL IN NEVADA

Shell Oil Company, which has been drilling in the Eagle Springs area, Nye County, Nevada, about 60 miles southwest of Ely, has found an oil horizon which may make Nevada the twenty-ninth oil-producing state in the nation. The News Letter of the Nevada Mining Association, Louis D. Gordon, Secretary, has the following comment in the March 15 issue:

> "The important oil news of the last month is the announcement by the Shell Oil Company that their Eagle Springs No. 1 Well in section 36, T. 9 N., R. 57 E., had encountered oil in commercial quantities. The announcement was made at the close of business February 17, 1954, when the hole was approximately 6588 feet deep. The top of the oil bearing horizon was given as 6453 feet and a drill stem test of the 80-foot interval below this horizon indicated the well had a potential of about 180 BOPD. The high formational pressures were a very encouraging sign. Immediately upon recovery, the oil is quite gassy and has a gravity of 25.9° API, which is a good grade of crude, although nothing exceptional. The pourpoint is 80° F, which means that below that temperature the oil is solid and closely resembles black shoe polish. There was considerable surprise at the age and type of the reservoir rock,

for it is of Tertiary Age, probably the Miocene Epoch, the rock being a pyroclastic, or volcanic debris ranging in particle size from dust and ash to bombs and other ejectamenta. This type of lithology is most unusual for a petroleum reservoir rock.

"Since the initial announcement, the well has continued to drill and is currently below 7200 feet. The petroleum saturation continued as deep as 6913 feet. The Shell is currently seeking the top of the Paleozoic System. The 'pay-zone' of 460 feet already discovered will boost the daily capacity of the well far above the 180 BOPD figure which was based on 80 feet of pay."

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RADIOASSAYER

A "radioassayer," a new instrument for making routine tests for radioactivity has been installed at the laboratory of the Department of Geology and Mineral Industries, State Office Building, Portland, on loan from the Atomic Energy Commission. Radioassayers have been placed in a number of mills and labertories on a temporary basis by the Commission to test all samples as they pass through. The first report of this program is given in U.S. Atomic Energy Commission RME-4025, "Routine testing of samples for radioactivity in mills and assay offices in the United States," a Progress Report by Muriel Mathez, 1953.

The radioassayer is designed to check radioactivity present in the ranges 0.05 percent to 0.1 percent and 0.1 percent to 0.15 percent U_3O_8 equivalent, the 0.05-percent range especially being lower than can be determined on most Geiger-Müller counters. The purpose of this program is to provide a means for routine monitoring for radioactivity diverse types of ore samples that might not otherwise be tested for radioactivity.

Three types of particles are given out by radioactive materials as they decompose. The first, or alpha particle, is the same as a helium nucleus, being composed of two protons plus two neutrons. The alpha rays are moving at 2,000 to 20,000 miles per second and are able to penetrate several centimeters of air or a very thin foil of metal. Because of their size they are able to knock the ions out of many other atoms before they lose their energy.

The second type of emanation is known as beta rays or particles. The beta rays are nothing more than streams of fast moving electrons, which have been thrown out of the radioactive material. They travel several hundred times farther than the alpha rays since, with energies of about the same range, it would take 7500 of them to equal the mass of one alpha particle. However, a thin sheet of metal such as aluminum will stop most of the beta rays.

The third type of emanation, known as gamma rays, does not consist of particles at all, but of waves, very much like light waves, except that they are at a much higher frequency. The gamma rays travel at the speed of light, and from a few inches up to several feet of lead or concrete are required to stop them. It is for this reason that Geiger counters for use in the field usually use a tube that is most sensitive to gamma rays.

The radioassayer is designed as a beta ray counter, because beta rays are the most intense at short distances, and the sample can be placed quite close to the GM tube. Most of the tube is covered with a heavy lead shield, which also tends to cut down the background count from stray gamma rays and cosmic rays from the outer space.

The Department has previously checked with a Geiger-Müller counter all samples submitted for identification or assay, but the radioassayer will allow a more positive quantitative estimate especially for low radioactivity than has previously been possible.

There is no charge for checking any sample on this instrument and members of the Department will be glad to make radioactivity tests during regular office hours.

T.C.M.

ROBA AND WESTFALL QUICKSILVER

The DMEA office in Spokane has reported that the only current active work in Oregon under a DMEA contract is at the Roba and Westfall quicksilver prospect on Murderers Creek, Grant County. A loan of $20,140 was obtained. The shaft has been sunk to a depth of 80 feet from the collar, an advance of 52 feet, under the DMEA contract. The shaft has penetrated the footwall of the mineralized zone and it is stated that water is a problem. The other Oregon DMEA contracts have either been completed or rescinded.

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OREGON LIGHTWEIGHT AGGREGATE INDUSTRY

Producers of pumice and pumicite

Cascade Pumice
Lloyd A. Williamson
114 Oregon Avenue
Bend, Oregon

Deschutes Concrete Products Company
Chester T. Lackey, Owner-Manager
Redmond, Oregon

Central Oregon Pumice Company
644 Franklin Street
Bend, Oregon

Harney Concrete Tile Company
Don Robbins
Burns, Oregon

During 1952 pumice produced in Oregon amounted to 59,578 short tons valued at $201,809.

Producers of volcanic cinders

Cinder Hill Quarry
Leroy E. Grote
Redmond, Oregon

Red Rock Cinders
Don E. Hurrle
Redmond, Oregon

Large quantities of volcanic cinders for road surfacing are produced by the State Highway Department. Value of production is not available.

Producers of expanded shale

Smithwick Concrete Products Company
1750 N.E. Lombard Place
Portland, Oregon

Northwest Aggregates, Inc.
9255 N.E. Halsey Street
Portland, Oregon

Total production about 93,000 yards valued at approximately $418,500.

Producer of diatomaceous earth

Dicalite Company, Division
Great Lakes Carbon Company
Terrebonne, Oregon

No production statistics are available.

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MINERAL IDENTIFICATION BULLETIN REVISED

One of the most popular State Department of Geology and Mineral Industries publications, Bulletin 16, "Field Identification of Minerals for Oregon Prospectors and Collectors," has just been issued in its fifth edition. The bulletin contains descriptions of nearly 200 minerals together with tables which aid in the determination of unknown specimens. A section of the 133-page bulletin is devoted to descriptions of mineral-testing equipment and basic prospecting tools. Several radioactive minerals have been included for the first time as well as other minerals which have become important in recent years. The bulletin is an elementary reference book and the more easily understood physical tests are stressed rather than chemical tests. Copies may be obtained at the Portland office of the Department in the State Office Building or at Department field offices in Grants Pass and Baker. The price is $1.00.

PACIFIC NORTHWEST METALS AND MINERALS CONFERENCE

The Oregon Section of the American Institute of Mining and Metallurgical Engineers will be host to the AIME Pacific Northwest Metals and Minerals Conference to be held in Portland, Oregon, April 29 through May 1, 1954, at the Multnomah Hotel.

F. X. Cappa, Conference Chairman, reports that the three-day technical program, which will be open to the public, includes four sessions on metals technology and will feature iron and steel and both extractive and physical metallurgy. The Industrial Minerals Division is featuring a symposium on ground water and how it may influence industrial mineral production and processing. Serving on the panel will be H. A. Swenson, District Chemist, Quality of Water Branch, U.S. Geological Survey, who will speak on the quality and character of Northwest waters; R. C. Newcomb, District Geologist, Ground-Water Branch, U.S. Geological Survey, who will give a summary of the ground-water provinces in the Northwest and their water-yielding potentialities; and John W. Robinson, consulting ground-water geologist, Tacoma, Washington, who will discuss special or peculiar problems encountered in developing ground water for industrial mineral uses. A. M. Piper, Staff Scientist, U.S. Geological Survey, will be the moderator for the symposium and will summarize the presentations of the speakers. There will be a question and answer period.

In addition to the ground-water symposium, two sessions on industrial minerals, one on engineering geology, and one on mineral industries education, are on the program.

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CHROMITE IN 1953

According to the U.S. Bureau of Mines, production of domestic chromite during 1953 totaled 57,000 short tons including 22,000 short tons of chromite concentrates from the Mouat mine, Stillwater County, Montana, which began milling ore in August under a government contract. Purchases by the government at the Grants Pass ore purchase depot during the year increased 57 percent and totaled 35,000 short tons. Alaska entered the field of producers as a result of the development of the Red Mountain chromite deposit by the Kenai Chrome Company with a government loan and contract granted in March. (No Alaska production is reported. Ed.)

Consumption of all grades of chromite in 1953 exceeded that of 1952 by 13 percent and was 10 percent above the previous high of 1951. It is reported that there was a noticeable trend toward the use of low-grade chrome ores in the manufacture of a low-grade ferrochromium. A sharp drop in the price of low-grade South African chrome ore provided the incentive for making a lower grade ferroalloy. South African 44-percent ore (chiefly chemical grade) experienced a $4 per ton decline, and Turkish and Pakistan ore (high-grade metallurgical) sold for $2 per ton less.

Of the 13 countries shipping chromite to the United States in 1953, the Philippines supplied the largest quantity, most of which was refractory grade. The next largest supplier was Turkey which received the greatest dollar value. The Union of South Africa and Southern Rhodesia provided the major portion of the balance of the imports. The last three countries supplied metallurgical grade. All chemical ore came from Union of South Africa.

Stainless steels consumed 63.4 percent of the chromium used in chromium alloys and chromium metal during 1953.

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STUDY PREHISTORIC MINERS

There is evidence that miners worked in the Keweenaw Peninsula and on Isle Royale of northern Michigan as long as 4000 years ago and left with apparent haste. Where they came from and why they left has never been determined. A research project to study the subject has been set up by the Michigan College of Mining and Technology to attempt to solve what has been called one of the most important unsolved mysteries in North American archeology.

Extracted from American Mining Congress Journal, March 1954