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STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

702 WOODLARK BUILDING
PORTLAND, OREGON

August 25, 1941

STATE ASSAY LABORATORIES

400 E. 1 ST., GRANTS PASS

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ASSAYER

2102 COURT ST., BAKER

HUGH K. LANCASTER
FIELD ENGINEER

WILLIAM T. BURNS
ASSAYER

Dr. H. C. Harrison
Corvallis, Oregon

Dear Doctor Harrison:

Attached is copy of letter that is self-explanatory. William Huntley Hampton, a quite elderly man, enjoys a good reputation in Portland. The sample given him for assay--I gather from a telephone conversation with Mr. Derry,--was taken by our Mr. Libbey on the occasion of his and Derry's visit to the tin property sometime last year. Possibly this data of Hampton's will help you or give you some clue.

I am replying to Mr. Hampton, suggesting that you might wish to call on him sometime while in Portland. Regardless of the dependability of his results I am disposed to be very friendly with him.

Sincerely yours,

A handwritten signature in dark ink, reading "Earl K. Nixon". The signature is fluid and cursive, with the first name "Earl" and last name "Nixon" clearly distinguishable.

Director

EKN:vm
encl.

COPY

WM. HUNTLEY HAMPTON
2037 S.W. Park Ave.
Portland, Oregon

August 24, 1941.

Mr. Earl K. Nixon
State Department of Mines
Woodlark Bldg.
Portland, Or.

Dear Sir:-

I have noted the tin controversy in the papers recently and that you stood up against the findings of the Geological Survey pronouncement of absence of tin, etc.

I exposed the tin frauds in southern Oregon some years ago and was doubtful of the existence of tin in the obsidian when I was shown some samples sometime ago by Mr. Derry.

I recently got a sample from Mr. Derry expecting that I might make another expose and settle the controversy and confirm the conclusions anyone versed in mineralogy would arrive at when viewing the samples. I was very much surprised to find that the Obsidian does carry tin in quite a percentage. Heretofore unknown as silicate combination in an uncrystalline magma. Tin, in a few instances has been sparingly found in some silicates with some of the rarer elements, but not to such an extent as the present instance.

I am enclosing a copy of my letter to Mr. Derry on my findings for your information and hope it will be helpful.

Yours very truly,

(Signed):: WM. H. HAMPTON.

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WM. HUNTLEY HAMPTON
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TELEPHONE BEACON 8266

LABORATORY AND ASSAY OFFICE, ESTABLISHED 1886

475 WEST PARK STREET
PORTLAND, OREGON

2037 S.W. Park Ave.

August 20, 1941.

Mr. H. W. Derry,
Manager, New Industries Department,
Pacific Power & Light Company,
Portland, Oregon.

Re. Tin Ore near Burns, Or.

Dear Mr. Derry:-

I have made a careful partial analysis of the tin ore and the slag derived from the ore of which you sent me samples as I requested. I have been quite a time in accomplishing this as I had to keep off my feet most of the time intervening since receiving the samples. Here are the surprising results:-

The Ore contains 1.24% of tin oxide equivalent to $\frac{1}{2}$ 0.976% tin.
This is 19.52 pounds of tin per ton.
71.87% of Silica.

The Slag contains 0.80% of tin oxide equivalent to 0.63% of tin.
This is 12.6 pounds of tin per ton.
74.51% Silica.

Assuming that the slag was derived from ore of which the samples received are a true representative, it shows a decided loss in the process of smelting and an increase in silica content corresponding. It is evident that no fluxes were used in the smelting. Material with such a high silica content is very difficult to fuse and requires a very high temperature. The slag was not fluid enough when melted to allow any metallic particles to settle and coalesce. Such tin as was reduced to the metallic state would be volatilized and pass off as fumes and condense as oxide of tin.

The sample of flue dust you gave me was subjected to a regulation tin assay by fusion with soda and sulphur with the following results:- Tin oxide 0.44%, equivalent to 0.35% of tin, or 7 pounds per ton. The sample of metal obtained from the flue dust is pure tin.

To the best of my knowledge this is the first instance of tin occurring as a constituent of a rock mass in the form of silicate of tin. The ore is an obsidian that has been crushed, apparently, and consolidated. I believe it is a very old type of obsidian as it has nothing in common with obsidians of recent origin.

Tin occurs in some rhyolites in New Mexico in very small and unprofitable quantity, but it is in the oxide form and associated with other minerals that complicate the recovery.

The only occurrence of tin silicate heretofore has been artificial when tin oxide has been used to manufacture certain types of glass.

The only way to get reliable results as to the tin content of these ores is by chemical analysis methods and not by the customary assay methods.

It is very easy to appreciate how the controversy has arose, from this unusual occurrence of tin and the infrequency of requests for tin assays, which when made are not backed by any particular experience, if any.

The reason Cyanide of potassium or sodium is used for tin fire assays is because of its low melting point, nearly 200 degrees lower than the carbonates, and tin is reduced at a much lower temperature than many other metals, from its oxide the mineral cassiterite. Very accurate assay can be made of tin by using the carbonates and a reducing agent such as charcoal, argol or flour, but at a higher temperature. This obsidian glass with its tin silicate content requires a very high heat to decompose it and free the tin under such conditions where it is likely the tin will volatilize.

This should conclusively settle the controversy.

This new ore offers quite a metallurgical problem that will require some study and experiment for a profitable recovery of the tin. I have in mind a method which might prove commercial if the experiments carried on by the present promoters are unsuccessful.

Yours very truly

Wm. L. Hamilton

The Dalles, Oregon

United States	:	Involving Squaw Butte and Juniper
vs.	:	Ridge mining locations, Contests
Ronald B. Crow et al	:	2635-36-37-38-40-41-49 and 1 to
		6 incl.

By his letters "W" of November 10, 1939 and April 23, 1940, the Commissioner of the General Land Office directed adverse proceedings against the Squaw Butte claims, charging:

1. That the land is non-mineral in character.
2. That no discovery of valuable mineral has been made on the claims.

The claims are as follows:

Contest 2635- Shamrock Nos. 2 and 3 lodes, in sec. 1, T. 24 S., R. 25 E., W. M., located by F. W. Gloster on May 22, 1939.

Contest 2636- Squaw Butte lodes Nos. 49 to 54, and 7 to 12, in sec. 1, T. 24 S., R. 25 E. W. M., located by Earl Hagey, G. E. Hagey, and O. F. Selle on March 25 and June 14, 1939 - held by Ronald B. Crow.

Contest 2637- Squaw Butte lodes Nos. 43 to 48, in sec. 1, T. 24 S., R. 25 E. W. M., located by L. M. Selle, on June 14, 1939 - held by Ronald B. Crow.

Contest 2638- Squaw Butte lodes Nos. 37 to 42, in sec. 1, T. 24 S., R. 25 E., W. M., located by G. E. Hagey and Z. R. Hagey on June 14, 1939 - held by Ronald B. Crow.

Contest 2640- Squaw Butte lodes Nos. 1 to 6, and 79 to 101, in secs. 1 and 2, T. 24 S., R. 25 E., W. M. located by Ronald B. Crow on March 24 and August 21, 1939.

Contest 2641- Sunshine No. 5 lode in sec. 1, T. 24 S., R. 25 E., W. M., located by W. H. McKenzie and R. O'Farrell on May 17, 1939.

Contest 2649- Squaw Butte lodes Nos. 21 to 32, 60 to 65, 66 to 71, in secs. 1 and 2, T. 24 S., R. 25 E., W. M., located by O. F. Selle, H. E. Claridge, John Morris, and George Hagey on May 3d and 19th, 1939, and on July 3, 1939- held by Ronald B. Crow.

Notice issued to claimants and all answered denying the charges. Hearings were set but were continued from time to time by the Regional Field Examiner.

On October 16, 1940, upon request of the Regional Field Examiner, commissions to take depositions of certain witnesses issued to notaries public at Los Angeles and San Francisco, California, and at Spokane, Washington. Depositions were returned in each case.

By his letters "W" of June 17, and June 18, 1941, the Commissioner of the

Burns

General Land Office directed adverse proceedings against the Juniper Ridge claims, charging:

1. That the land embraced within the claims are non-mineral in character
2. That minerals have not been found within the limits of the claims in sufficient quantities to constitute a valid discovery.

The claims are as follows:

Contest 1- Mining locations 1 to 6, 49 to 54, 82 to 91, and 95 to 99, in sec. 6, T. 24 S., R. 26 E., and secs. 1, 2, 12 T. 24 S., R. 25 E. W. M., located by Ivan Duncan on October 31 and November 22, 1940.

Contest 2- Mining locations 7 to 12, 27 to 32, 60 to 65, and 78 to 81, secs. 1 and 2, T. 24 S., R. 25 E., and sec. 6, T. 24 S., R. 26 E., W. M., located by O. F. Selle on September 20, 23, and 24, 1940.

Contest 3- Mining locations 13 to 26 in secs. 2 and 3, T. 24 S., R. 25 E., and sec. 6, T. 24 S., R. 26 E., W. M., located by Earl Hagey on October 13 and 31, 1940.

Contest 4- Mining locations 37 to 42, 66 to 71, in sec. 1, T. 24 S., R. 25 E., and sec. 6, T. 24 S., R. 26 E., W. M., located by L. M. Selle on October 31, 1940.

Contest 5- Mining locations 43 to 48, 72 to 77 in secs. 1 and 2, T. 24 S., R. 25 E., and sec. 6, T. 24 S., R. 26 E., W. M., located by E. R. Hagey on October 31, 1940.

Contest 6- Mining locations 100 to 107 in secs. 2 and 3, T. 24 S., R. 25 E., W. M., located by D. B. Goldman on October 31, 1940 and November 22, 1940.

Notices issued in each case and in due time answers were filed denying the charges.

November 12, 1941, pursuant to request and by stipulation of counsel, the Register of this office ordered the consolidation of the Squaw Butte and Juniper Ridge contests, their locations being practically identical. Thereafter, the cases were considered as a whole.

November 17, 1941, upon request of the Regional Field Examiner, Commission issued to a notary public in Washington, D. C. to take the deposition of a witness. Deposition was received. February 23, 1942, upon a similar request by the Regional Field Examiner, commissions issued to notaries public at Albuquerque, New Mexico, Tucson, Arizona, San Francisco, California, Grants Pass and Portland, Oregon and Moscow, Idaho, to take depositions of certain witnesses. Depositions were returned, except from Grants Pass, Oregon.

April 9, 1942, the date to which hearing on the contests had been continued, both parties appeared before the designated officer at Burns, Oregon. The United States was represented by Ira Lantz, Field Examiner, and the defendants by Wm. J. Becker, Attorney. Testimony was submitted. No appearance being made

on the date of final hearing, May 8, 1942, the case stood submitted.

Samuel T. Guthrey, Field Examiner, testified to having first examined the claims in controversy in 1937 when they were called the Hub Group, and again in August 1939, then the Squaw Butte Group. He found the main formation of the land to be a rhyolite lava flow, with obsidian rocks, and where cuts had been made perlite showed. He found neither veins nor lodes and very little development work. Govt. Ex. A, B, C, D.

Cassius C. Smith, Field Examiner, testified to having examined the claims as to the mineral character of the land, in June and July, 1940. His findings are similar to those of Guthrey. Samples of the rock he had assayed showed no tin. Govt. Ex. D, E.

April 1, 1941, Carl Lausen, Regional Field Examiner, Paul F. Cutter, Field Examiner, and Arthur E. Granger, geologist, all arrived at the claims to examine them for their mineral content, especially as to tin. A. J. Kinsley, Field Examiner, who had previously examined the claims and made cyanide fusion tests of the rock, from which he had secured tin "buttons", accompanied them and showed them where he had taken the samples from which he had secured tin. All took samples of the rock from these places. Lausen and Cutter, working together, took sixteen samples. Granger took nineteen which he sent to the Geological Survey, at Washington, D. C. for assaying.

Cutter's testimony, taken by stipulation of counsel, at Portland, Oregon, on March 20, 1942, is considered in conjunction with Lausen's.

Lausen testified that he had found the land to be a thick flow of volcanic glass or rhyolite, with no evidence of veins nor mineralization nor occurrences in which tin is found in rhyolite. Lausen made some thin sections of the glass which he examined with a petrographic microscope. He found the rock contained oligoclase, feldspar, a soda lime feldspar, the most abundant mineral in any of the slides. He also found a few grains of pyroxene and magnetite. Cutter agreed with Lausen's description of the land. Lausen also testified that the instructions from the General Land Office was to ascertain from the defendants their method of making fusion tests, so Cutter secured a detailed statement of the method. Govt. Ex. B, Cutter's testimony.

In Baker, Oregon, at the laboratory of the Oregon Department of Geology and Mineral Industries, Lausen and Cutter made 11 fusions from the samples secured at the claims. Lausen described these in detail, which were largely experimental. No tin was found, nor did they find any in the light metallic lustre of the perlite beads, although they used the cacotheline test for tin.

In Portland, Oregon, Lausen and Cutter gave the Charlton Laboratories a third of the pulp prepared in Baker of their sample #2, with a copy of the instructions of the fusion method secured by Cutter from the defendants. Plf. Ex. B & C. No tin was discovered. They gave a sample of the same pulp to R.D. Carpenter, assayer, at Grants Pass, Oregon, with duplicate instructions same as given to the Charlton Laboratories. No tin found. Plf. Ex. D. Before leaving Portland they went to Vancouver, Washington, and had A. W. Petrey, Chief Chemist, of the Aluminum Corporation of America test a portion of the pulp of sample #2 by the spectrographic method. Plf. Ex. F and Fl. No tin discovered. Plf. G.

From Portland, Lausen and Cutter went to Grants Pass, Oregon, to the Laboratory of the Oregon Department of Geology and Mineral Industries where they made fusions 12 to 45. Out of all these fusions no tin was found excepting where tin in some form had been added to the fusions. Fusions Nos. 42 to 45, inclusive, were experiments made by Lausen to obtain silica jelly to precipitate tin, if any, out of the solution by electric current and plate the tin on a copper wire. He was unsuccessful. Lausen made no further fusions but Cutter testified to continuing up to No. 73.

Before Lausen and Cutter left Grants Pass, Kinsley appeared to the laboratory stating that Rhea was coming, and if they cared to have him, he would help them with the tests. Lausen was absent but Cutter agreed. Before Kinsley and Rhea arrived the next day, Lausen and Cutter prepared four tests for them. Two of these tests were from their samples Nos. 2 and 7, but the third was serpentine and the fourth basalt, Lausen having picked up samples of these minerals on the road between Burns and Portland, many miles from the claims. The Crucible that Kinsley selected to test contained basalt. No tin found. Rhea tested the other three samples and produced a tin button from the serpentine.

Cutter, with the help of Rhea, ran fusion 54 which was sample #3. When the crucible was broken, Cutter was elsewhere but Lausen was with Rhea. No tin found, but a few seconds later Lausen heard Rhea pounding outside. Lausen hurried out. Rhea showed him part of a broken crucible with a tin button lodged in it and stated he had gotten it from the crucible just broken.

Cutter continued with the tests. Nos. 55 and 56 produced no tin. No. 57, which he ran with Rhea's help, produced a tin button. The remainder of the fusions Cutter ran alone. No tin found. Govt. Ex. F. The tin buttons showed almost pure metallic tin. Govt. Ex. E.

Cutter and Kinsley, at the University of California laboratory, worked over their samples by the cyanide fusion test, each making close to 100 fusions. No tin found.

Vernon C. Bushnell, soil surveyor, testified that he was employed by the Charlton Laboratories when the Lausen and Cutter sample was received for testing, with full instructions to use the cyanide fusion method. He and Kinsley tested the sample. No tin found. Govt. Ex. B. Bushnell also made a rock analysis of one of Kinsley's samples, 28-K. He found the rock to be Rhyolitic obsidian, made up of silica, titania, iron oxides, alumina, calcium oxide and magnesium oxide, in so far as his analysis went. No tin found. This analysis of Bushnell's, with added information from A. W. Petrey, of the Aluminum Corporation of America, and his own knowledge of rock, was worked out into percentages by Lausen as given in his testimony. No tin indicated.

Besides selecting samples at the claims, Granger examined the land and made a reconnaissance map of the area. Govt. Ex. A. He described the area as volcanic basalt and rhyolite, with no veins nor segregations of ore material to indicate the presence of tin.

R. C. Wells, chief chemist, U. S. Geological Survey, at Washington, D.C., testified to having received the nineteen samples of rock sent to the Survey of Granger. He described two methods, the gravimetric and the volumetric, used in testing the samples for tin. He explained that the gravimetric method used

by him, while not exactly a standard method, is rather a research method to find very small quantities of tin, making sure that no quantity of tin can be lost and if any tin is in the rock it can be finally obtained. He, and three assistants, tested the samples. Slight traces of tin is shown in some samples, but all under one percent, which are not actual percentages but the maximum possible limit of tin. See Wells deposition. Plf. Ex. 1, 2, 3. (Sample 17 was a tin button set in a crucible and sample 18 a crucible, both given by Kinsley to Granger).

Wells further testified that if the silica in the rock is as high as 70% no tin will be obtained by the cyanide fusion method.

The commission issued for the taking of deposition at Washington, D.C., was modified by Counsel stipulation to add the testimony of four witnesses for the Government and two for the defendants. Accordingly, Victor North and Joseph Axelrod, chemists, testified to having run tests of the samples given them by Dr. Wells, according to the method and results as shown on Plf. Ex. 1 - Wells' Deposition.

Charles Milton, Geo-chemist, testified that Dr. Wells had given him Granger's sample #3 to test, which he did by the gravimetric method, which he believed would show the presence of tin far below the fraction of a percent. He found no tin. Plf. Ex. 1 - Wells' Deposition.

George Steiger, retired chemist, formerly chief chemist of the U. S. Geological Survey, stated that the spectrographic method was used principally to locate traces of mineral. He made spectrographic tests for tin in all of the Granger samples from #4 on, excepting #17. He got no tin, except traces less than 1% from some of the samples. Plf. Ex. 8.

Earl Nixon, Director of the Oregon Department of Geology and Mineral Industries, testified that he first saw the claims in controversy on November 25, 1939; that he took samples where he had been told tin had been found; that he sent these samples to the Bureau of Mines at Reno, Nevada, with instructions to test them by spectrographic method. No tin found. Govt. Ex. A and B.

John Allen, geologist, under Nixon's supervision, testified that Nixon had directed him to examine the claims, which he did on July 10, and October 20, 1941; that he took samples from various localities on the claims; made a geologic survey of the property and surrounding area; noted four different rock types, pumice, perlite, massive and banded andesite, all of volcanic origin, all glassy, with no secondary mineralizations such as would support the presence of tin; that he made two maps, a geologic and a topographic map. Govt. Ex. C and D. He also testified that he gave his samples to H. C. Harrison, chief chemist, of the Oregon State Department of Geology and Mineral Industries, who was with him on the claims in October, 1941.

H. C. Harrison testified that, among other samples, he had received seven samples from John E. Allen; that he took three samples himself; and that out of fourteen different tests he selected four, the cacothalene, the molybdic, the mercuric chloride plus analine, and the diazene test, these tests being for the determination of small amounts of tin, not over 5%. The tests were also selected for their sensitivity, the stability of the reagents, the sharp color changes involved and because they are specific for tin. He applied the tests in duplicate for each sample. He found tin in not more than .05% in any of the samples. He also made spectrographic tests, finding small traces of tin, not over .05%.

March 13, 1942, by stipulation of counsel, the deposition of Arthur C. Kinsley, Field Examiner, a witness for the defendants, was taken at San Francisco, California. Kinsley also testified at the hearing in Burns, Oregon, on April 9, 1942. His testimony shows that the defendants asked the Regional Field Office at San Francisco, California, to send a field man to the Squaw Butte plant, so, in October 1940, Kinsley was sent there to study and watch the operations of the plant, but the plant was not working when he arrived. He examined the land, finding it, as other field men had, to be a rhyolite lava flow. He took samples from spots where he was told tin had been found. He watched Wm. Rhea make cyanide fusions of the rock and secure tin buttons. After waiting two weeks, and the plant still idle, Kinsley, taking his samples with him, and accompanied by Wm. Rhea, went to Portland, Oregon

Very little is brought forth in the testimony to indicate Rhea's educational background, if any, or his experience in working with tin, or even his relation to the defendants. Kinsley testified that when he first met Rhea he understood him to be the chemist for the defendants, and Rhea was so designated by them, but later he was referred to as merely, "an employee of the defendants." To Kinsley, Rhea did not claim to be a chemist but he did claim a "rule of the thumb" or rudimentary training in chemistry, and that he had former experience in working with tin but this was not elaborated upon. However, the defendants appear to have relied upon Rhea's apparent ability to secure tin by his cyanide fusion tests of the rock on their claims, as he appears to have been chosen by them to accompany Kinsley to Portland to teach the latter his method of working these fusion tests. Kinsley testified that he did not ask for Rhea's assistance but when he was approached on the subject by the defendants he concurred.

In Portland, Kinsley rented the John Beede Laboratory where he worked off and on for two months. He had the use of the laboratory at such times as it was free from dangerous fumes and people, except Rhea. John Beede and his brother, Clarence Beede, were also in and out of the laboratory most of the time. However, Kinsley states that they had nothing to do with his samples, and that Rhea had "no hand whatever in . . .

After preparing his samples for analysis, Kinsley sent one-third of the pulp to the Charlton Laboratories for tin test, gave one-third to John Beede for a gold and silver test, and kept the remainder for his own experiments. He spent a month under Rhea's tutelage, making fifty or more fusions and recovering one or two buttons. Results from the Charlton Laboratories, by their wet assay method, showed only a trace of tin in one sample. Def. Ex. 11 A, B, C. The gold and silver test showed only trace. Def. Ex. 12. Kinsley described in detail the furnaces he used. Def. Ex. 13 and 14. Assays of his first tin buttons recovered, of Rhea's fusions and assays. Def. Ex. 15, 16, 17, 18.

On December 16, 1940, Kinsley returned to the Squaw Butte plant and witnessed an unsuccessful test of the furnace. He collected samples from around the furnace. Def. Ex. 19 A, B, C. and 20. While at the claims he secured two more samples at a distance from where he had formerly sampled the rock. Def. Ex. 21, A, B, C, D, and 24, which shows tin in the buttons, but no tin by the Pearce-Low assay. Assays of buttons secured from his 29-K sample, or his "control", which he used to test other fusions, showed almost pure tin. Def. Ex. 26, a and b. For Kinsley's map of claims, see Def. Ex. 33.

In April 1941, Kinsley took still more samples from the claims. Def. Ex. 34. Def. Ex. 35 and 36 are all assays of more buttons he found and of slag found in a furnace he used.

Kinsley testified to having sent three samples to the Colorado School of Mines and three to the University of Arizona. Reports not filed but he testified that the results from each place was nil or trace only as to tin. He also sent five samples to the U. S. Geological Survey at Washington, D. C. the results of which are covered in the deposition of Charles Milton. See Wells deposition.

Def. Ex. 37, 38 and 39 are books on tin.

Kinsley testified that he and Rhea were associated 75% of the time during which Kinsley was making cyanide fusion tests and working on the samples he took at the claims; that he made some two hundred fusions in all and recovered fifteen buttons. He also testified that he and Cutter had worked over their samples at Berkeley, California, Kinsley making fusion tests of all the samples he had worked at Beede's Laboratory, but that at Berkeley he had recovered no tin.

By stipulation of counsel, the depositions of four witnesses for the defense were taken on March 19, 1942, before Cloyd Rauch, a notary public, at Portland, Oregon.

Marvin F. Pullen, testified that his business was retinning old milk cans and utensils; that he first learned of the Squaw Butte claims from O. F. Selle, whom he met at Baker, Oregon; that, due to war conditions, he feared his business would suffer for lack of tin, so he visited the claims several times, took samples, and although he had had no mining experience, knew nothing of chemistry nor smelting, he built himself some three furnaces in an attempt to secure tin from the samples by the same process he used to salvage tin from the dirt and sweeping in his workshop. He used an iron mortar he made himself to crush the rock and then roasted it in the furnace. He also had Clarence Beede crush ore for him, from which he made eleven consecutive runs. He felt sure he got tin but how much he could not tell. No assays were produced. He gave up trying to find tin in the ore as the results were so small and too expensive to be continued.

John F. Beede testified he had been assaying since 1922; that he first assayed Squaw Butte rock in 1929 or 1930 but found only 1% of tin; that he estimated the rock contained 72% or 73% of silica, and he classified the rock as rhyolite obsidian; that he had rented his laboratory to Kinsley with the understanding that the defendant would pay the rental; that he had nothing to do with Kinsley's work; that he accompanied Kinsley to Burns when the latter went to see the furnace work in December 1940; that Kinsley took several samples back with him to Portland; that Kinsley worked over these samples alone, making some sixty or seventy cyanide fusions but secured no tin; that Kinsley had to return to San Francisco before Christmas 1940; that Rhea returned to Portland and that he and Clarence Beede, John Beede's brother, made the fusions of the samples left by Kinsley; that he, John Beede, was to have nothing to do with the work and was to do no assaying. Much of the remainder of Beede's testimony concerns the identification of the defendant's exhibits already testified to by Kinsley.

Chester Beede, son of John Beede, testified that he had worked in his father's laboratory off and on since 1936; that Kinsley gave him a sample to test sometime before Christmas 1940 and that he secured a tin button.

Clarence Beede, a Brother of John Beede, testified that he worked off and on in his brother's laboratory since 1930; that he met Kinsley about Christmas time 1940 and began keeping notes for Kinsley on March 3, 1941 while Kinsley worked fusion tests on his samples. These notes covered the days of March 3 and 4, and April 21, 22, and 24, 1941; that he also kept notes of his own cyanide fusion tests beginning December 11, 1940 and continuing to December 28, 1940 when Rhea appeared to work with him. These notes, kept in a manner similar to Kinsley's "working data", add little or nothing to the testimony already given by Kinsley. However, Rhea's first fusion produced a tin button, as did many of those that followed. Clarence and Rhea worked the fusions alternately, and Clarence obtained his first button after Rhea's appearance.

Oscar F. Selle, one of the defendants, testified that he first heard of the claims in controversy when they were known as the Hub Group; that in 1939, in Los Angeles, California, he met Ronald Crow who was looking for tin; that he had sent Crow samples of rock from the claims and Crow had asked him to locate claims for him. Not being able to do this, Selle asked Earl Hagey to do the locating. Selle testified to having made fusion tests of the rock and securing bits of tin, although he had never had any assaying nor mining experience. No evidence of assays filed. He stated he had met Wm. Rhea in the summer of 1940 at Burns, Oregon, when Rhea was making cyanide fusion tests of the ore and getting tin buttons. He also admitted that he had never seen any one except Rhea make successful cyanide fusions of the ore, and secure tin.

Earl Hagey, one of the defendants, testified that he was in the garage business from 1921 to 1939, when he supervised the staking of the Squaw Butte claims for Ronald Crow, having staked over one hundred claims. He stated he had made cyanide fusion tests of the rock with Rhea, but the results were not brought forth. He also testified to having assays of the rock. Def. Ex. 71, a compilation of assays, but no assay certificates filed. He also testified to having made an attempt to locate Wm. Rhea, presumably to have him appear at the Burns hearing, but no evidence was introduced to show Rhea was actually contacted nor was he subpoenaed to appear at the hearing.

The evidence adduced at the various hearings in these cases reveals careful, painstaking work on the part of the Government's field examiners, geologists, chemists and mineral experts, in their endeavor to prove or disprove the presence of tin in the claims in controversy. Using the latest methods known to the scientific world in detecting minerals in ores and rocks, testing the rock again and again to detect the smallest possible trace of tin, they all, with the exception of one, came to the same conclusion, that no real discovery of mineral, especially tin, had been made on any of the claims.

The evidence brought forth by the defendants, wherein they attempt to stress the cyanide fusion method of recovering tin from the rock, as superior to the latest scientific methods, by their alleged finding of tin buttons in the rock, is not convincing.

I am of the opinion that the Government has amply proven its charges and I so find; that "the lands within the claims are non-mineral in character; that minerals have not been found within the limits of the claims in sufficient quantities to constitute a valid discovery." I recommend that the mining locations heretofore described in the Squaw Butte and in the Juniper Ridge Groups, located in T. 24 S., R. 25 and 26 E., W. M., be declared null and void.

Defendants will be allowed thirty days from receipt of this decision within

which to appeal to the Commissioner of the General Land Office.

W. F. JACKSON

Register

October 31, 1942

tin

LAW OFFICES

W. M. J. BECKER

FIRST NATIONAL BANK BLDG. - PHONE PARKVIEW 7100

50 SOUTH CENTRAL AVENUE

CLAYTON, MISSOURI

January 16, 1943.

Mr. H. C. Harrison,
Mr. John Elliot Allen,
702 Woodlark Building,
Portland, Oregon.

Gentlemen:

I wish to thank you for your thoughtful remembrance in forwarding to me your very well written report of your views of the reported occurrence of Tin at Juniper Ridge, Oregon.

When my views have been completely complied, I will likewise take the liberty of submitting to you a copy thereof for your scholarly consideration.

With kindest personal regards to yourself, your chief and everyone else in the office, I remain,

Sincerely yours,

WJB:en

Wm. J. Becker
Wm. J. Becker.

gld

RECEIVED
JAN 22 1943
STATE DEPT OF GEOLOGY
& MINERAL INDS.

Reports Tin Ore in Oregon

PORTLAND, Ore., March 25 (AP) —Evidences of vanadium and tin, possibly in commercial quantities, were found in ore samples examined in the State's new spectrographic laboratory, Dr. H. C. Harrison, spectroscopist, reported today. The ore locations were not made public.

Arrowhead -

LAW OFFICES

WM. J. BECKER

FIRST NATIONAL BANK BLDG. - PHONE PARKVIEW 7100

50 SOUTH CENTRAL AVENUE

CLAYTON, MISSOURI

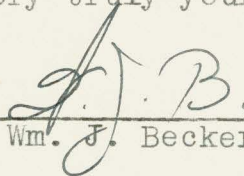
April 20, 1942

Dr. H. C. Harrison,
c/o Oregon State Department of Mining,
Woodlark Building,
Portland, Oregon.

Dear Doctor:

Enclosed is a clipping from an Cincinnati paper. Congratulations. I hope the tin that you found is somewhere in the neighborhood of our deposits. In any event I again wish you the best of luck.

Very truly yours,


Wm. J. Becker.

WJB:en

RECEIVED
APR 25 1942
STATE DEPT OF GEOLOGY
& MINERAL INDS.

tin

WM. HUNTLEY HAMPTON
CIVIL, MINING AND CONSULTING ENGINEER
CHEMIST AND METALLURGIST
~~475 WEST PARK STREET~~
PORTLAND, OREGON

2037 S.W. Park Ave.

September 29, 1941

Dr. H. C. Harrison,
Sunset Hill,
Corvallis, Or.

Dear Dr. Harrison:-

Your favor of Sept 15th was received in due course and I note contents notint the receipt of the information I gave Mr. Nixon.

Note what you say about a tin silicate mineral noted by Mellor. Has it a name?

Richters Inorganic Chemistry- Smith- calls attention to the acidic and basic action of tin oxides.

The smelters of tin have great difficultied because of the graet tendency of tin oxide to enter the siliceous slags.

Bruno Kerls Assayers Manual- a very old book- calls attention to the necessity of adding iron oxide to a tin assay by the cyanide method of high silica ores or residues, slags, etc., to take care of the silica.

You ask about witnessing an analysis by me sometime. I have no objection to that. I do not know when I will be at it again and I work at such unseemly hours from other peoples habits.

I have had a lot of letters written to me since I published my findings, and have also had visits from a number of the people intereted in the tin deppsits.

I was told by one of these parties that Mr. Nixon had informed Mr. Derry that you was not able to get results by my "formula" I have no formula of my own devising. I follow the scheme laid down in the standard works on analysis of things in general and especially that dwelling on insoluble silicates, glass, etc. (Scott, Treadwell, Classen. Fesenius, et al.

I expect to get some samples shortly from definite places and then I contemplate some further study on the matter as I have some ideas I wish to confirm.

Yours very truly,

Wm. H. Hampton

STATE GOVERNING BOARD

W. H. STRAYER, CHAIRMAN, BAKER
ALBERT BURCH MEDFORD
E. B. MACNAUGHTON . . PORTLAND

EARL K. NIXON
DIRECTOR

F. W. LIBBEY
MINING ENGINEER

JOHN ELIOT ALLEN
GEOLOGIST

LESLIE L. MOTZ
METALLURGICAL CHEMIST



STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

702 WOODLARK BUILDING
PORTLAND, OREGON

September 11, 1941

STATE ASSAY LABORATORIES

400 E. 1 ST., GRANTS PASS

RAY C. TREASHER
FIELD GEOLOGIST

ALBERT A. LEWIS
ASSAYER

2102 COURT ST., BAKER

HUGH K. LANCASTER
FIELD ENGINEER

WILLIAM T. BURNS
ASSAYER

Dr. H. C. Harrison
R.D. #2 -- Sunset Hill
Corvallis, Oregon

Dear Doctor Harrison:

Attached hereto is a letter from Mr. William Huntley Hampton which is self-explanatory. You might put it in your file for future reference when you see Mr. Hampton again.

Sincerely yours,

Earl K. Nixon
(nm)

Director

EKN:vm
encl.

THE DIRECT PRODUCTION OF REFINED OILS AND AMMONIA FROM OIL SHALES, LIGNITE COALS AND PEAT. EQUIVALENT TO OIL FROM WELLS COMPLETE RECOVERY OF OILS FROM OIL SANDS UNCHANGED.
NO DESTRUCTIVE DISTILLATION IN RETORTS, NO ACID REFINING.

HAMPTON PROCESSES
(Patented)

NEW ELECTRIC, OIL, GAS OR FUEL CONTINUOUS RETORTS AND FURNACES FOR QUICKSILVER WITHOUT SOOT PRODUCTION, FOR METALLURGICAL CALCINING AND DESULPHURIZING WITH RICH BY-PRODUCTS FREE FROM FUEL COMBUSTION GASES.
IMPROVED QUICKSILVER RETORTING, ELECTRIC FIRED ROASTING AND SINTERING MACHINES WITH BY-PRODUCT RECOVERY.

WM. HUNTLEY HAMPTON
CONSULTING MINING AND CIVIL ENGINEER
CHEMIST AND METALLURGIST

LABORATORY AND ASSAY OFFICE, ESTABLISHED 1886

~~475 WEST PARK STREET~~

PORTLAND, OREGON

2037 S.W. Park Ave.

Sept. 6th, 1941

TELEPHONE BEACON 8266

Mr. Earl K. Nixon,
State Department of Mining,
702 Woodlark Bldg.,
Portland, Or.

Dear Mr. Nixon:-

Since you were here with Dr. Harrison I have been thinking over the subject he brought up, ^{the} subject of the acidity of stannic oxide and that it was incompatible that a silicate of tin was possible such as I had stated in my opinion of the Burns ores. Of course it could exist as a sodium stannate, but also the tin in the Burns ore exists as the non-acidic oxide- the stannous oxide- as 90% of the tin precipitated and separated was in the stannous form.

I find that my impression that silicate of tin was mentioned in some of my analytical works was from an assumption that tin was included among other elements in fused silicates such as glass that might be encountered.

In the International Tables it is not listed as a chemical compound, but that does not say it does exist, because I have noted quite a number of omissions in the tables of compounds in everyday use for years.

I run across the following in Crookes & Rohrig Treatise on Metallurgy- a very old work- Under heading as to the properties of tin

" Furthermore, as oxide of tin combines as a base with silica, and also, though less markedly, as an acid with oxide of iron, manganese, lime, &c., its tendency to scorification is very great, forming combinations from which the tin may be partly extracted only at a high temperature, when the foreign metallic oxides present (chiefly oxide of iron), are also reduced in larger quantities." He does not distinguish between the oxides.

In Dana's System of Mineralogy I find that some of the analysis of tin stone contain as much as 6.5% of silica.

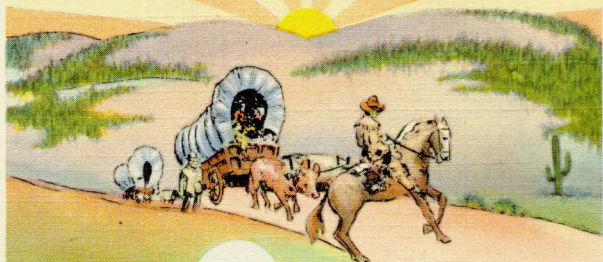
It also notes the following mineral occurrence but as yet un-named, I quote- " Stannite Brieth. (Handb. 772, 1847), an amorphous, pale yellowish-white substance, from Cornwall, with Hardness-6.5, G. 3.54 has been regarded as a pseudomorph after feldspar, containing much oxide of tin as a mixture with other ingredients. Bischof obtained, Silica 51.5, Tin 38.91, Aluminum oxide 4.53, Ferric oxide 3.55, Calcium 0.16, ign. 0.43 Total 99.15. " It looks to me that tin exists as a silicate. without doubt

Yours very truly,

Wm. Huntley Hampton

RECEIVED
SEP 8 1941
STATE DEPT OF GEOLOGY
& MINERAL INDS.

RENO



OVERLAND
HOTEL





POST CARD

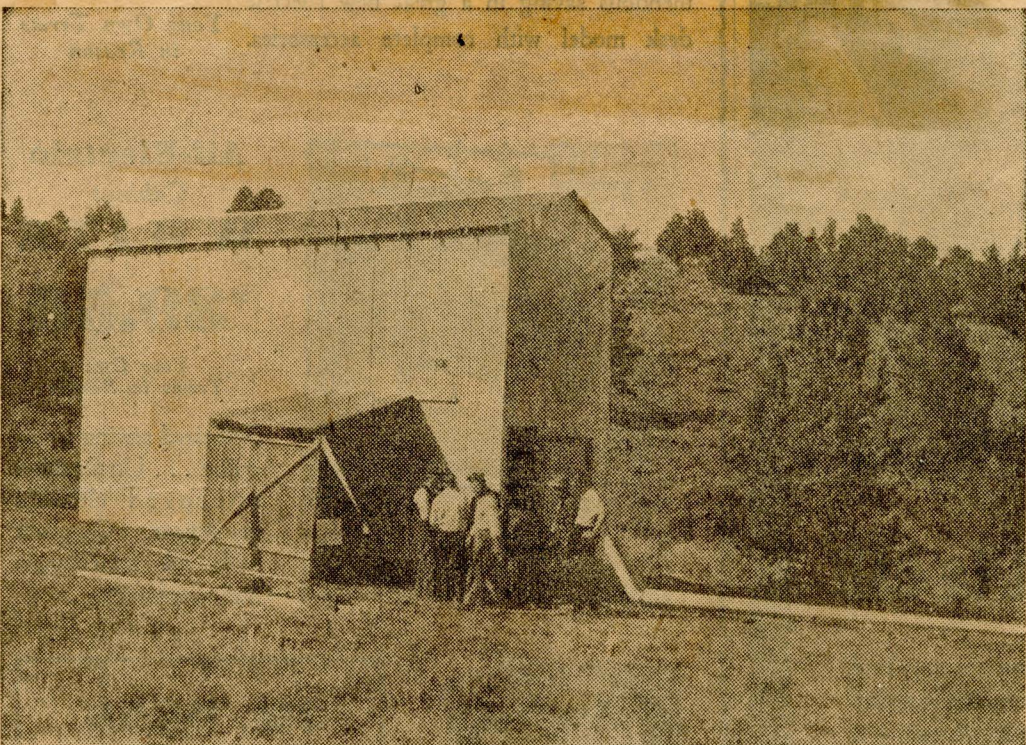
Dr H C Harrison
702 Woodlock Bldg
State Mining Bureau
Postland
Ore.

GENUINE CURTEICH-CHICAGO "C.T. ART-COLORTONE" POST CARD (REG. U.S. PAT. OFF.)

Hello Mr Harrison.
Still Roaming
around as closing
deal on one of
my own Proj.
Will see you
soon to make that
test
Yrsk
Fred Miller



TIN from Oregon ore will be smelted in this \$10,000 pilot unit. The ore lies in a 2000-acre tract near Burns. From left to right—O. F. Sellel, Baker mining engineer, the discoverer of the new process that gives the Oregon ore value, Earl Hagey of Burns, Sellel's partner in the development, and Albert L. Koebel of Sandpoint, Idaho, owner of the patent rights on a new smelting process in use at the mine.



TIN OXIDE is recovered from a series of 96 six-foot bags after smelter gasses have been cooled in the bag house.



The Oregon Journal
October 15, 1940.

GOVERNOR Charles A. Sprague, right, has the new type of ore explained to him by Mining Engineer William F. Hayden, who represents St. Louis investors. This picture was taken at one of the test shafts on Juniper ridge. The shaft revealed deposits 278 feet deep and still continuing.

Times-Herald

Covers Harney County Like the Sagebrush

Ira Mahon
630 N. E. Law
SUBSCRIPTION RA
ONE YEAR, \$1.50

Burns, Oregon, Friday, October 18, 1940.

Number

Tin Developers Vision 250 Ton Commercial Unit

Harney Public Invited for Guest Day

Sunday Morning Fixed for Caravan To Juniper Ridge

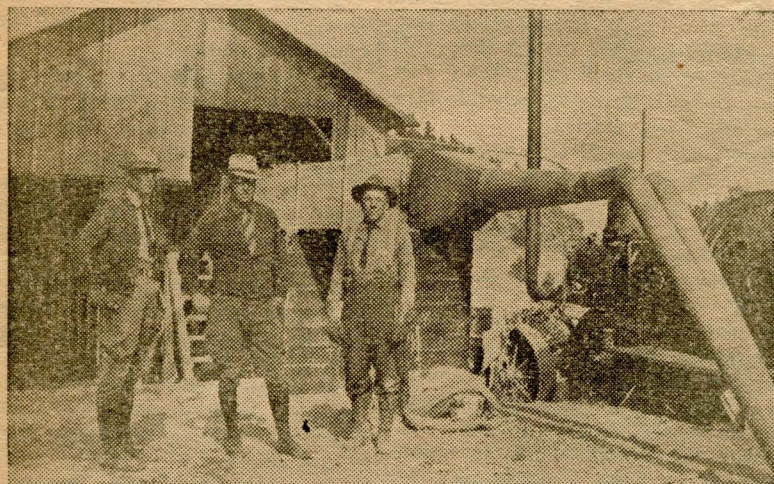
Members of Burns chamber of commerce Tuesday noon accepted an invitation from the developers of what is expected to become America's first large-scale tin mine and will visit the property in a body Sunday morning. Caravan cars will gather at Hotel Arrow Head, leaving for the mine at 9 o'clock, and all others of the Harney county public interested are invited to join the chamber party.

In accepting the invitation from the mining group, the chamber voted to ask William F. Hayden, O. F. Selle, Albert J. Koebel and Earl Hagey to be the chamber's honor guests at next week's regular Tuesday noon luncheon. Mr. Hayden is mining engineer for the group, here for the past eight months from St. Louis; Mr. Selle, former assayer and mining expert at Baker, is the original man in the undertaking; Mr. Hagey, a Burns man, is Mr. Selle's partner, and Mr. Koebel, resident of Sandpoint, Idaho, is owner of the patented smelting process used in handling the new-type ore.

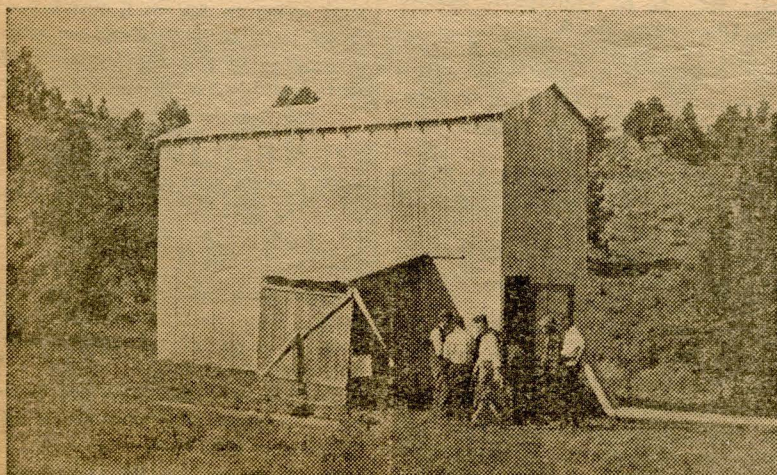
MINE HISTORY TOLD

The mining group's invitation to

Camera Glimpses Juniper Ridge Action On Day of First Demonstration



Here, in front of the smelting unit of the test plant at Juniper Ridge, are, from left to right: O. F. Selle, discoverer; Earl Hagey of Burns, his partner, and Albert J. Koebel of Sandpoint, Idaho, owner of the patented new smelting process used for the new type ore.



Through pipes shown in the upper photo, tin oxide gases are drawn and cooled for 400 feet to the "bag house" shown above. The building houses 96 six-foot bags which capture the tin oxide while permitting the cooled gases to escape.

Newest Move Based on Pil Plant Tests

Huge Ore Depos Declared Enough To Supply Nation

Developers of a tin mining project on Juniper Ridge, adjacent to Squaw Butte range experimental station and 37 miles west of Burns, already are considering installation of a commercial plant capable of handling 250 or 500 tons of ore daily on the basis of results obtained through a \$10,000 pilot plant in operation on the property since last weekend. The announcement was made yesterday.

William F. Hayden, St. Louis consulting engineer, said he would be within the next few days for Burns to obtain plans and range for the installation, provided tests now being conducted show to contain values as in mill analyses up to this time. He estimates the project would require six months to a year and said would anticipate additional units will be proven necessary and would be as "fast as possible."

It was asserted impossible to estimate the number of men who might be employed in connection with operation of the first commercial plant until plans are further advanced. Hayden said he believed such a roll would number not less than

mining engineer for the group, here for the past eight months from St. Louis; Mr. Selle, former assayer and mining expert at Baker, is the original man in the undertaking; Mr. Hagey, a Burns man, is Mr. Selle's partner, and Mr. Koebel, resident of Sandpoint, Idaho, is owner of the patented smelting process used in handling the new-type ore.

MINE HISTORY TOLD

The mining group's invitation to the chamber and the general Harney county public was extended through Judge Robert M. Duncan. Attorney for the undertaking before his appointment to the circuit judgeship, Judge Duncan has been closely in touch with the development from the start.

Judge Duncan told the chamber that the mine was not a promotion and that those now interested are able and will put the property into commercial production.

The ore deposit was discovered by Mr. Selle 10 years ago but was inactive until this year. In the meantime, however, Mr. Hagey was taken into partnership in getting the 107 claims together and, in 1937, Charles F. Hoyt and D. B. Goldman, capitalists of St. Louis, Mo., were interested for the development. During this period also the country was closely prospected and the new process outlined for a type of ore that never before has yielded metal of any kind. The four men are now owners of the property. Mr. Hayden was employed to supervise development and technical activities and has been active on the ground since March of this year.

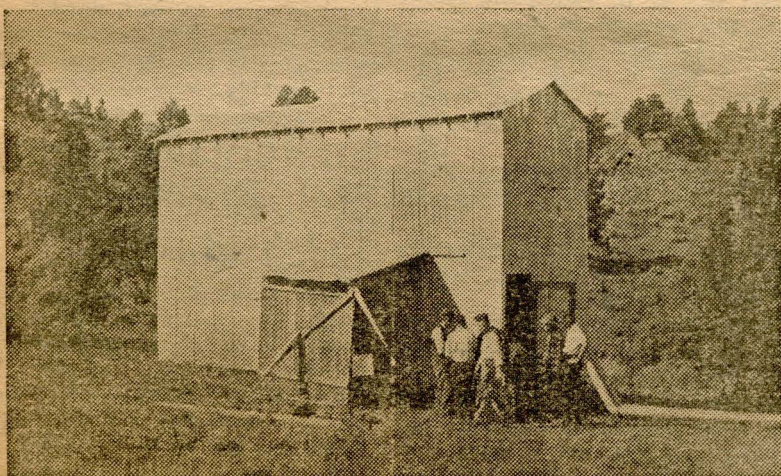
PROCESS REVEALED

Mr. Koebel was called from Sandpoint with his new smelting process when the time came for installation of the pilot plant in the field, after "highly promising and very encouraging" laboratory experiments.

Under the process in use, as explained by Koebel, the ore as mined goes to a mill where it is ground and from there through a roaster to remove moisture before going into a blast-type smelting furnace. Intense heat, 3000 degrees, melts silica and mica and reduces the tin values of the ore to a gas which in turn is drawn through a cooling tunnel 400 feet to a "bag house" where cool gases are filtered through 6-foot bags, containing wool, which stop the fine oxide while fumes escape. The oxide is then recovered from the bags and reduced to metallic tin by regular laboratory processes.

Going into operation for the first time Thursday night, the pilot plant had handled five tons of ore at noon Friday of last week with assays confirming laboratory tests of the past several months, according to William D. Rhea of Hines, an assayer experienced with tin ores in Central and South America and formerly with the U. S. government in the Panama Canal zone.

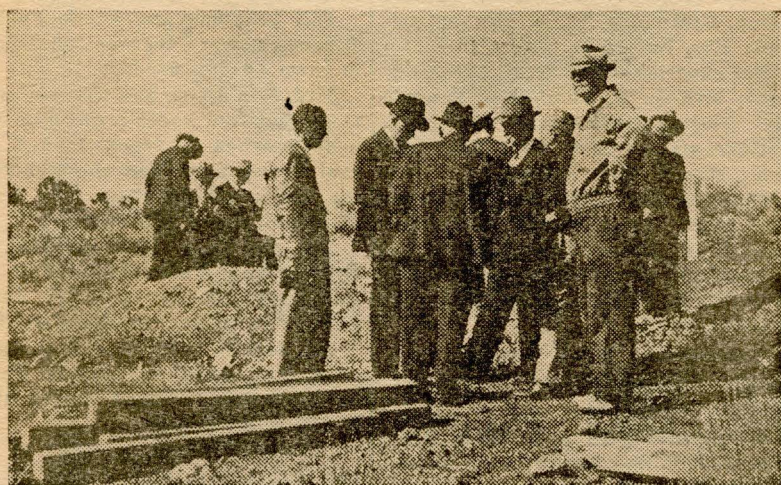
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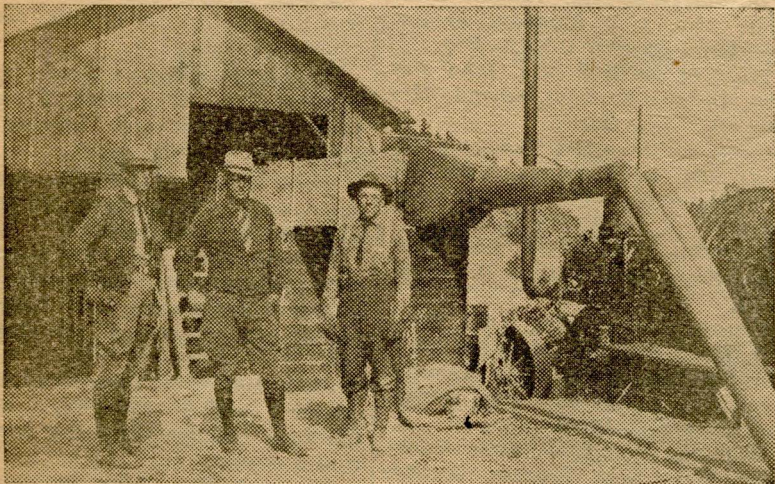


Ore in great, solid body is covered by a lava crust ranging from a few inches to three feet deep and, at this point is exposed in elephant-size out-croppings. In foreground of inspection party is Governor Sprague, left, and Judge Robert M. Duncan.



Here the opening day party visits one of the many test shafts, one of which reaches a depth of 278 feet, still continuing in ore. Gathered around the shaft at the rear are Earl Snell, secretary of state, left; Archie McGowan of Burns, and Carl Abrahams of Salem, brother of Mrs. R. M. Duncan. In the foreground, from left: Charles F. Hoyt, St. Louis capitalist in the development; Governor Sprague; Consulting Engineer William F. Hayden of St. Louis, with back to camera; W. H. Derry of Portland Chamber of Commerce; D. B. Goldman, St. Louis capitalist interested with Hoyt, bareheaded, and Judge Duncan.

Camera Glimpses Juniper Ridge Action On Day of First Demonstration



Here, in front of the smelting unit of the test plant at Juniper Ridge, are, from left to right: O. F. Selle, discoverer; Earl Hagey of Burns, his partner, and Albert J. Koebel of Sandpoint, Idaho, owner of the patented new smelting process used for the new type ore.

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William F. Hayden, St. Louis consulting engineer, said he would leave within the next few days for San Francisco to obtain plans and arrange for the installation, providing tests now being conducted show ore to contain values as in mill and assay tests up to this time. He estimates the project would require eight months to a year and said owners anticipate additional units will be proven necessary and would be added as "fast as possible."

It was asserted impossible to estimate the number of men who might be employed in connection with operation of the first commercial unit until plans are further advanced. Mr. Hayden said he believed such a payroll would number not less than 150.

GOVERNOR IS WITNESS

Lifting a veil of secrecy from nine months of preliminary work, the pilot plant was first demonstrated Friday of last week. It is supplementing under field conditions earlier laboratory tests for the recovery of tin oxide through an entirely new process which the developers assert will give America its first large-scale tin producer and make the nation self sufficient in the metal it now chiefly lacks for both economic and military purposes.

Witnessing the first demonstration were Governor Charles A. Sprague, Secretary of State Earl Snell, F. W. Libbey of the state department of geology and mineral industries, W. H. Derry of the promotion department of Portland chamber of commerce and 50 other invited guests.

ORE TON NETS \$17

Using the new process on a type of ore that previously has not yielded any type of metal, the developers claimed a recovery of from 34 to 49 pounds of metallic tin to the ton, worth 50c a pound at the present market. It was estimated a ton of the ore could be handled at a cost not to exceed \$9 a ton, and gold was reported as a by-product in sufficient quantity to probably pay entire oper-

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In addition to viewing the pilot smelting plant, visitors were taken over the 2000 acres of federal range land embraced in 107 mining claims and were advised that the ore now located "would be sufficient to supply the needs of the entire nation for many years." (The United States is now importing in excess of \$100,000,000 of tin annually.)

The ore in the huge deposit is found outcropping in one place and is seldom more than three feet under an over-cap of lava. It has been tested by a series of shafts over the property and in one place to a depth of 278 feet, still continuing in ore. It is a solid mass, not in veins, and subject to mining by power shovel.

The developers (listed in a companion news story on this page) were discouraged in the early stages by failure of assayers to find a showing of tin in the new-type ore by usual methods but favorable assays, corresponding to their own findings, they announce, have now been obtained from a number of nationally recognized sources by standard orthodox methods.

Oregon Journal — August 4, 1941.

Verify Tin at Burns

Portland Re-Tinners Co. Runs Successful Cyanide Fusion Tests, Offers to Demonstrate; Says U. S. G. S. Report Not Last Word.

PORTLAND, July 31.—To the Editor of The Journal—In the last two months, I have made several trips to Burns tin deposit, and brought in samples of tin ore. We have made several runs of these samples taken from various parts of the tin deposit in our furnace. On every run, we got results. In fact we got tin on every run.

I have read the newspapers and quote the following: "Dr. Mendenhall, director of the USGS, informed Senator Holman that his staff will make further cyanide fusion tests as requested by Holman, although convinced that 'if any tin at all is present, it is in such small quantities as to be insignificant.'" Other tests used by the survey are more reliable and would have shown tin if as little as one pound a ton existed. But none of the 16 samples reacted positively, Dr. Mendenhall declared.

We are not chemists, but the statement made by Mendenhall is contrary to our findings. We will put on a demonstration with our furnace, to prove to anyone who doubts our ability to produce tin from Burns tin ore. We also are convinced there can be a commercial recovery made of the tin ore. But this recovery will have to be worked out in some proper laboratories other than the USGS and our state laboratory. Dr. Mendenhall's opinion on the subject is not considered final by our group.

There is no question we have a very large tin deposit near Burns, Or., in spite of negative reports made by United States Bureau of Mines and USGS.

Incidentally, why has A. C. Kinsley, department of interior investigator been taken from this work and sent to Alaska? It is well known that when working with W. D. Rhea, Burns chemist, he was successful with cyanide fusions, and made favorable reports on the Burns tin deposit. He is needed here. Why can't we get him?

M. F. Pullen,
Oregon Re-Tinners Co.

No Tin in Samples, Sen. McNary Is Told

WASHINGTON, Sept. 13—(P)—W. C. Mendenhall, director of the geological survey told Senator McNary (R-Ore) Wednesday the survey's experts had found no commercial tin in samples taken from Juniper Ridge, near Burns, Ore.

Oregon miners had insisted there was tin in commercial quantities near Burns and the senator asked the survey experts to make careful investigation. The director said this had been done and chemists and mining experts reported no trace of commercial tin.

The director said he was "forced regretfully to the conclusion that commercial tin does not exist in Juniper Ridge."

Portland, Oregon

Oregonian — June 24 or 25, 1941.

Tin Supply Burns Claim

Portland Chamber
Delegation Guest

BY PAUL LAARTZ
Staff Writer, The Oregonian

BURNS, June 24 (Special)—

This eastern Oregon lumber and livestock city is convinced that it has the nation's future tin development virtually in its back yard.

Circuit Judge Robert M. Duncan best voiced this belief before a visiting Portland Chamber of Commerce delegation meeting here Tuesday noon with the Burns Chamber of Commerce, by declaring:

"There is enough tin in Juniper hill, if it can be recovered economically, to pay our national debt" and "make the United States independent of the world for its tin."

The ex-president of the Oregon state senate, displaying 3½ ounces of the metal, which he said had been produced from ore samples from the Squaw butte area, some 40 miles west of here, declared "all we are asking is federal assistance, and we are not getting it."

Some \$40,000 in cash and \$20,000 in labor has been put into the 2000-acre area in attempting to develop the metal since it was discovered some 15 years ago, he told the visitors. Industries and interests should be pooled in co-operative fashion to advance the community and state. E. Don Ross, Portland chamber president, and R. B. Ambrose, president of Columbia Empire Industries, told the Burns and Portland business men.

The Oregonian — July 20, 1941.

More Tests For Tin Set .

The state department of geology and mineral industries has been advised that the United States geological survey has acceded to a request by Senator Rufus Holman to make more tests of ore from the Burns area in search for tin.

The state department has started an investigation in its new spectographic laboratory of the various methods of testing ore for tin with the idea of clearing up confusion over whether or not tin exists in the Burns deposits.

Dr. W. C. Mendenhall, director of the United States geological survey, informed Senator Holman that his staff will make further cyanide fusion tests as requested by the senator, although convinced that "if any tin at all is present, it is in such small quantities as to be insignificant."

Other tests used by the survey are more reliable and would have shown tin if as little as one pound per ton existed, but none of the 16 samples reacted positively, Dr. Mendenhall declared.

The Burns deposits are held by private interests which have been involved in a dispute with federal agencies as to whether or not tin exists.

Oregon Tin; Yes, or No

Solicitude of a Journal Reader for a Once-for-All Decision Leads Him to Demand of The Journal an Answer That Still Has Metallurgical Experts Stumped.

GRANTS PASS, June 23,—To the Editor of The Journal—I have read with great interest the column by Mr. Tom Humphrey under the caption "We Have Oregon Tin, or Haven't We?"

For some time I have been making spectroscopic studies of the minerals and rocks of Oregon and have examined a number of specimens alleged to contain tin. I have also listened to many wild tales about mysterious buttons of metal obtained by amateur metallurgists with cookstoves.

Now Mr. Humphrey makes the definite statement that A. C. Kinsley has obtained buttons of tin from the Burns deposits. Yet he concludes the column with the surmise "If there's tin at Burns . . ."

Why the question? If Mr. Kinsley or anyone else knows a process whereby buttons of metal have been obtained from the Burns deposits, there cannot be the slightest difficulty in determining whether or not these buttons are tin. If he has obtained tin where qualified experts have failed, the fact can be easily demonstrated, immediately and positively. No elaborate investigation is needed. Certainly it is incumbent on him to make such a demonstration or be branded as a charlatan.

This controversy has raged for a long time. When things come to such a pass that a dignified organ like The Journal devotes a whole column to the subject, leaving the matter still in doubt, certainly the time has come for a showdown. Either tin has been extracted from the Burns deposits, or it has not. If it has been extracted, the fact can be demonstrated.

At last we have a positive statement in your columns that tin has been extracted by Mr. Kinsley. This statement should be verified or withdrawn.

Will you give your readers the real truth of the matter? Frederick W. Vreeland.

Geologic mapping, sampling and field investigation will start within the next two weeks, and will be carried out by the geological staff of the state department of geology and mineral industries. Laboratory research under the supervision of Professor George W. Gleason of Oregon State college, using present facilities at the college and additional special apparatus to be acquired, will be carried out as planned at present, largely by Dr. H. C. Harrison, research chemist and spectroscopist, recently secured by the Oregon department of geology and mineral industries.

Dr. Harrison, who will install and be in charge of the department's new spectrographic laboratory, will leave his present position at the New York State College of Ceramics and take up the Oregon work August 1.

Results of the tin research, whether favorable or otherwise, will of course be made public at the proper time, according to Mr. Nixon.

The Importance of Oregon Tin Tests

Referring to a recent article on this page about the Burns tin controversy, a Grants Pass correspondent wants The Journal to say, definitely and without quibbling, whether or not there's tin in the Squaw Butte area.

That's a pretty big order, if he means tin recoverable in commercial quantities.

Nothing would please The Journal more than to be able to say, with authority, "There's recoverable tin in great quantities near Burns." But, as the Grants Pass critic himself admits, "this controversy has raged for a long time." Experts have wrangled over it for years, and who is The Journal to say, here and now, who's right and who's wrong?

The primary purpose of The Journal article in question was to state the case and to encourage just such a showdown as the Grants Pass writer demands.

It is no longer a question of whether or not tin has been extracted from Burns samples. Using a roasting and cyanide fusion process, A. C. Kinsley, an interior department engineer who worked on the Burns tin ore deposits for months, and other reputable chemists and assayers, have obtained buttons that unquestionably are tin. But that isn't all there is to it. Orthodox methods of tin recovery don't work on the Burns ore; that, too, has been demonstrated by experts, including the United States bureau of mines. And Kinsley's recovery tests, though hundreds of them are positive, are not consistent, and neither Kinsley, the discoverers of the deposits nor the Oregon state department of geology, and mineral industries knows exactly why.

It is to find out why, and to evolve, if possible, an economical, consistent process of recovery, that the state department of geology and mineral industries is undertaking, in co-operation with Oregon State college, an exhaustive series of tests this summer, tests that a federal agency should have made.

These tests should be as thoroughgoing as possible, orthodox and unorthodox. Nothing is of more importance to Oregon or to national defense. But until they are completed, neither The Journal nor anyone else can say, and prove it, that there's a mountain of tin near Burns—recoverable tin. The Journal hopes there is.

Tin Report Not Complete Yet, Nixon Declares

BAKER, June 13—(P)—The negative findings of the United States geological survey as to the importance of tin in the Squaw Butte area near Burns was questioned today by Earl Nixon, director of the state department of geology and mineral industries, who is in Baker today following a trip to Burns where he studied the tin deposits and started preliminary work for a more full investigation of the properties.

"I regard as premature and possibly even misleading the statement attributed to Dr. Mendenhall, director of the survey that the material in dispute contained no significant amount of tin," said Mr. Nixon.

"So far as we are aware nothing like an adequate amount of either field or laboratory work has been done to justify the conclusion of Dr. Mendenhall."

Mr. Nixon indicated here that a complete survey will be made in the near future on the matter of tin deposits in the state and that the information will be released as soon as it is available.

NIXON DOUBTFUL OF TIN REPORT

Further Investigations Planned in Burns Area

The negative findings of the United States geological survey as to the importance of tin in the Squaw Butte area near Burns, Oregon, was questioned by Earl K. Nixon, director of the state department of geology and mineral industries, who was in Burns Thursday, making plans for further investigation. Mr. Nixon is in Baker today and granted an interview with the Democrat-Herald.

"I regard as premature and possibly even misleading, the statement attributed to Dr. Mendenhall, director of the survey, that the material in dispute 'contained no significant amount of tin,'" said Mr. Nixon. "So far as we are aware, nothing like an adequate amount of either field or laboratory investigation has been done, by either the geological survey, or any other agency, to justify the conclusion quoted above," he said.

Evidence so far gathered definitely suggests the presence of a fundamental problem in physical chemistry that is unsolved as yet, according to Mr. Nixon. "If such is the case, and the ultimate findings are at variance with the conclusion of the survey, the effect of a possible favorable result would be not only startling from a scientific viewpoint, but of the utmost strategic importance to the United States. This consideration alone, in the present national defense emergency, with our absolute dependence upon foreign sources for our tin supply, should compel most serious consideration of this problem."

In the belief that further field and laboratory investigation is justified, the Oregon department of geology and mineral industries, working jointly with the department of chemical engineering of Oregon State college, is completing plans for a detailed research program on the tin problem.

Financing for this investigation is being supplied by a private group principally interested in the tin claims.

OREGON'S interest in the nation's "tin situation," as presented in the accompanying article, is heightened by recent demonstration operation of a \$10,000 pilot plant, near Burns, for recovery of tin oxide through what is believed to be an entirely new process.

Those interested in the development assert that their process may revolutionize the tin industry and make the United States self-sufficient in the metal it chiefly lacks.

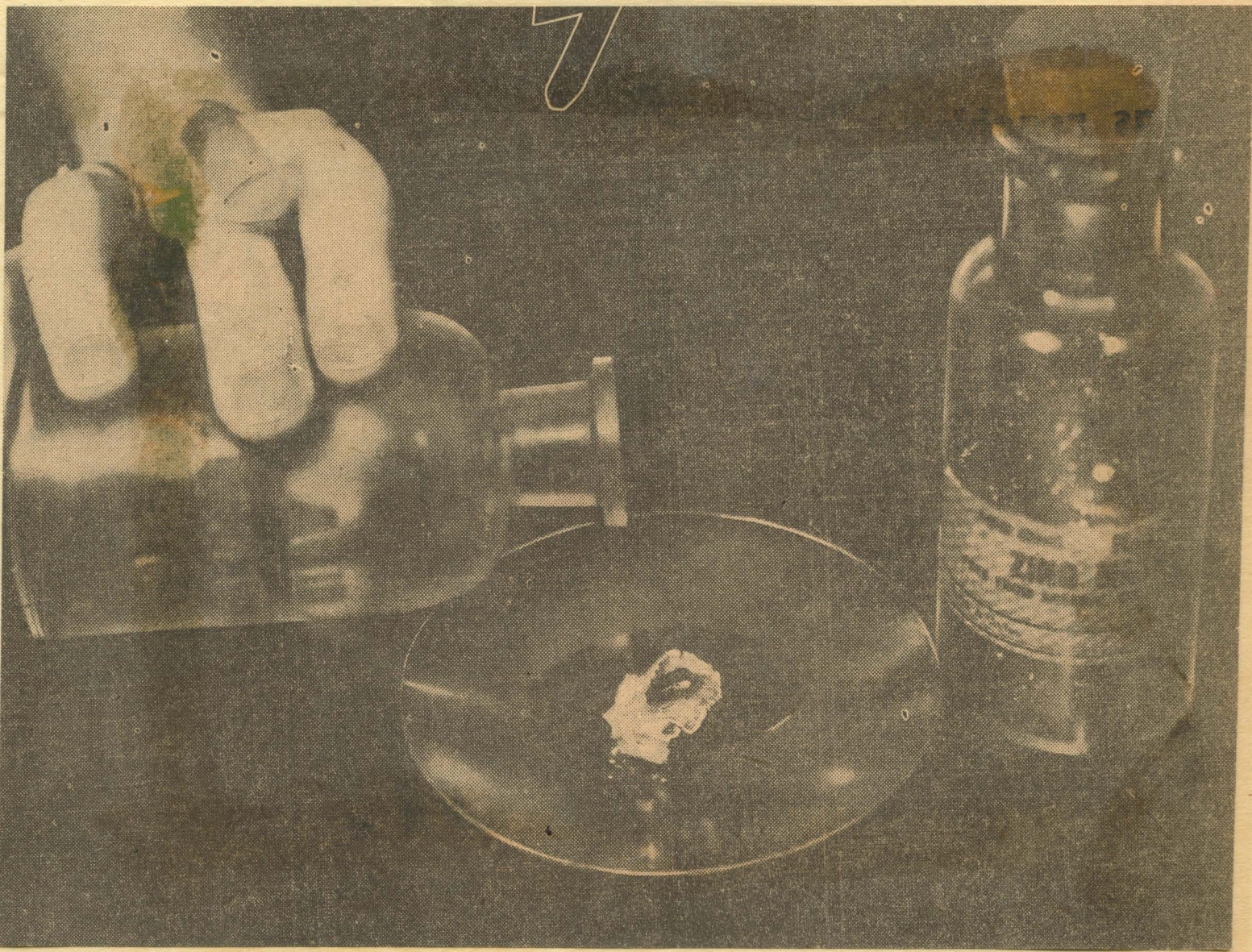
The ore, which the developers say had previously not yielded any type of metal, lies on Juniper Ridge, on the edge of the Squaw Butte federal range experiment station, 37 miles west of Burns. Recovery at the pilot plant is declared to have amounted to from 34 to 50 pounds of metallic tin, worth 50 cents a pound at the present market. Production costs are said to be not to exceed \$9 a ton. Tonnage of ore "in sight" in the area is declared to be "sufficient to supply the needs of the world for 500 years."

O. F. Selle, mining engineer of Baker, is credited with discovery of the ore 10 years ago, but nothing was done about it until a year ago, when others were made interested in the project and its possibilities.

Returns at the pilot plant are said to have confirmed laboratory tests. The plan is to continue ore treatment at the plant until 100 tons of ore have been run through. Ore from all parts of the deposit, ranging over 2000 acres of federal range, will be treated for the purpose of demonstrating commercial probabilities of large scale development.

Governor Sprague, Secretary of State Snell and F. W. Libbey of the state department of geology and mineral industries were among invited guests who witnessed the test run at the pilot plant in October.

Oregon Journal 17.1.40



The test for tin ore: Place zinc on watch glass, ore on the zinc, and pour on few drops of hydrochloric acid; if tin is present in the ore, a coating will form.

Journal
12/1/40



The largest and finest crystal of cassiterite, or tin ore, ever found. The prospector may not find a crystal this large in the United States, but he probably will find smaller ones of the same shape.

Briefly, science's answer is a method by which the United States can produce more tin and become less dependent on other countries.

As in primitive times, when the caveman threw stones at his adversary, wars are still fought with rocks; although now rocks give up their valuable ores for the construction of highly-mechanized war machines, powerful guns and death-dealing projectiles. And the one rock that warring countries rate as valuable as any other is a black, sometimes brown, mineral called cassiterite. In common language cassiterite is tin dioxide, the mineral from which man obtains the important metal—tin.

Like tin, other strategic metals are imported into the United States in large quantities; for example, the minerals from which tungsten and manganese, so important in making steel armor and guns, are obtained. But in an emergency the United States could obtain manganese and tungsten from its own ores at a price. With tin the situation is different. The United States, even in normal times, uses about 100,000 tons of tin a year. However, less than 2½ tons are produced from the available sources. For a strategic metal, this is indeed an unfavorable position for any nation.

Tin is regarded as a strategic metal because it is needed in almost every machine made. It is required in every machine bearing; possibly no moving parts would be available without it. And that makes it an essential metal of peacetime as well as of wartime.

The tin in the making women's stockings; a pair of silk hose contains more of the metal than a small tin can.

What seems paradoxical regarding Uncle Sam's problem of tin is that there is tin in the United States, considerably more than is now produced, although perhaps not enough to make the country independent of outside sources. It might even be true that enough tin could be found in the United States to meet the country's needs.

If this be true, and many mineralogists verify it, why hasn't Uncle Sam gone after it? Why doesn't he strive for self-sufficiency in this precious metal as he has in other strategic ores?

The answer to this is that very few people can tell cassiterite, or tin ore, when they see it; and there has been no simple test for the ore.

Cassiterite does not look like tin, and formerly it was only possible to test it with elaborate laboratory equipment. Many of the thousands panning streams for gold have passed up tin ore that would have been more valuable than the gold they found, if they found any gold, simply because the prospectors did not know how to tell tin ore when they saw it. And even if they had been looking for it, they never would have been sure it was tin until the ore had been sent to a laboratory for testing.

But science has now simplified the problem. Samuel G. Gordon, curator

of minerals at the Academy of Natural Sciences, Philadelphia, and a mineralogist of international reputation, has worked out a simple test for tin in its ore, a test that any prospector may make in the field. With this simple test it is possible that the United States may, for the first time, be systematically prospected for tin.

Mr. Gordon points out that with the hitherto elaborate laboratory methods, only the biggest companies could prospect for tin, and look for it in large quantities. Now the small prospector, the man responsible for finding the gold wealth of the United States, may look for it. While the small prospector may not locate a mine that will solve the entire tin problem of the country, he still will probably find enough to pay him for his trouble if he follows Gordon's directions. It should be remembered that there was a time when the United States was dependent on the outside world for the important metal, molybdenum, and then a deposit was found in the West that was so rich that the country can export some in addition to meeting its own needs.

The mineralogist's test, which he describes as infallible, requires only a piece of zinc metal (which can be used over and over again), a little slightly diluted hydrochloric or muriatic acid, and something like a watch glass in which to make the test.

The piece of zinc foil or zinc metal

is placed on the watch glass. The grain of suspected tin mineral to be tested must then be placed in contact with the zinc. A drop or two of the acid is added, at which time gas—hydrogen—will start to bubble off. In a few seconds the mineral, if it contains tin, will be coated with the tin metal due to electrolysis. The tin is not shiny, but appears as a gray coating on the mineral.

Black minerals suspected of containing tin can first be tested with a magnet. If the grains of mineral are attracted to the magnet, the mineral does not contain tin.

Thousands of years ago the Phoenicians sailed to the end of the then-known world, to the "Cassiterides"—the British Isles, particularly to Cornwall—for the tin found there. They needed tin to make bronze, by mixing it with copper, and bronze was the principal metal of the day. Now man goes to the other side of the world for his tin, to British Malaya, the Dutch East Indies and Thailand for tin, and man is ready to fight for this metal. About a quarter of the earth's supply of tin comes from the high Andes of Bolivia, supplemented by sizable production from Nigeria and the Belgian Congo.

In the United States tin has come chiefly from placers in the Black Hills of South Dakota and Wyoming, and an old mine at Gaffney, S. C. Alaska has produced 145 tons. These finds were made because the miners working there were trained men knowing laboratory tests.

But just where should the prospector look for tin?

According to Mr. Gordon, deposits of tin are limited to veins in granitic rocks or their neighborhoods, or to placer concentrations in streams that have drained such areas.

"In the United States," he says, "granites are the backbone of the Rocky mountains and the Southern Appalachians. Granites occur in most of the states, excepting those of the Mississippi valley—and there are even exceptions there since granites are found in Arkansas and Texas. Granites are common in the Eastern states beyond the margin of the coastal plain. Alaska is most promising, as is the vast area known as the Canadian shield about Hudson Bay, especially in the Far North.

"Granite is a common rock, and it may be worthwhile to look for tin wherever there is granite. Mineralizing solutions effected concentrations of metals during the cooling of the molten rock of which our granite of today was the cooled product. Such concentration is most frequent about the margin of granite areas, and those localities, and the streams draining them, are the best places to begin to look for tin ore."

The best systematic prospecting of granitic areas for tin would seem to be panning the sands of streams at their margins, using a gold miner's pan, according to Gordon.

Take his word for it, tin is well worthwhile looking for.

"If the prospector finds tin, he will be well paid for his trouble. The little over two tons found in the Black Hills had a value of \$3500. With this simple test prospectors may not only net themselves comfortable sums, probably more than the average man panning streams for gold can make, but there is always the possibility that a deposit will be found that will make the United States largely independent of the outside for this all-important metal."

Journal 17/1/40



Discovery of a simple test for cassiterite makes it possible for a prospector to pan streams for tin or follow veins in caverns of granitic rocks, as illustrated above.

Baker Dem.Herald
10/11/40

Baker Dem.Herald
10/12/40

G.P.Courier
10/12/40

PROCESSING OF TIN IMPROVED

Baker Mining Engineer Develops Work; Demonstration Given

Oscar F. Selle, Baker mining engineer, has developed a new process for recovering tin from a deposit of ore 30 miles west of Burns, according to information received here.

Private tests were to have been made at the property today with Governor Charles A. Sprague and Secretary of State Earl Snell in attendance. Mr. Selle has been working for 11 years on the deposit, said to cover 2000 acres. Some of the metal has already been recovered in a new five-ton pilot plant erected by the sponsors.

In 1929 Selle found the deposit of volcanic ore, which he believed contained tin in commercial quantities. After several years of work on the property, he gained the financial support of Charles F. Hoyt and D. B. Goldman of St. Louis, Missouri. The process used by Selle is a patented smelting process discovered by A. J. Koebel of Sandpoint, Idaho.

SPRAGUE VIEWS TIN OPERATIONS

O. F. Selle of Baker Demonstrates New Methods

BURNS, Or., Oct. 12. —(AP)—Tin operations of a type which sponsors claim may revolutionize mining methods were demonstrated yesterday on a lonely juniper ridge 35 miles from here.

Governor Charles A. Sprague and secretary of State Earl Snell watched the first sizeable smelting of tin from lava ore.

O. F. Selle, Baker, Ore., mining engineer in charge of the venture, declared that from 175 to 190 pounds of tin and from \$6.50 to \$15 in gold was contained in each ton of ore.

He said the ore, a deposit from an immense lava flow of ages ago, is not in veins but in a solid mass to a great depth. It has been made accessible, he asserted, by a new method involving volatilization of the metals, or suspending them in the form of gas.

The process was developed and patented recently by Albert L. Koebel of Sand Point, Idaho. Financial backers of the development are Charles F. Hoyt and D. B. Goldman of St. Louis, Mo.

Tin and Gold Smelted from Oregon Lava

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Grind 2 or 3 lbs of ore fine-- Cook three hours in
a strong solution of caustic soda.

Filter--Wash-- Dilute-- Make slightly acid with nitric
and evaporate to dryness-- take up in boiling water
several times to get rid of all sodium nitrate. The
remaining white precipitate is tin oxide. Good luck.

R. F. Sells.

W. H. STRAYER, CHAIRMAN, BAKER
ALBERT BURCH MEDFORD
E. B. MACNAUGHTON PORTLAND



EARL K. NIXON
DIRECTOR

F. W. LIBBEY
MINING ENGINEER

JOHN ELIOT ALLEN
GEOLOGIST

JAMES A. ADAMS
METALLURGICAL CHEMIST

STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

702 WOODLARK BUILDING
PORTLAND, OREGON

STATE ASSAY LABORATORIES

400 E. 1 ST., GRANTS PASS

RAY C. TREASHER
FIELD GEOLOGIST

ALBERT A. LEWIS
ASSAYER

2102 COURT ST., BAKER

HUGH K. LANCASTER
FIELD ENGINEER

LESLIE C. RICHARDS
ASSAYER

September 25, 1941

Dr. H. C. Harrison
State Assay Laboratory
Grants Pass, Oregon

Dear Dr. Harrison:

I have just received a letter from Ivan Duncan, the pertinent part of which I am enclosing a copy herewith. I have discussed it with the boys in the office here.

I don't know whether the tin that appears in the buttons that Duncan is evidently getting came into the ore by natural means or otherwise, but it seems to me that we must eliminate any possibility of the method he suggests getting tin out of the samples that John Allen took. In other words, I think it is up to us to demonstrate beyond ^{any} peradventure of a doubt that tin can or can not be obtained from our samples by the method outlined by Ivan Duncan.

There is always a possible chance that some dub will stumble onto something that the experts have been looking for unsuccessfully. This is no criticism of experts, but it has happened. My personal feeling is that probably someone is salting the samples they are using, but whatever I think about it I want to be able to write a letter to Ivan Duncan and his father saying--if that is the answer--that after exhaustive tests their method does not get tin out of the samples ~~we~~ took which indicates quite definitely to us that no tin exists in the samples which we took.

Would you then, probably working with Bassett, go thoroughly into the matter of treating tin samples with the method outlined in the attached letter. Then please report to me your findings, negative or otherwise.

Best wishes.

Sincerely yours,

Carl K. Nixon
Director

EKN:ac

C
O
P
Y

Burns, Oregon
Sept. 24, 1941

Earl K. Nixon
Department of Geology and Mineral Industries
702 Woodlark Building
Portland, Oregon

This test is conducted in a reducing atmosphere which we have found necessary. Take a large crucible (the twenty or thirty gram size) and place a mixture in it consisting of the following proportions.

- 2 4 parts of ore (ore should be finely ground 40 to 60 mesh or finer) - 10 gms
- 1 2 parts charcoal, coke, or coal - 5
- 1 2 parts sugar syrup (made by dissolving sugar in water almost to point of saturation) - 5

These should be well mixed. Either put a regular crucible cover over the crucible or better yet, invert a smaller crucible over the larger one and force it down until it fits as tightly as possible so as to form an air tight cover.

The charcoal is to be preferred because when coal especially or coke is heated in an air tight container there is an oily residue left that is impossible to get rid of, and which seriously hampers the recovery of the tin. This oily residue acts as a flotation reagent and picks up the particles of tin and carries them off when the material is being panned to recover the tin.

This crucible with the charge in it may be then heated in almost any type of furnace or even by an open burner. It should be heated to above a red heat but not to a white heat for from ten to fifteen minutes. The time being dependant on your type of furnace and heat that is being applied. This time applies to the length of time after the crucible has reached a red heat. Earl has worked this successfully here by heating the crucible in a black-smiths forge.

After the crucible has been removed from the heat and allowed to cool the charge is reground in a mortar and panned to recover the tin. Use a mortar to regrind the charge as a grinder will smear the tin particles on the plates and you would lose them. Also it flattens the small tin particles so that they will pan much easier. The tin will be in the form of very fine tin shot and as sponge tin. The sponge tin will float off if you are not careful. If you find an oily coating coming to the surface of the pan you will have to skim this off and put it thru a fine mesh cloth and then reduce this to recover part of your tin. For reducing the tin pannings to a button some such agent as palm oil should prove satisfactory. It is used in a major share of the retinning plants to recover their scrap of tin.

(signed) Ivan M. Duncan

T I N F I A S C O

The Engineering and Mining Journal says:

"Human nature being what it is, and more so at some times than others, one would naturally expect the defense program to stimulate a lot of "important" mineral discoveries, particularly of strategic materials. So we were not surprised some weeks ago when a visitor wanted to advertise in E. & M. J. a Western tin property and a process for recovering the tin. He would disclose neither the location of the property nor the nature of the process, but we gathered that they were complimentary. Without the process it would be impossible to find tin in the rock, so both had to be advertised and sold together. We declined the business, whereupon our visitor complained that 'you scientific fellers are all alike, you don't believe anything you don't already know!' And he departed with pity for our ignorance, and assurance that he would return with evidence of an established industry. Then we would be sorry we had spurned his proposal.

"Subsequently the pother over the so-called Burns tin episode in Oregon reminded us of this experience, because there again we found the familiar pattern of a fiasco: earnest promoters; clever manipulators of a special process; a group of 'scientific fellers,' who, although mystified by the hocus pocus, still didn't believe it; and violent partianship and sharp words on both sides of a hot controversy. It has all happened many times before and will happen over and over again. It has ceased to be diverting and leaves us cold.

"Despite our vistor's deprecation of 'scientific fellers,' there is increasing reason to rely on science in determining the presence or absence of a metal in a rock. The spectroscope gives conclusive evidence. So when reputable analysts in private practice and in government laboratories use this instrument of precision we accept their finds against those of adroit operators of special processes. Especially unimpressive is the claim for recovery of tin by a volatilization process from rock that yields no spectrum of tin when volatized in the electric arc."

The August issue of The Technocrat, published by Technocracy, Inc. of Los Angeles carried an article entitled "The Great Tin Conspiracy-Politicians Sabotage American Security by Submitting to World-wide Monopoly" which we imagine was the sort of stuff which our contemporary, E. & M. J., refused to accept as advertising matter.

The closing paragraphs in The Technocrat's article are hereby reprinted merely as an illustration of the humbug and nonsense which is being distributed to gullible persons on the Pacific Coast at what may prove to be their undoing.

"America has plenty of domestic tin ore. That is known and is being demonstrated (see part one).

"America has the world's greatest array of scientific and engineering skill. That is known and has been demonstrated.

"America can build efficient tin refineries. That is known and has been demonstrated.

"There is no reason physically, why America cannot become independent of foreign sources of tin - and their accompanying entanglements. 'The problem facing the United States', as the 1935 Tin Investigation so aptly put it, 'is . . . the breaking down of politic- economic and other more or less artificial barriers'.

"America has grown up enmeshed in the rules, entanglements and intrigue of the Price System. The security and future of America itself has always come second in the gigantic game of International Business. But this artificial barrier to the physical security of this Continent is crumbling. The hoary era of Business First must give way to the dawning era of America First and Always".

The records show that the mine production of tin in the United States (exclusive of Alaska) has amounted to a little less than 40 tons during all of the last 40 years. It would be interesting to know how many millions of dollars of government and private money was expended in producing 40 tons of the more than 2,250,000 tons of tin which has been required in the United States during the last 40 years. No form of mining venture in this country has ever been so unprofitable - except to the stock-jobbers - as has been tin.

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Editorial appearing in the
American Metal Market of September
24, 1941 published at 111 John Street,
New York.

COPY

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COPY

the College and additional special apparatus to be acquired, will be carried out as planned at present, largely by Dr. H. C. Harrison, research chemist and spectroscopist, recently secured by the Oregon Department of Geology and Mineral Industries.

Dr. Harrison, who will install and be in charge of the Department's new spectrographic laboratory, will leave his present position at the New York State College of Ceramics and take up the Oregon work on August first.

Results of the tin research, whether favorable or otherwise, will of course be made public at the proper time, according to Mr. Nixon

STATE DEPARTMENT OF GEOLOGY AND
MINERAL INDUSTRIES

~~320 S. W. OAK STREET~~
PORTLAND, OREGON
702 WOODLARK BUILDING

September 15, 1941

Honorable Robert M. Duncan
Burns, Oregon

Dear Judge Duncan:

I have assumed that your failure to answer my last letter, urging that you make some arrangement for a tin demonstration at Corvallis, has been caused by your duties at court or possibly because you may have been under the weather. We have been minus about half of our staff for the last two or three weeks because of flu that is going around.

Dr. Harrison has worked on the tin matter constantly for more than a month at the laboratories at Corvallis, making very detailed tests, checking various analytical methods, and analyzing various samples of the Squaw Butte rocks. I confess that the results have not been very encouraging. We have checked samples recently assayed by Mr. William Huntley Hampton who obtained about one percent tin and cannot verify his results. We had the Oregon Retinners group make a demonstration for us, and the demonstration was unsuccessful. We have done, I believe, a great deal more work of basic scientific nature than has the Geological Survey, the Bureau of Mines, or any private group on this matter and, unless something comes to light very promptly, we may have to conclude that the brief work done by the Geological Survey was correct in general.

As our spectrographic laboratory equipment is being rapidly assembled, it will be necessary to bring Dr. Harrison back to Portland quite soon. We had hoped to get you and Mr. Hagey and perhaps Mr. Rae to come to Corvallis and give a demonstration but I am sure your reasons for not coming have been perfectly legitimate and have been caused by your inability to do so. Nevertheless, we are now in the position of having to drop the matter of proof in your lap, and we should get the matter settled in the next week or ten days because of Dr. Harrison's other duties. I might say that Harrison has had rather complete spectrographic tests made in eastern laboratories of various samples we have taken from the Squaw Butte area, and the results have been negative.

It would not be fair to close up and report on the matter without your having a chance to get the parties in question to demonstrate their wares. Would you write me at your very earliest convenience and tell me if you can help in this situation?

With kindest personal regards, I am

Sincerely yours,

E. J. D.
Director

EKN:vm

Tests Reveal Tin Missing

The controversy over validity of prospectors' claims of important tin discoveries near Squaw Butte, 37 miles from Burns, appeared headed for a negative conclusion Wednesday.

The geological survey notified Senator Charles L. McNary, republican, Oregon, according to an Associated Press dispatch from Washington, D. C., that tests of a number of samples of the alleged tin-bearing ore "contained no significant amount of tin."

A group of prospectors and production men known as the "Hub" has filed a patent claim on 20 square miles of the Squaw Butte area federal land, claiming discovery of the highly strategic defense metal, tin.

Scientific Dispute Arises

Interior department investigators using routine tests found no trace of tin, but using the cyanide test employed by the "Hub" reportedly did discover tin. A scientific dispute arose, while promoters went ahead with a \$10,000 pilot plant near Burns and declared they are recovering tin worth 50 cents a pound at a cost not exceeding \$9 a ton.

Whether the report of the geological survey will end the dispute appeared debatable, since the patent claimants have the right of appeal.

COPY

Sept 10, 1941

Director Earl K. Nixon
State Department of Geology and Mineral Industries
702 Woodlark Building
Portland, Oregon.

Dear Mr. Nixon:

I have just completed the quantitative analysis of several portions of the sample obtained from Mr. Hampton and thought you might be interested in a prompt report.

Samples A₁ and A₂ were fused with a mixture of potassium hydroxide and sodium peroxide, a Nickel crucible being used for the fusion. The solution obtained from the A₁ fusion mixture was analyzed by the Pierce-Lowe method based on the titration of the reduced solution with a standard solution of iodine using starch as the indicator. The solution obtained from the A₂ fusion was analyzed by the same general procedure except the method by Hildebrand and Lundell was used.

Samples B₁ and B₂ were fused with a mixture of potassium hydroxide and carbon. The solution obtained from the B₁ fusion was analyzed by the Pierce-Lowe method and the solution obtained from the B₂ fusion was analyzed by the Hildebrand and Lundell method.

The following results were obtained:

A ₁	0.003% Sn
A ₂	0.004% Sn
B ₁	0.004% Sn
B ₂	0.005% Sn

None of the qualitative procedures used with this ore gave indications of a larger quantity of tin and I feel that the quantitative results agree sufficiently to conclude that the samples do not contain an appreciable quantity of tin.

I am going ahead with the quantitative analyses of the rest of the ores.

If you can obtain the field rheostat to be used with the motor-generator we can assemble the control panel.

Sincerely yours,



E. B. MacNAUGHTON

THE FIRST NATIONAL BANK OF PORTLAND
PORTLAND, OREGON

RECEIVED
OCT 4 1942
STATE DEPT OF GEOLOGY
& MINERAL INDS.

October 3, 1942

Mr. Earl K. Nixon, Director
State Dept. of Geology & Mineral Industry
Woodlark Building
Portland, Oregon

Dear Mr. Nixon:

I have hastily scanned the preface to our tin report.
In my opinion it needs editing, eliminations and simplification.

On the first and second pages I have indicated a few
instances which make for better English and less redundancy. I am
opposed to playing up the mistakes and errors in judgement of others.
State the facts as we found them and our conclusions - nothing more.

I would like to see a revised edition.

Yours very truly,

E B MacNaughton

E. B. MacNaughton

EBM Re

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON

OFFICE OF THE DIRECTOR

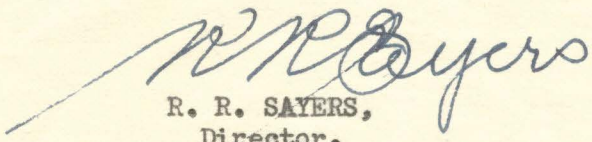
July 8, 1941.

Dr. H. C. Harrison
Alfred University
Alfred, New York

Dear Dr. Harrison:

With reference to your letter of June 29 addressed to the College Park Station, the sample you submitted has been subjected to careful spectrographic analysis and tin could not be detected. As the method will reveal the presence of at least .01 percent tin, your sample, if it contains any tin whatever, contains less than this amount.

Yours faithfully,


R. R. SAYERS,
Director.

Sample # 29 K,

H.C.#.

On July 9 I drove from Baker to Burns and met Mr. Lancaster in the evening. Had dinner and saw Judge Duncan after dinner.

On July 10 we left early in the morning which was spent at Juniper Ridge establishing plane table network. After helping Bruce and Hugh take sample No. 1 from the west side of pit No. 2, while they took sample No. 2 I worked nearby the pit setting up stakes and starting the survey. While these samples were taken I was never more than 500 feet away. We had lunch in the car and during the afternoon Hugh and Bruce took Sample JR 3 and 4 from the trench near camp and from pit No. 3 while I was completing a traverse.

On July 11 we all went to pit No. 1 at the south end of the property and started to take sample JR 5. I then left Bruce and Hugh for a traverse while they completed the work, and cut across country to pit No. 4 where we met and took sample JR6, a long channel in the north side of the pit.

On October 20, Harold and myself drove from Eugene to Burns, arriving at 8:30 and having dinner. We talked to Ivan Duncan on the phone.

On October 21 we went out to the property with Ivan and Hagey and made a general trip over the property including the workings to the west. In the evening Harrison went to the show and Allen visited at Mrs. Carrico's.

October 22 Harrison spent the day with Hagey and Duncan burning ore. Allen made several traverses and collected some samples from the ledge up the creek from camp just below pit No. 4. In the evening Duncan, Hagey, Brown, Allen, and Harrison spent the time at the laboratory of the high school testing samples taken.

October 23 Allen and Harrison drove to the property early in the morning and built several fires in the creek bed to burn ore. Allen went on a traverse when Duncan and Hagey turned up, returning about noon. Spent the afternoon mortaring ore from various samples, mixing ore with powdered balsam, treating for 5 to 10 minutes in "jack rabbit" furnace and panning out concentrates.

Before we left to drive to Bend that evening, Hagey gave us samples which he said were from concentrates of ore from the west pit made in a mill north of Prairie City. (probably Blankman custom mill).

State Department of Geology and Mineral Industries

COPY

702 Woodlark Building
Portland, Oregon

Burns, Oregon
September 24, 1941

Earl K. Nixon
Department of Geology & Mineral Industries
702 Woodlark Building
Portland, Oregon

This test is conducted in a reducing atmosphere which we have found necessary. Take a large crucible (the twenty or thirty gram size) and place a mixture in it consisting of the following proportions.

4 parts of ore (ore should be finely ground 40 to 60 mesh or finer)
2 parts charcoal, coke, or coal
2 parts sugar syrup (made by dissolving sugar in water almost to point of saturation)

These should be well mixed. Either put a regular crucible cover over the crucible or better yet, invert a smaller crucible over the larger one and force it down until it fits as tightly as possible so as to form an air tight cover.

The charcoal is to be preferred because when coal especially or coke is heated in an air tight container there is an oily residue left that is impossible to get rid of, and which seriously hampers the recovery of the tin. This oily residue acts as a flotation reagent and picks up the particles of tin and carries them off when the material is being panned to recover the tin.

This crucible with the charge in it may be then heated in almost any type of furnace or even by an open burner. It should be heated to above a red heat but not to a white heat for from ten to fifteen minutes. The time being dependant on your type of furnace and heat that is being applied. This time applies to the length of time after the crucible has reached a red heat. Earl has worked this successfully here by heating the crucible in a blacksmiths forge.

After the crucible has been removed from the heat and allowed to cool the charge is reground in a mortar and panned to recover the tin. Use a mortar to regrind the charge as a grinder will smear the tin particles on the plates and you would lose them. Also it flattens the small tin particles so that they will pan much easier. The tin will be in the form of very fine tin shot and as sponge tin. The sponge tin will float off if you are not careful. If you find an oily coating coming to the surface of the pan you will have to skim this off and put it thru a fine mesh cloth and then reduce this to recover part of your tin. For reducing the tin pannings to a button some such agent as palm oil should prove satisfactory. It is used in a major share of the retinning plants to recover their scrap of tin.

(signed) Ivan M. Duncan

TIN

MICROCHEMICAL TEST FOR TIN

M. N. SHORT USGS 825

To apply the test for tin to cassiterite the procedure is quite different than that for sulpho-salts of tin. It is first fused with sodium carbonate, and then dissolved in a parting cup with 1:5 HCl, the solute is then drawn up into a capillary tube and blown out onto a slide. To the spot on the slide a fragment of cesium chloride is added. This gives the colorless octahedra characteristic of tin.

thioglycollic acid
sodium azide

Vol. 31, 1937, 8429⁷

Colorimetric determination of tin by means of toluene-3-4-dithiol ("Dithiol"). R. E. D. Clark. Analyst 62, 661-3 (1937).--In a previous paper, C. A. 30, 6302⁵, it was shown that substituted 1,2-dithiols are delicate and specific tests for Sn and details were given for detg. Sn with 4-chlorobenzene-1,2-dithiol. There is some difficulty in prepg. this reagent whereas the reagent now recommended can be obtained commercially ("dithiol"). To det. Sn, the acid soln. should be treated with dil. thioglycollic acid to ensure reduction to the stannous condition, made acid with concd. HCl and treated with a little agar-agar jelly which prevents coagulation of the red ppt. and permits a colorimetric comparison. The soln. is boiled until all the agar agar is in soln., cooled under the tap, and a little reagent (0.2 g. dithiol dissolved in 100 ml. of 1% NaOH soln. and treated with 0.3-0.5 g. of thioglycollic acid) is added. After diln. to a definite vol., the soln. is heated in boiling water for 1min. and the color is then measured in a Lovibond tintometer. Excellent results were obtained with 2.5 to 30 p.p.m. of Sn. The red units, the yellow units and the brightness were measured.

Mellor and Thompson, A Treatise on Quantitative Inorganic Analysis, p. 313

THE DETERMINATION OF TIN

The Detection of Tin

Clark has shown that 4-methyl-1:2-dimercaptobenzene and 4-chloro-1:2-dimercaptobenzene are specific reagents for tin.¹ The test is carried out by adding a few drops of a 0.2 per cent solution of either reagent in sodium hydroxide solution to the suspected solution, acidified with up to 15 per cent of hydrochloric acid. On warming, a pink to magenta-red colour develops within a few seconds if as little as one part in a million of stannous tin is present. If the tin is in the stannic state, the colour develops more slowly and the test is not so sensitive. Consequently a trace of thioglycollic acid should be added before applying the test to ensure that the tin is in the stannous condition. No other elements interfere except bismuth, which gives a brick-red precipitate quite unlike the colour given by tin. The test has been adapted for the colorimetric determination of tin and has been found to give an accuracy of about 10 per cent with from 1 to 5 parts of tin per million of solution.

¹ R. E. D. Clark, Analyst 61, 242, 1936. For the preparation of the reagents, see W. H. Mills and R. E. D. Clark, Journ Chem. Soc., 175, 1936; R. E. D. Clark, Tech. Publ. Internat. Tin Res. Dev. Council, A, No. 41, 1936. For the detection of tin by nitrophenylarsinic acid, see B. Tougareff, Bull Soc. chim. Belg., 45, 542, 1936.

Page 7 Per

200.005 5 p.p.m.

1. Vol. 35, 1941, 1001⁸

New procedure for determining tin in ores and ore-dressing products. Friedrich Leutwein. Z. anal. Chem. 120, 233-42 (1940).—Just as Ti^{III} can be titrated with a soln. of 1.5-2.0 g. methylene blue per l. so Sn^{II} can be titrated in 4-6 N HCl; the end point is shown by the final blue color. For the reduction of Sn^{IV} , ferrum reductum, Cd and Zn proved unsatisfactory, but 2 g. of pure Al wire proved efficient. Two mols. $C_{16}H_{18}N_3SCl = 1$ mol. $SnCl_2$; the reduction product is $C_{16}H_{18}N_3S$. The methylene blue soln. can be standardized against $TiCl_3$. For ores contg. very little Sn, an app. is shown in which chlorination of the sample and volatilization of $SnCl_4$ can be accomplished. Good results were obtained with 2-5-g. samples contg. 0.2-0.7% Sn. Diazine S, toluyene blue, indigo tetrasulfonate and thionine (lauth's violet) were tried in place of methylene blue and satisfactory results were obtained with thionine. For ordinary ores it is recommended to fuse the sample in an Fe crucible with 10 times as much Na_2O_2 , ext. the melt with water, filter, boil to decompose excess peroxide, make acid with HCl, reduce with Al and titrate with methylene blue.

2. Vol. 34, 1940, 6189⁹

New methods for the decomposition of the cassiterite ores. A. G. Karabash. Zavodskaya Lab. 1937, No. 3, 366-8; Khim. Referat, Zhur. 1938, No. 6, 77; cf. C. A. 32, 4465¹.—To reduce SnO_2 in fused alkalis for analysis, two methods are proposed. (1) Treat the 200-mesh sample of the ore or concentrate with a mixt. of condd. HNO_3 and HF and with HNO_3 alone (1:4), transfer the insol. residue to an iron crucible, add 15-20 times the amt. of NaOH, remove the water carefully, bring the temp. to 550-800°, add to the fused alkali fine shavings of metallic Zn, fuse for 30 min., lixiviate with water, acidify with HCl and det. Sn according to Evans (cf. C. A. 22, 41) (reduce with Pb and titrate with 0.1 N I). The best decompn. of cassiterite takes place with a ratio $SnO_2:Zn:NaOH = 1:1:20$ and at a temp. of 500-600°. The av. relative error due to incomplete decompn. is 0.55%. The proposed method possesses no advantages over the method of fusing with Na_2O_2 . (2) Fuse the SnO_2 (sepd. in the same manner as in the 1st method) with 10-12 times the amt. of NaOH, heat to dark-redness, introduce 0.5-0.8 g. of metallic Na by means of a special cone-shaped Fe cover. Na is dissolved rapidly without explosion or a considerable gas formation. The whole process takes 5-6 min. at 550°. A complete decompn. of cassiterite is obtained. The remainder of the procedure is the same as in the 1st method. Owing to the use of metallic Na the 2nd method is not convenient.

3. Vol. 31, 1937, 3414⁶

The analysis of low-grade tin ores. Robert Holtje and Hans Schlegel. Z. anorg. allgem. Chem. 231, 97-103 (1937).—Mix 3-10 g. of the ore with 1/3 as much CuO and fuse the mixt. with twice as much of a mixt. of equal parts Na_2CO_3 and KCN. Heat gently at first and then for an hr. with the full heat of a strong flame in a Frerichs-Normann furnace. It is important that the crucible should rest in the furnace so that it is well enveloped by the hot flame. Take the crucible out of the hot furnace, allow it to cool and break it. Hammer off the slag from the Cu regulus which will also contain all the Sn. Digest the button with hot HNO_3 , filter off the metastannic acid and wash it with dil. NH_4NO_3 soln. Ignite in a Ni crucible, melt the residue with a little NaOH, after

try sign 2 on by 2000.

7. Vol. 33, 1939, 1624⁴

Simplified method for determining tin in ores. Bruno Hirsch. Z. anal. Chem. 115, 184-5 (1939).--Fuse the sample with 10 times as much Na_2O_2 in an Fe crucible. Digest the residue with 60-80 ml. of 20% HCl , transfer to a 300-ml. flat-bottomed flask and wash the crucible and beaker with water. The 300-ml. flask should contain at the start 2 Swedish horse-shoe nails and 0.8-1.0 g. of Ferrum hydrogenic reductum, which contains 90% Fe and very little carbide. Heat to boiling and continue heating until all the Fe powder has dissolved in not over 5 min. Add a few pieces of marble, some cold water and titrate with dil. I₂ soln. at 20° to a starch end point. The Fe nails prevent a reoxidation of the Sn^{++} .

8. Vol. 33, 1939, 2049²

Smelting, metallurgical dusts. Jesse O. Betterton, Albert J. Phillips and Roos E. Allen (to American Smelting and Refining Co.). U. S. 2,139, 065, Dec. 6. Metallurgical dusts comprising oxides of Pb, Sn and Zn, are sintered in the presence of sufficient borax to form a clinker and a substantially noncompacting smelting charge. Successive portions of the resulting sinter are charged into an electrothermic shaft furnace in the presence of reducing agents; the initial charging is regulated so that each portion of the charge becomes heated throughout to incandescence before further addns. of charge are made, zinciferous vapors are educted from the shaft, and the charge is maintained sufficiently deep to avoid appreciable losses of Zn vapor. The vapor is conducted into an external condenser and condensed into liquid Zn. Solder metal is recovered from the reaction zone in the shaft. App. is described.

9. Microgravimetric separation of tin and antimony. Vol. 32, 1938, 879⁸
M. v. Mack and F. Hecht. Mikrochim. Acta 2, 227-41 (1937).--Attempts to det. small quantities of Sn, in the presence of other elements likely to be present, by pptn. with benzenearsonic acid proved futile. If other metals are absent, Sn can be pptd. as metastannic acid by heating with NH_4OH and NH_4NO_3 and the metastannic acid can be weighed as SnO_2 . Cupferron can be used advantageously for sepg. Sn and Sb. The Sn must be in the stannic condition which can be accomplished by treatment with perhydrol. Tartaric acid is then added and the soln. is made very slightly acid with HCl , after which a liberal excess of cupferron is added. The Sn ppt. is washed with 0.05% cupferron soln., dried at 60-70°, ignited and weighed as SnO_2 . Excellent results were obtained in 15 expts. with 4-7 mg. of Sn. In the filtrate from the Sn detn. it is necessary to remove the excess cupferron before attempting to ppt. Sb as sulfide. Oxidation with HNO_3 proved difficult to accomplish but the desired end was effected by the repeated action of perhydrol and ammonia. Then, in the slightly acid soln., the Sb can be pptd. by introduction of H_2S and the filtered sulfide can be weighed as Sb_2S_3 after heating the Al block. Results obtained in sepg. 1-7 mg. of Sn from 1-7 mg. of Sb were excellent. A new type of micro filter stick is described which proved useful for all Sn detns. The methods here described appear to be suitable for detg. Sb and Sn in alloys.

10. Vol. 23, 1929, 4664

Treating tin-bearing ores, etc. W. Witter, M. Lissauer, H. Lissauer and B. Griesmann (trading as M. Lissauer et Cie). Brit. 304,829, Oct. 27, 1927. Sn ores and other sn-bearing materials are mixed with a reducing material such as C and heated in stages from 200° to 800° to remove As, Sb, Pb and Bi successively by volatilization without affecting the Sn. Zn also may be partially removed in a similar manner. Cu and Ag may be sepd. by use of NaCl in a subsequent treatment. A rotary furnace may be used, and various details are given.

11. Vol. 23, 1929, 3891

Tin ores. Guggenheim Brothers. Fr. 655,965, June 15, 1928. Crude Sn-contg. material is treated to remove objectionable impurities and reduced in the presence of a carbonaceous reducing agent and a mixt. of alkali and alk. earth fluxes, preferably lime and soda with excess lime. The charge may be briquetted with molasses, sulfite liquor, etc. The preliminary treatment may consist in heating with a mineral acid and leaching with NaCl and NaOH solns., from which Ag, Bi and Pb may be pptd. by diln. W may be recovered as Ca or Fe tungstate from the NaOH soln. If "hardhead" is treated it is first roasted to oxidize the Sn.

12. Vol. 27, 1933, 938

Production of tin from its ores. Henry E. Coley. Brit. 361,402, Aug. 18, 1930. Sn ores are heated, e. g., to 950-1000°, and are then subjected to the action of a non-gaseous sulfidizing agent in the presence of a reducing agent. A liquid S-contg. hydrocarbon may serve as both sulfidizing and reducing agent. The sulfide formed is volatilized and may be oxidized in suspension or dissolved in HCl and pptd. with NH_3 as hydroxide, which is heated to form oxide.

13. Vol. 27, 1933, 3183

Treating Tin ores. Setsuro Tamaru and Yuko Koisumi (to Mitsubishi Kogyo K. K.). U. S. 1,902,735, March 21. Sn ore is treated with an O-contg. alk. earth compd. such as lime and the mixt. is ignited in the presence of a trace of a reducing agent such as charcoal and the Sn is converted into a form easily sol. in acid and alkali and may be extd. by dil. H_2SO_4 .

14. Vol. 27, 1933, 483

Experiments on smelting precipitated fine tin dust. V. A. Vanyukov, N.N. Murach and A.N. Genvarskii. Tsvetnue Metal. 1931, 204-10.--The ordinary method of compressing Sn dust into briquets and smelting the briquets under a layer of powd. coal in closed crucibles is wasteful, since a good deal of the powder oxidizes and escapes in the form of a white smoke. The method used in these expts. was: Cause the Sn dust to react with Cl_2 to get SnCl_4 , reduce this to SnCl_2 with Sn scrap and ppt. the Sn with Zn. Press the ppt. into briquets which had the compn: Sn 79.38, SnCl_2 6.7, FeCl_2 2.3, ZnCl_2 2.04, H_2O 5.95, other impurities 4.63%. Place these briquets in crucibles under a protecting cover of various salts, such as KCN, ZnCl_2 , CaCl_2 , Na_2CO_3 , $\text{CaCl}_2 + \text{Na}_2\text{CO}_3$, $\text{ZnCl}_2 + \text{CaCl}_2$, $\text{Na}_2\text{CO}_3 + \text{K}_2\text{CO}_3 + \text{NaCl}$ and $\text{Na}_2\text{SO}_4 + \text{NaCl}$. This method gave good results.

15. Vol. 26, 1932, 5032

Disintegration of stannic oxide and of cassiterite by means of reducing vapors. G. L. Chaborski and Margareta M. Badescu. Bul chim. soc. romane chim. 32, 7-18 (1929).--The proposed method consists in passing vapors of an aliphatic alc. over heated SnO_2 or cassiterite (temp. not specified). The app. consists of a glass flask for boiling the alk., a Jena glass (if MeOH or EtOH is used as reducing agent) or quartz heating tube in which is placed a boat contg. the sample, a condenser and a receiving flask. With pure SnO_2 , the Sn is calcd. from the wt. of the residue after reduction; with ores it is calcd. from the loss in wt. by reduction. In 38 detns. on SnO_2 and cassiterite, the results were within $\pm 0.07\%$ of those obtained by Wells' method (Chem. News 64, 294; Ber. 1891, 2505). Total time

15. (Cont'd)

required for a detn. (including cooling in the heating tube) does not exceed 3 hrs., and 3-4 detns. can be carried out simultaneously in the same tube. Reduction with MeOH, EtOH or PrOH requires 5-10 min.; with higher alcs. or crude MeOH, it requires 10-15 min. The condensed vapors from one detn. can be reused, but the time of reduction and vol. of vapors required are increased.

16. Vol. 26, 1932, 1565

Reduction of tin. Berzelius Metallhütten-Ges. M.B.H. Fr. 714,588, Mar. 31, 1931. Sn contained in ores or the like, with or without a content of Zn and other metals is reduced by heating the ore mixed with a solid reducing agent and a flux such as borax, in a muffle or elec. furnace without melting the charge. The Sn remaining in the charge is brought to a reguline or granular metallic form, while the Zn is sepd. by distn. Cf. C. A. 25, 2678.

17. Vol. 26, 1932, 1566

Treating tin-bearing materials. Edgar A. Ashcroft. U. S. 1,843,060, Jan. 26. Material such as an ore concentrate, slag or residue is heated to about 350-400° with NH_4Cl to produce NH_3 and volatile metallic chlorides, the heated material is lixiviated with water and the sol. salts are extd., and metals are pptd. from these sol. salts by use of the recovered NH_3 . Cf. C. A. 25, 5384.

18. Vol. 25, 1931, 1481

Tin. Soc. D'Electrochimie, D'Electrometallurgie et Des Acieries Electriques D'Ugine. Fr. 692,640, June 22, 1929. In extg. Sn from its ores, alloys or slags, an auxiliary element contg. a proportion of Si which allows the formation of an Fe silicide unattached by HCl or by an acid soln. of SnCl_2 , is added to the initial charge.

19. Vol. 25, 1931, 3593

Cassiterite analysis by a new method of attack. Setsuro Tamaru and Noboru Ando. Z. anal. Chem. 84, 89-98 (1931).—If cassiterite is mixed with CaO and wood charcoal in the ratios 1 SnO_2 :7 CaO:0.2 C and heated to 900° for an hr. in an indifferent atm. (obtained by covering the mixt. with CaO), the insol. SnO_2 is converted to Ca_2SnO_4 , which is decomposed easily by HCl. The CaO cover should be at least 0.015 mm. thick. The assumption is made that the SnO_2 is first reduced to SnO which reacts with CaO and is eventually oxidized back again to stannate. The reason why a similar decompn. is difficult to accomplish with KOH is traced to a protective film of stannate formed around the particles of native SnO_2 .

20. Vol. 31, 1937, 1733⁸

Colloidal tin ore deposits. Robert Herzenberg. Econ. Geol. 31, 761-6 (1936).—Pegmatitic, pneumatolytic and high-temp. hydrothermal processes cannot entirely account for the fact that cassiterite was formed even later than kaolin, alunite, and siderite, that it is in many places very fine-grained and that it was deposited as colloform wood-tin in some Bolivian Sn deposits. Expts. show that a gel of colloidal stannic acid is formed by oxidation of sulfostannate sols and that in a few days minute crystals of SnO_2 develop in the gel. It is believed that the deposits were formed by rising alk. sulfostannate solns. encountering descending oxidizing atm. waters, causing the formation of colloidal stannic acid, from which cassiterite forms as crystals of various sizes, crusts, stalactites and wood tin.

21. Vol. 30, 1936, 2135⁵

Tests for metal ions, making use of organic dyes. Horace M. Tenney and H. J. Long. J. Chem. Education 13, 82-3 (1936).--If 2 drops of a satd. soln. of fluorescein in dild. MeOH is added to an aq. soln. contg. Pb^{++} , and then NH_4OH is added dropwise until a ppt. is formed, a pink coloration usually appears at once and the ppt. is pink-or rose-colored. If a soln. contg. Ag is tested in the same way except that the NH_4OH is replaced by Na_2CO_3 , a pink-or rose-colored ppt. is also formed. If 2-3 drops of 2% naphthol yellow S soln. is added to a soln. contg. Sn^{++} and the soln. is treated with NaOH dropwise, the color of the neutralized soln. becomes bright pink.

22. Vol. 30, 1936, 3741⁹

Detection and determination of tin by means of substituted 1,2-dimercaptobenzones. A specific reagent for tin. Robert E. D. Clark. Analyst 61, 242-5 (1936).--As reagents 4-methyl-1,2-dimercaptobenzene and 4-chloro-1,2-dimercaptobenzene were used. About 0.2 g. of solid was dissolved in 100 ml. of NaOH soln. The solns. of the reagents are readily oxidized in air, the white disulfide being pptd.; they should, therefore, be stored under H_2 . On addn. of a few drops of the reagent soln. to an acid soln. (up to 15% HCl) contg. Sn, a pink or red color is produced when only 1 part of Sn is present in 10^6 parts of soln. The color develops in a few sec. with Sn^{++} and forms slowly with Sn^{++++} . Addn. of a trace of thioglycollic acid causes the rapid reduction of Sn^{++++} and formation of the color. The reagents react with Ag (yellow), Hg (pale yellow), Cu (black), Bi (brick red), Co (black) and Pb (bright yellow), but when an excess of reagent is used, only Cu, Bi and Ni cause serious interference. In qual. analysis, if a little of the reagent is added to the $(NH_4)_2S$ ext. of the sulfides of Group II, then on making acid the red test is obtained under conditions in which SnS_2 is usually difficult to detect. The test is also useful for the colorimetric detn. of Sn. Add 1 drop of thioglycollic acid to the acid Sn. soln. and dil. until the concn. is 1.5 to 6 p.p.m. Compare with the color obtained with a known quantity of Sn.

23. Vol. 30, 1936, 1686¹

Determination of tin in minerals and in metallurgical residues by means of 0.1 normal potassium bromate. Leopold Deutsch. Ann. chim. anal. appl 18, 10 (1936).--For detg. Sn in minerals it is recommended to fuse the sample with Na_2O_2 ; alloys should be dissolved by heating with H_2SO_4 and Na_2SO_4 . After reducing with 5 g. of ferrum reductum it is recommended to filter and use an aliquot for the Sn detn. The Sn is reduced to metal by adding approx. 1 g. of Al and the Sn is then dissolved in 60 ml. of concd. HCl by heating. After the reduction the soln. is cooled out of contact with air, by allowing $NaHCO_3$ soln. to flow into the flask as necessary. The cold soln. is titrated with $KBrO_3$ in a soln. contg. $ZnCl_2$, ZnI_2 and starch as indicator. In alloy analysis, the Sn and Sb are titrated together in the above manner after the Sb has been detd. by itself with $KBrO_3$ in the usual manner.

24. Vol. 29, 1935, 79⁸

New Method for detecting sulfurous acid and its salts and tin. Hans Freytag. Ber. 67B, 1477-80 (1934).--A green 2-benzylpyridine reagent paper turns red in the presence of 1 part of SO_2 in 28,000 parts of gas. By burning 3 compds. such as 2-naphthylamine-8-sulfonic acid, H acid, Fe sulfide, etc., in air, SO_2 can be detected in the resulting gas. $SnCl_2$ gives the same reaction as SO_2 .

25. Vol. 29, 1935, 3258²

Analysis of cassiterite ores. F. A. Per'yanchikh. Zavodskaya Lab. 3, 581-3 (1934).--Roast a sample of ore (contg. 0.25 g. Sn) to oxidize sulfide, digest with hot HCl to dissolve Fe_2O_3 and boil with HNO_3 until all tungstates are dissolved. Dil., filter and wash with water and dil. NH_4OH . Fuse the residue contg. SnO_2 with $\text{Na}_2\text{CO}_3 + \text{S}$ and ext. the melt with water. Filter, add HOAc to the Na_2SnS_3 soln. to ppt. SnS_2 , filter, ignite the residue to oxide and fuse with KOH at about 300° . Ext. with water, make slightly acid and reduce with Zn . To the Sn^{++} soln. add 1 g. NaHCO_3 to provide an atm. of CO_2 , some KI and an excess of standard KBrO_3 soln. Titrate the I_2 equiv. to the excess bromate with $\text{Na}_2\text{S}_2\text{O}_3$ soln.

26. Vol. 31, 1937, 7792⁹

New method of decomposing cassiterite for the determination of tin. A.G. Karash. Zavodskaya Lab. 6, 366-8 (1937).--The procedure is based on the decompn. of SnO_2 in ores with NaOH and Zn or Na . Evap. to dryness 0.5-3.0 g. of powd. ore with 10 cc. HCl and 10 cc. HF in a Pt dish. Treat the residue with HNO_3 , dil. and filter. Transfer the filter with the residue to an Fe crucible, incinerate the filter paper, and fuse the ash with 20 parts of NaOH . Heat at first slowly for 10 min. and then at $550-800^\circ$, add 1 part (0.35-0.4 g) of Zn foil fragments (0.8 X 0.3 X 0.3 mm.), continue heating until the liberation of H_2 bubbles has ceased (30 min.), then cool, dissolve the melt in H_2O and an excess of HCl and det. Sn by titrating the soln. with I soln. by Evans' method (cf. C.A. 22, 41). More satisfactory results are obtained by reducing any SnCl_4 in the soln. by boiling it with Pb foil for 1 hr. (250 cc. soln. contg. 70 cc. of concd. HCl) and titrating with 0.1 N I in a CO_2 atm. Analogous results are obtained by decompn. the 1st residue with 6-8 g. NaOH in the presence of 0.5-0.8 g. Na .

27. Vol. 31, 1937, 5300⁶

Occurrence of tin in micas. S. A. Borovik. Compt. rend. acad. sci. U.R. S.S. 14, 349 (1937). (in English).--Homogenous mica laminae contg. Sn were investigated chemically and spectroscopically to det. whether the Sn enters the crystal lattice. The results indicate that it does. The amts. of Sn are too small to det. by x-ray analysis.

28. Vol. 31, 1937, 4240⁸

Decomposition of cassiterite by zinc dust in the presence of hydrochloric acid at high and low temperatures. V. A. Podgorbunskii. J. Applied Chem. (U.S.S.R.) 9, 2138-44 (In French 2144) (1936).-- Zn dust reduces cassiterite quantitatively at $700-500^\circ$ in 12-5 min. A complete reduction is possible at $400-700^\circ$ in 20 min. or more.

TIN

H. A. Baker¹ and B. S. Clark²

Sn, at. wt. 118.7; sp. gr. 6.56; m.p. 232°; b.p. 2275°; oxides SnO₂ and SnO.

DETECTION

Tin is separated, together with arsenic, antimony, gold and platinum, from the hydrogen sulphide precipitate of the metals of the second group, by the action of yellow ammonium sulphide. (Normal ammonium sulphide does not readily dissolve the sulphides of tin). If the ammonium sulphide solution is acidulated with hydrochloric acid and the acid solution reduced with iron, antimony, arsenic, platinum and gold are precipitated in the metallic form. The presence of tin, which is present as stannous chloride, is indicated by the reducing action of the solution on mercuric chloride, a white precipitate of HgCl or a gray precipitate of Hg being thrown down.

Reduce the hydrochloric acid solution of the sample by means of a small piece of iron wire. Treat with an excess of cold potassium hydroxide. Filter if the solution is not clear. Add an ammoniacal solution of silver nitrate. (One part AgNO₃:16 parts NH₄OH.) A brown precipitate of metallic silver indicates the presence of tin. Antimony, arsenic, platinum and gold are precipitated by the iron, while all of the heavy metals remaining, except lead, tin, aluminum, chromium, and zinc, are removed by the treatment with potassium hydrate.

Welch and Weber³ recommend the following method for detection of tin: Add 10 cc. concentrated hydrochloric acid to the superficially dried precipitated sulphides from the ammonium sulphide separation. Filter off arsenic which does not decompose. Dilute filtrate to 70 cc. volume. Saturate with H₂S. Heat to expel excess H₂S. Add 5 cc. of hydrogen peroxide and heat until precipitate is redissolved. Add 5 to 10 grams of oxalic acid and pass H₂S into the hot solution. Antimony separates as a red sulphide. Filter. Filtrate contains the tin. Reduce with test lead and add mercuric chloride. White or grayish precipitate indicates presence of tin.

ESTIMATION

The estimation of tin is required in connection with the analysis of tin ores, dross, ashes, dust, tin plate, alloys such as solder, canned foods, and general analysis.

OPENING UP TIN ORES

As the oxides of tin are not readily soluble in acids the tin can be most easily removed by assay. Ores, slags, dross, and ashes are first subjected to the assay process. The button obtained is then analyzed either volumetrically or

¹Chief Chemist, American Can Company.

²First Assistant Chemist, American Can Company.

³Jour. Am. Chem. Soc. 38, 5, 1011, 1916.

gravimetrically by one of the methods given below. Having the weight of the button and the per cent of tin in it, the per cent of tin in the sample as received can be calculated.

There are two general processes of assaying, namely, the Cyanide Process and the Carbonate of Soda Process.

THE CYANIDE PROCESS

The theory of this method is that the oxides are reduced to the metal by the action of potassium cyanide, the reaction being represented as follows:



Potassium cyanide reduces other metals also so that the button obtained is not pure.

Procedure. Take 100 grams of the sample which has been dried and finely powdered. (For complete analysis the moisture should be determined in the usual way). Mix thoroughly with four times its weight of powdered potassium cyanide. Place about 1 in. of potassium cyanide in the bottom of a number H (height 5-7/8 ins., diameter 3-3/4 ins.) Battersea clay crucible. Place the mixture of sample and cyanide on top of the cyanide in the crucible and cover with enough more cyanide to fill the crucible to within 1 in. of the top.

Place the crucible in the assay furnace and heat slowly until it has been thoroughly warmed and the cyanide begins to melt. Then increase the heat gradually to a pure white, taking care that the cyanide does not boil over.¹ Grasp the crucible with the tongs and tap it gently on the hearth to assist in settling the metal. Continue the heating until all of the organic matter has disappeared, adding more cyanide from time to time if necessary. Near the end of the process the molten mass becomes clear and transparent and finally pasty and translucent. When this last condition appears, remove the crucible from the furnace and allow it to cool slowly at the temperature of the room.

When cool, break the crucible and slag away from the button. The appearance of the button and the slag immediately surrounding it indicates whether or not the process has been properly manipulated. The button itself should be firm and compact and the slag around it should be white or greenish in color. If the button is spongy or if the slag has a dirty black color, the assay should be discarded and a new determination made, using a fresh sample.²

Weight of Button = per cent Metal in Sample.

$$\frac{\text{Weight of Metal} \times \text{per cent Sn}}{100} = \text{per cent Sn in the Sample}$$

NOTE. This process should be carried on under a hood in a segregated room, and every precaution should be taken to avoid breathing the poisonous fumes of potassium cyanide.

¹Lunge advises that the cyanide should not be allowed to boil. He uses a small sample (10 grams). "Technical Methods of Chemical Analysis" 1, Part 1, p. 256. It is our experience that satisfactory results are not obtained unless the extreme heat of the furnace is used.

²See also Mellor, "A Treatise on Chemical Analysis," p. 270, 1913.

THE SODIUM CARBONATE METHOD

The sample is fused with equal parts of sodium carbonate and sulphur.¹ The fusion is then dissolved in water. The tin goes into solution as a thio-stannate of sodium. Iron and copper are then separated by the addition of sodium sulphite, leaving arsenic, antimony and tin in solution.²

OTHER METHODS OF OPENING TIN ORES

Fusion with Sodium Hydrate. The sample of ore is used with ten times its weight of sodium hydrate. The process is carried out in an iron crucible and then transferred to nickel. The fused mass is dissolved in water and the tin determined in the usual way.³

Reduction by Means of Hydrogen. The ore may be reduced by strongly igniting in a porcelain tube in a current of hydrogen. The reduced metal is then dissolved in hydrochloric acid and the tin estimated by a standard method.

Fusion with Sodium Peroxide. J. Darroch and C. Meiklejohn⁴ opened ores, slags, etc., by fusing with sodium peroxide in a nickel crucible. They dissolve the fused mass in hot water and acidify with hydrochloric acid. The sample is then ready for the necessary separations.

¹ Very finely divided carbon is sometimes preferred. Air must not be allowed to enter the crucible. Else decomposition is not complete. Mellor, "A Treatise on Chemical Analysis", 1913, p. 270. If carbon is used instead of sulphur the process becomes one of reduction to the metal and is carried out in the assay furnace. The details of operation are similar to the cyanide process. The metal separated as a button in the bottom of the crucible. The button contains other metals with the tin and must be analyzed further for exact percentages.

² Mellor objects to the method as being tedious and dirty.

³ Low, "Technical Methods of Ore Analysis," 3d Edition., pp. 208-213, 1908.

⁴ Engineering and Mining Journal, 81, 1177, 1906.

AN INVESTIGATION
of the
REPORTED OCCURRENCE OF TIN AT JUNIPER RIDGE (SQUAW BUTTE), OREGON

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CHAPTER I
A Survey of
The Occurrences of Tin
INTRODUCTION

A field study of any area, with the purpose of determining the presence or possible presence of any metal, presupposes a background survey of the available literature concerning that metal.

(1)

An analytical study also under certain conditions requires an exhaustive search of past techniques and procedures, before a choice can be made among them.

Surveys

An extremely condensed summary of the bibliographic/and analytical procedures made is presented here for purposes of completion.

Location and General Features

The Juniper Ridge area discussed in this report is about one square (2) mile, lying south of the east-west central Oregon highway (No. 54) at a point 96 miles from the town of Bend and 34 miles from Burns. It is crossed by the meridian of longitude 119° and the parallel of latitude $43^{\circ} 31' 15''$. It comprises the $S\frac{1}{2}$ of Sec. 36, T. 23S., R. 25E.; and the $N\frac{1}{2}$ of Sec. 1, T. 24S., R. 25 E.W. M.

The area lies on the northeast corner of the U.S. Geological Survey, Squaw Butte Ranch Sheet, towards the topographic east end of Juniper Ridge.

Relief and Drainage

The area is traversed from southwest to northeast by an intermittent (3) creek, which has cut a steep-walled, and in places precipitous, canyon from 50 to 200 feet deep into a series of benches which drop down by steps from an elevation of 5000 feet at the southwest corner of the area to 4500 feet at the highway. Another dry gulch runs northwesterly through the northeast quarter of the area, and nearly joins the main creek before turning north for 1500 feet where creeks both debouch (1500 feet apart) upon the north sloping alluvial piedmont, along which runs the highway. Another east trending gulch drains the southeastern quarter of the area.

Climate

(4)

The climate of this area is semi-arid, with an average annual precipitation of less than 10 inches. The summers are hot and dry and the winters cold. The streams are intermittent, and no springs are present.

HISTORY

Tin Tin is thought to have been used since very early times, and is probably (5)

mentioned by Heroditus and Homer although translation may have been in error.

Some authors aver that it was used in Egypt and China as early as 1600 B.C.

The Phoenicians carried on an extensive tin trade, as early as 1000 B.C.,

between the "Cassiterides Islands" generally thought to be The British

(Mellor, 27: 276, Fawns, 05)

Isles and Mediterranean ports.

In the thirteenth century, much of the world's supply of tin came from Cornwall, but tin was also discovered at about that time in Saxony and Bohemia; and a number of 16th century writers mention East Indian deposits which may have been a source of metal as early as the eighth century.

MINERALOGY

There are only two minerals, cassiterite and stannite, which have been (6)
mined for tin on a commercial scale. Of these, the mineral cassiterite

(Dana, 22: 676)

According to Dana other minerals which contain tin as a part of their chemical makeup are:

canfieldite	$4Ag_2S \cdot SnS_2$	stokesite	$H_2CaSnSi_3O_{11}$
teallite	$PbSnS_2$	nielmitite	Y, Fe, Mn, Ca, Stanno-niobate
franckeite	$Pb_5Sn_3FeSb_2S_{14}$	nordenskiöldine	$CaSn(BO_3)_2$
cylindrite	$Pb_3Sn_4FeSb_2S_{14}$	hulsite	$12(Fe, Mg)O \cdot 0.2Fe_2O_3 \cdot 1SnO_2 \cdot 3B_2O_3 \cdot 2H_2O$

27:

Mellor also reports the following:

cuprocassiterite	$4 SnO_2Cu_2Sn(OH)_6$
plumbostanite	$Sn_2Sb_2Pb_2(Fe, Sn)_2S_{11}$

He also lists tin as occurring in small quantities as an accessory constituent in a number of other minerals:

columbite	aeschinite	phonolite
plumbocolumbite	cyrtolite	microlite
tantalite	fredricite	olivine
yttrotantalite	polycrase	pyrophanite
ixiolite	eucrasite	kaolin
ilmenite	sipylite	cryolite
ferroilmenite	ferberite	mica
rutile	tapiolite	lepidolite

ilmenorutile	tritomite	manganoepidote
euclase	hjelmite	pyrolusite
fergusonite	tyrite	pyrite
samarskite	malacone	fahlerz
monazite	zircon	sperrylite
delorenzite	scheelite	incblende
risorite	hatschettolite	thalenite
		tourmaline

GEOLOGIC OCCURRENCE

Although tin is so uncommon that it is not listed as among the (7)
 26 most abundant elements present in the igneous rocks of the earth's
 crust (Clarke, 24:29) and the amount has been estimated to be in the order
 of .000006% (Mellor, 27:280) in acid igneous rocks the percentage is
 sometimes as high as .001% (Fries, 42:283)

The extensive literature regarding the occurrence of tin is
 summarized by Hess and Graton (05), Mellor 27:284), Jones (25)
 and Fawns (05), while a complete bibliography is given by Hess
 & Hess (12)

Tin deposits are widely scattered on all the continents, but 85% of all the world's production comes from two areas: the deposits at Malay, Siam and China, and the Bolivian deposits (Mellor, 27:280).

About 70% of the world's production is derived from alluvial placers, (8) mainly from the Malay Peninsula, the islands of Banca and Billiton near Sumatra, and from Nigeria and China (Lindgren, 28:277). Minor amounts are mined in New South Wales, Victoria, and Tasmania. Small amounts of stream tin occur in Alaska (Knopf, 08; Johnson, 10; Harrington, 19; Chapin, 19; Fearing, 20; Steidtmann & Cathcart, 22; Waters, 34), in the Black Hills of South Dakota (Hess, 09; Darton & Paige, 25), in North and South Carolina (St. Clair, 35; Haney, 28) and in Mexico (Sampson, 27).

The source rock of tin (cassiterite) is either granitoid rocks, (9) pegmatites, or quartz veins. Tin-bearing veins are generally considered (Ferguson & Batemen, 12; Singewald, 12) to have a close genetic connection with the acidic granites, and to have been emplaced soon after the cooling of the major part of the granite, under "pneumatolytic" conditions (Lindgren, 28:734-5). It is found near the contacts of granites, in part in fissures, in Finland, Saxony, Tuscany, Devonshire (Lindgren, 28:817),

and on the Seward Peninsula, Alaska (Knopf, 08; Harrington, 19; Steidtmann & Cathcart, 22). It is associated with a large number of contact metamorphic and lime-silicate minerals and sulphides, although tourmaline is more abundant.

Pegmatite dikes bearing tin have been mined in the United States in South Carolina near Gaffney (Haney, 28), the Black Hills (Smith & Page, 41), and in Virginia (Erguson, 18).

The largest production of "hard rock" tin has been from the high-temperature or hypothermal veins, which have a definite mineral association of such minerals as molybdenite, arsenopyrite, wolframite, bismuth, and bismuthinite, with much less abundant pyrite, pyrrhotite, chalcopyrite, galena, and sphalerite. Quartz is the chief gangue mineral, accompanied by lepidolite, fluorite, topaz, tourmaline, axinite, and apatite (Lindgren, 28:725). Mines in this type of vein include those of Cornwall, Bolivia, Japan, New South Wales, Tasmania, Saxony, and in North America, Nova Scotia (Messervey, 33; Davidson, 33), Manitoba (DeLuvy, 20; Wright, 32), and British Columbia.

Some tin occurs in mesothermal replacement veins associated with silver. The Bolivian veins are the best examples of this type.

Cassiterite occurs in a gangue of quartz with pyrite, arsenopyrite, sphalerite, chalcopyrite, stannite, tetrahedrite, andorite, ruby, silver, and jamesonite (Lindgren, 28:657). Tin silver veins also occur in British Columbia (Gunning, 31).

The tin deposits of the western United States, although not of great (10) economic importance, would come in for special notice. There are a number of occurrences in California (Pabst, 38:123), some of which have been mined, as in Riverside County (Fairbanks, 97; Dudley, 35; Sampson 35). Tin also is known to occur in Plumas and Trinity Counties (Hanks, 84: 410), in San Diego County (Penfield & Ford, 16; Schaller, 16), and in Siskiyou County (Pabst, 38:123). Tin occurs in Idaho (Livingston, 19), near Spokane, Washington (Anderson, 28; Fernquist, 35), and in Nevada and New Mexico. The Nevada and New ^eMexico cassiterite deposits are of special interest, because the veins occur in Tertiary rhyolites, as at Majuba Hill, Pershing County, Nevada (Smith & Gianella, 42) where they appear in altered tourmalinized and sericitized plug or rhyolite porphyry breccia. In the Black Range of Catron and Sierra Counties, New Mexico, the tin-bearing stringers occur in fractured and altered zones of mid-Tertiary rhyolites, which

have a fan-shaped cross-section of the primary flow banding, suggesting the extrusive vents (Hill, 20; Naething, 21; Fries, 40). The cassiterite in northern Lander County, Nevada, occurs in veinlets in Miocene rhyolites, as "incrustations deposited in fumarolic vents along fissures formed by differential contraction during the cooling of the lavas" (Fries, 42:279; Knopf, 16a, 166). It should be especially noted that in all these occurrences of tin in rhyolite, the cassiterite occurs in veins or veinlets in rock which has been hydrothermally altered, and that the fresh rock has only a normal minute trace (.001%) of tin

(Fries, 42:283). *In connection with the reported occurrence of tin in Oregon obsidians the author was instructed to undertake a thorough analytical investigation of obsidians to determine the presence and qualitative det. of tin.*

METHODS OF DETECTION OF TIN

Qualitative Chemical Analysis

(11)

A survey of the analytical procedures used for the detection of tin disclosed a large number of possible procedures which were weighed one against the other to determine which was most likely to yield conclusive results (~~when used with the material to be analyzed.~~)

In this investigation, Juniper Ridge rock samples were to be analyzed for the presence or absence of tin or ~~any of its compounds.~~ *in any form or combination.* The analytical procedure or procedures used must detect the presence of tin when it is associated with the other constituents of the sample. On the other hand, each analytical procedure must not yield a positive test for tin due to the interfering influence of other

constituents in the sample, even though tin or its compounds are not present in the sample. ~~(That is, a procedure must be such that the test for tin is specific.)~~

Fifteen different reagents or tests were chosen for this investigation.

These reagents were used to test samples of Juniper Ridge rock to which tin had been added in the form of metallic tin or as compounds of tin. Four tests were chosen as being specific for tin when present in Juniper Ridge rock; that is, none of the constituents in Juniper Ridge rock interfered with the positive reaction for tin of any of these reagents. Further investigation showed that none of these reagents gave a positive reaction for tin when used with samples of Juniper Ridge rock to which ^{tin} or compounds of tin had not been added.

Quantitative Chemical Analysis

(12)

One fire assay method and two wet-chemical methods were investigated, by using standard samples of Juniper Ridge rock to which metallic tin or compounds of tin had been added. The reason for this investigation was to determine the ability of these methods to determine quantitatively the amount of tin added to the standard samples.

Spectrographic Analysis

(13)

A number of different methods of spectral excitation were used with standard samples of Juniper ridge rock to which metallic tin or compounds of tin had been added, to determine the lowest concentration of tin which could be detected by all

of the spectrographic methods investigated. Quantitative { spectrochemical
analyses were made to determine the concentration of tin in the samples of ~~spectrographic~~
Juniper Ridge rock submitted for analysis.

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CHAPTER II

GEOLOGIC INVESTIGATION OF A PORTION OF JUNIPER RIDGE

INTRODUCTION

(15)

Early in July of 1941, the author was requested to make a survey of the geologic features of a portion of Juniper Ridge, and to collect samples of rock from this area for study. Due to limited time available, it was advisable, that, for purposes of the investigation, a detailed study and mapping of the area around the camp* was preferable to a less intensive study of a larger area composed of rocks apparently identical to those in the more restricted area.

On July 10th and 11th, a primary triangulation control network was established, and the major portion of one square mile was topographically mapped, the map overlapping the northeast corner of the U.S.G.S. Squaw Butte Ranch sheet. A portion of the geology was plotted and samples were taken at that time. *In* On October 22 and 23 the area was revisited, further samples taken, and the geologic field work was completed.

LITERATURE

(16)

Banded rhyolitic lavas and perlitic obsidians are well-known in eastern

*The term "camp" as used in this report designates the location of the bunk houses, the furnace house and bag house, on the south side of the creek, near the center of the south line of sec. 36, T. 23S., R. 25 E.W.M.

Oregon. Although the geologic literature is not abundant, most of the areas that have been mapped contain one or more units with rocks similar to those in the Juniper Ridge area.

The Glass Buttes, only 15 miles west of Juniper Ridge contain a rock sequence of perlite, obsidian, vitrophyre, dacite, andesite and basalt whose characteristics are very close to those of Juniper Ridge even to the pumice caps of the flows. (Waters, 27) The rhyolite series here is probably correlative with the Steens Mountain lavas of Miocene age.

Areal mapping of the Harney Basin to the east (Piper, 39) comes within twenty miles of Juniper Ridge. The Palomina Buttes, just south of the highway fifteen miles west of Burns, are composed of extrusives that:

"....are inflated throughout and even pumiceous at some spots, and commonly disclose conspicuous flow banding. Their matrix is largely siliceous glass (index of refraction less than 1.54) in which perlitic cracks and shards are common. The common feldspar ranges from oligoclase to acidic andesine, but some orthoclase (?) is present. Hornblende has been abundant as a primary mineral but is largely altered to biotite. A few small crystals of apatite are present, but no other accessory minerals were recognized in the thin section. The rock of the Palomina

Buttes has been ascribed provisionally to the older siliceous extrusives.

"Where the older siliceous extrusives and the Steens basalt are in contact they are separated by an unconformity that has strong relief and involves considerable erosion and local angular discordance. The angular discordance is disclosed in the northern part of the Crowcamp Hills, in the eastern part of Riddle Mountain, and in the area east of Malheur Gap. In the last-named area the older siliceous extrusives are crumpled and fractured, whereas the Steens basalt lies nearly flat, is faulted in a rather simple pattern, and is not crumpled." (Piper, 39:52)

Other rocks of later age in the Harney Basin are similar to some of the spherulitic phases of the Juniper Ridge felsites.

"In the northern part of the area, the lower part of the Danforth formation comprises thick extrusive sheets and masses of reddish gray rhyolite. At some places its members are conspicuous owing to an abundance of evenly distributed spherulites and lithophysae ("stone bubbles") that are lined with opaline silica. These openings are usually discontinuous and do not impart perviousness to the rock.....

"In the Sagehen Hills, west and southwest of Burns, the rhyolite that has been classified as the lower part of the Danforth formation includes considerable black glass, is massive, and is jointed so closely that its initial layers cannot be readily discriminated. Certain spherulitic facies in that locality may belong with the older siliceous extrusive rocks (p. 51), which they resemble closely in petrographic character." (Piper, 39:46-47).

In the Baker Quadrangle further to the northeast (Gilluly, 37: 50-53), there are, underlying Columbia River basalt, porphyritic flow-banded andesites and rhyolites which are associated with light gray pumiceous appearing flow breccias. On the Owyhee river (Bryan, 28:44) there is a red to black flow-banded porphyritic rhyolite, without quartz phenocrysts, which underlies the Miocene Owyhee basalt. Further to the south in the Steens Mountain area (Fuller, 31:60) there are spherulites and platy rhyolites underlying the Steens Basalt which, since they show no quartz, are classified as rhyolite on the basis of their chemical composition. In the extreme southeastern corner of the state (Yates 42:324) Miocene lavas range from obsidians to porphyritic rhyolites, and in general exhibit well developed flow banding.

GEOLOGY

(17)

Four distinct rock-types were distinguished in the field, three of them closely related in age. A tentative order of superposition was established (a larger area of mapping would be necessary to finally determine age relationship) as follows:

- (D) Slightly vesicular platy gray olivine basalt flow.

-----Unconformity-----

- (C) Red porphyritic pumiceous obsidian, as dikes or lenses,
and pale gray porphyritic pumiceous obsidian, mostly
occurring as float.

- (B) Black (and some red banded) porphyritic and perlitic
obsidian, with lithophysae often abundant, occurring
in lenses within the felsite (A).

- (A) Finely banded platy or massive red and gray porphyritic
felsite. Massive phase usually contains numerous lith-
ophysae, banded platy phase often contorted and folded.

Surrounds and grades into (B).

Distribution of rocks:

(18)

Within the area studied, the most widely distributed rock type is the platy felsite (A) which, with the massive phase, forms all the "rim rock" with the

exception of basalt (E) in the northeast corner of the area. Lenses of perlite obsidian (B) occur below the massive felsite cliffs at several places east and southeast of the camp (see plate I), in the creek bed both just west of camp and up the ridge for several hundred feet to the west, and in the creek bed and east of the creek 3500 feet to the southwest of the camp. It also occurs on the flat-topped erosion surface of the main block 2500 feet south of the camp and 2500 feet south-southwest of camp. The size of the perlite lenses in this area is from a few tens of feet to nearly a thousand feet in length, and from a few inches to several tens of feet in thickness. Red pumiceous-obsidian (C) was observed in four localities on the level bench-surface of the main block, where it appears in narrow vertical (northwesterly-striking) dikes or lenses. The gray pumiceous-obsidian occurs as float covering most of the flat-topped portions of the main block as well as portions of other blocks. It was found in place in only one cut north of the fence-line near the end of the upper road.

Petrography:

(19)

In the hand specimen, the flow banded phase of the porphyritic felsite (A) is made up of parallel layers of glassy black and less glassy pinkish material averaging less than 1 mm. in thickness, but varying from a maximum

thickness of 3 mm. down to thicknesses only measurable under the microscope.

The black bands weather on the surface to a darker red color than that of the pink bands, which do not change color upon weathering. Euhedral to subhedral feldspar phenocrysts up to 2 mm. in diameter make up about 5% of the rock.

They appear almost exclusively within the black bands, which swell to lap around them. The massive phase of the felsite appears to have a composition similar to that of the reddish bands, but it is usually characterized by the presence of frequently hollow pink-colored lithophysae which grade in size up to 3 cm. in diameter, and sometimes make up as much as 30% of the rock.

Under the microscope the banded porphyritic felsite is seen to contain as phenocrysts about 5% subhedral andesine-oligoclase ($Ab_{65}An_{35}$) from 0.2 to 1.0 mm. long, and about 1% anhedral magnetite grains. The eutaxitic (Kemp & Grout, 40:62) groundmass consists of 90% intergrown micro-spherulites probably composed of orthoclase (and possibly quartz), averaging .005 mm. diameter (Tyrrell, 29:99). Elongated cavity fillings parallel to the banding are filled in by deuteric growth of the spherulites lining the cavities and the centers of the cavities are filled with a nearly clear isotropic material, probably hyaline opal. Extremely minute longulites, probably of iron ores (3 - 5%) are scattered throughout the groundmass parallel to the flow banding.

In the hand specimen the black perlitic obsidian (B) appears to contain (20)
about 5% phenocrysts of white subhedral feldspar. The surfaces of the well-developed perlitic fractures have a brilliant black to pale gray gloss, depending upon the thickness of the individual shells of the "perls". Lithophysal phases contain up to 80% of globular and irregularly shaped pink material, which has a radiating fibrous texture and open cavities in their centers (Tyrrell, 29:98). The boundaries of this material are usually sharp but sometimes grade into the glass.

Under the microscope the phenocrysts make up about 8%. About 4% is resorbed andesine-oligoclase from .6 to 1 mm. in size. Darker cloudy areas of glass often occur around the resorbed feldspar phenocrysts. There is 2% subhedral augite, .5mm. or less in size, 1% hypersthene, and 1% iron ores up to .1 mm. in size. The groundmass is perlitic glass, dusted with 5 - 10% of fine opaque needles, which are from 5 to 10 mumu (.005 - .01 mm.) long and from .1 to .5 mumu (.0001 - .0005 mm.) thick. These are probably magnetite, since grinding the rock yields 5 - 10% magnetic dust. The order of crystallization is magnetite - pyroxene - feldspar - magnetite (?) longulites - glass.

The pale gray pumice-obsidian appears in hand specimen to have only about (21)
5% porosity, but the tubules and directive texture in the glass is well defined in the hand specimen, and vitreous lustre is not universally apparent. There

are a few xenoliths of basic rock up to 2 in. across, presumably torn from the walls of intruded rock. The specific gravity of a lump is only slightly less than that of adjoining rocks. White feldspar phenocrysts averaging 1 - 2 mm. long, make up about 5% of the rock. A few minute black crystals of iron ores are also apparent.

Under the microscope the gray pumice is seen to be composed of about 5% subhedral andesine-oligoclase ($Ab_{65}An_{35}$) phenocrysts (.3 - 2 mm.) in a vitrophyric (Kemp & Grout, 40:110) groundmass composed 75% of oriented tubules of clear glass with an index of 1.505 (70% SiO_2 552); 15% oligoclase-andesine microlites; and about 5% fine accessory iron ore grains.

In the hand specimen the red porphyritic obsidian contains large (up to (22) 5 mm. long) oriented plates of white feldspar, which make up about 5% of the rock, in a groundmass composed of approximately even parts of dark red unevenly fractured glass and paler slightly pumiceous material.

Under the microscope the red pumiceous obsidian is somewhat porphyritic, the phenocrysts being composed of 5% euhedral to subhedral and broken andesine-oligoclase (.3 - .8 mm. diameter); and 1% euhedral strongly pleochroic iron-rich olivine averaging .3 mm. in diameter. The vitrophyric groundmass is composed of glass which retains a directive pumiceous texture, but the tubular

openings are largely lacking. About half of the glass is clear and the other half is dark yellow, probably due to contained iron oxide, the latter distributed in irregular elongated blebs, strings, and patches.

The olivine basalt (E) is a dark gray platy and porphyritic lava with an (23) aphanitic groundmass characterized in the hand specimen by irregular patches of lighter material oriented parallel to the platy structure. Under the microscope the phenocrysts are seen to be composed of 10% subhedral to anhedral and corroded labradorite ($Ab_{30}An_{70}$) laths from .2 to 1.5 mm. long, and about 2% anhedral resorbed augite from .2 to 1. mm. in diameter. There are a few large subhedral to anhedral olivines (over 2 mm. in diameter) often more or less completely altered to iddingsite, and a few grains of subhedral prismatic hypersthene. The groundmass consists of about 60% andesine-oligoclase microlites with a felted or felsophyric texture; 15% interstitial anhedral clinopyroxene grains; and 10% iron ores in subhedral crystals and in irregular blebs.

The three rock-types A, B, and C have similar indices for their glass (24) constituents (150 - 1.51) which indicate (George, 24:353) that they have a silica content between 68 and 72 per cent. The feldspars are similar (averaging $Ab_{65}An_{35}$) and no quartz was identified. On a mineralogic basis the rocks would be called andesites, on the basis of their chemical composition (judging

from the glass index) they would be classified as rhyolites. The field term "felsite" (Kemp & Grout, 40:62) is thus retained in referring to them in this paper.

Mineralization:

(25)

None of the rock-types described showed secondary alteration other than slight weathering features, even adjacent to the faults. Secondary limonite is developed very infrequently on the fractures of the black perlite and there has been deuteric alteration of the hypersthene and olivine of the basalts, but otherwise all the rocks are remarkably fresh, with no suggestion of hydrothermal mineralization.

Origin of the Rocks:

(26)

The rhyolitic series of platy felsites and obsidians in the Juniper Ridge area were extruded as viscous, gas-charged lavas from a number of central or fissure vents, and spread out as thick steep-sided flows or flattened domes (Williams, 32:69,79; 35:282; Tyrrell, 31:31). This extremely viscous lava contained initial patches and layers differing in composition, gas content, viscosity, and degree of crystallization of the glass, so that movement of the mass drew the irregularities out into parallel bands and lines, which are characterized by various portions of spherulites, glass microlites and stony material of slightly varying composition (Tyrrell, 29:39). Similar banding in

rhyolites at Mt. Katmai (Fenner, 26:740) seem to be due to the streaking out of partly and completely fused inclusions of more basic lava (andesite), and is not banding of early crystallized magma or "schlieren". Certain lenticular areas within the glassy magma cooled so rapidly that not only did the chilled glass have no time to crystallize, but the contraction due to cooling caused fracturing of the glass around numerous closely spaced centers and produced the perlite lenses (Tyrrell, 29:99).

The banding, the resorption of phenocrysts, and the apparent difference in composition between them and the glass suggest that possibly the original highly acid magma came up through a coarse grained andesite, picked up small portions of it which were largely dissolved, thus changing the composition of the lava.

Expansion of contained gases with possible explosive activity in slightly later extrusives of similar composition developed the pumiceous obsidians, of which the red phase due to oxidation of iron content (Fuller, 27) seems, according to field relations, to represent an intrusive phase. This pumice cap is similar to that at Glass Buttes (Waters, 27). Basaltic flows followed the felsites, and are later than the pumice-obsidians.

Structures:

Attitudes of the flow-banded felsites may vary from horizontal to vertical within tens of feet; in a few localities the contortion is so intense that attitudes could not be plotted on the scale used. On a larger scale, however, plotted attitudes indicate a number of primary structures. These structures are not always continuous beyond the fault blocks within which they lie, and there is little correspondence of axial trend between fault blocks. They undoubtedly represent primary intrusive features. In several localities there are areas of quaquaversal outward dips surrounded by corresponding sequences of inward-dipping rock-types around the periphery of the structural domes. These are characteristic of plug dome or viscous intrusion (Williams, 32). (27)

Jointing in the rocks of the area is most prominent parallel to the primary flow-banding, so that the rocks break up into platy polygons whose thickness depends primarily upon the degree of development of the flow-banding. Jointing has also been developed in other irregularly oriented directions but to a lesser degree. (28)

A well-defined system of northwest-southeast trending normal faults divides the area into blocks with differing elevations, all down-dropped on their north-east side (see Plate II). Faults have been mapped on the basis of displaced erosion surfaces, offset or abruptly terminated perlite lenses, (29)

anomalously broken (rather than contorted) banding in the felsite, and physiographic ridge-saddles and adjacent ravines.

The main front fault strikes N. 80° E., and is the only one which does not trend in the northwest quadrant. Displacement of 50 to 300 feet along this fault has resulted in the development of the north escarpment of Juniper Ridge which more or less parallels the highway for several miles. Within the area mapped the amount of displacement dies out rapidly on this fault from east to west, being taken up by other members of the system which join it. South of this fault, the warped surface of the northeast block slopes about 4° to the southwest.

The northwest block, whose surface slopes about 2° to the northwest, is separated from the northeast block by a fault striking N. 50° W. with a displacement of only a few tens of feet. The northwest and southeast blocks, lying between the northeast and the main blocks, are separated by a splinter-fault striking N. 80° W., with a displacement of over 100 feet.

The main block has a nearly horizontal surface, being bounded on the northeast by a fault which strikes N. $50-60^{\circ}$ W., and becomes a part of the main north escarpment of Juniper Ridge to the west of the area. This block, which is from 2,000 to 2,500 feet wide, is separated from the warped east and southeast sloping south block by a small displacement along a less well-defined

fault which also strikes N.50-60°W.

The uniform northeast trend of the main creek, structural anomalies and contorted, crumpled, and broken flow planes in felsite at several localities along the creek, and the wind-gap between the two creeks northeast of camp all suggest a zone of movement trending N.30°E. through the area. Since it does not displace the block-surfaces, it was probably of early development, antedating both the other fault movements and the erosion cycle which modified the surfaces of the fault blocks. It may even have been established contemporaneously with the outflow of the lavas.

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