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R. Lawler

TUNGSTEN PROSPECT 9/23/35

Call from E. T. Eckel (with broken right arm) who is locally represented by R. H. Cornelius, Atty., Title and Trust Bldg. Phoenix and is a friend of Albert Wells (formerly at BlueBell Mine) who sent him to me.

Eckel has staked six claims on Boulder Creek, Yavapai County which are best reached by driving from Prescott through Simmons to Camp Wood and from there about 17½ miles south to Joe Stroger's Ranch at the end of the road. Horses may be procured at this ranch and the ride or walk from there to the claims is about 3½ miles and for a guide either Joe Stroger or his son Kenneth would serve or R. J. Cook (who is not a miner) or Eckels brother Claude, who is prospecting on his own claims some 2½ miles away.

Also about 2½ miles northwest from Eckel's Tungsten prospect is a property now being worked by leasers/by Mr. and Mrs. Sterling Ellis and Eckel says that during the war or before this was worked by Lawler and Homer Woods, who took out a lot of ore.

Eckels claims show both veins and placer in the creeks and Eckel has shot into one vein (quartz) which shows good wolframite of which he left sample, and is over 1 foot wide.

His vein ore and also placer have given assays when sorted or concentrated up to 55% WO_3.

He has also found cubic crystals of cerium (rare earth found in monazite) which are light and greasy and also columbite (oxide of iron and columbium) both of which he thinks may have great value.

The elevation of the claims is about 5000' and the formation is granite porphyry [illegible] to the north and quartz porphyry to the south with the quartz veins in which there is also some iron pyrites and near by this is a ledge with manganese and below is found some gold, silver and

copper value, also Eckel claims that there is tin which seems very doubtful.

The property can be reached in winter by driving from Hillside to the Nelson Ranch and then on the road to Wild Horse Basin to the Smith Ranch which is about 5½ miles from the property.

Eckels will sell all claims for $5000 and will give plenty of time for an examination or would lease and seems to be reasonable.

Suggested procedure would be to first see Homer Woods in Prescott and ask him about the Eckels property and the district in general and then to visit the claims if it seemed worth while (There is good deer hunting and some turkey along Pine Creek) Take gold pan for the placers.

Parties who might be interested in the showing are the Boriana Mining Co. (Frank Hood) Livermore of Boston and Leith of the Vanadium Co., possibly L. R. Smith.

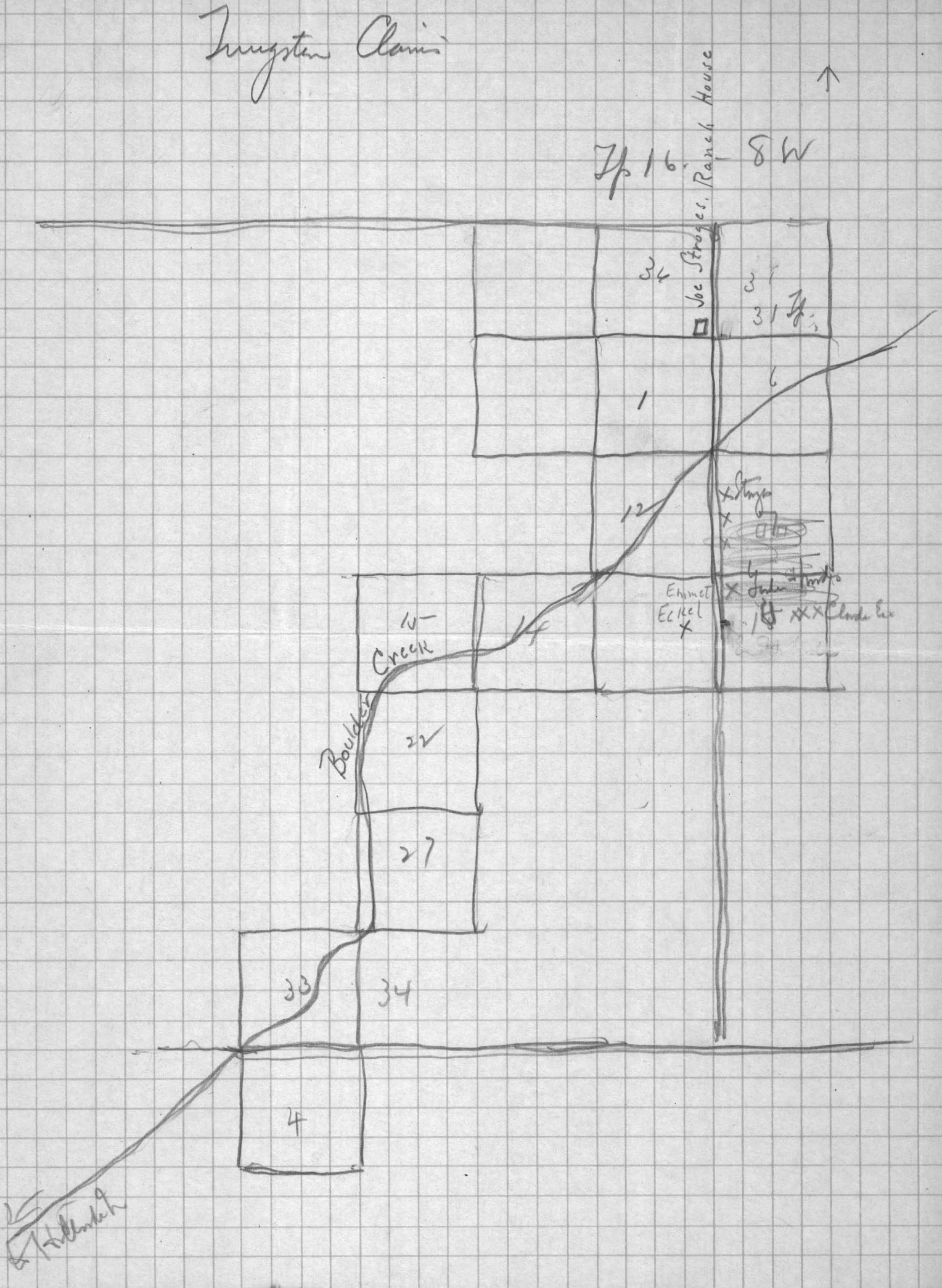
Frank Giroux may know something of the district, danger is that it will prove very pockety and without any persistent value.

Eckel does not own the gold, silver, copper showing which he says is very big and located some 7 miles southeast from his tungsten claims. His samples from there showed:

	Au oz.	Ag. oz.	Cu.%	Value gross per ton.
#1--	0.16	1.80	2.53	$11.50
#2	0.22	1.5	1.4	11.37

From Joe Stringer's Ranch ride to Boulder Creek & cross & then 3 or 4 miles up a deep gulch on the east side to the Tungsten claim

See Tucker-Wood file


Tungsten Claim
Tp 16 S R 8 W
Joe Stroger Ranch House
34
31
1
6
12
Stroger
Ernest Eckel
Boulder Creek
22
27
33
34
4

2 (Hawley & Hawley.
Douglas

Samples of Mr. J. S. Douglas, for E. Eckel

Office No.		Marked	Gold Ozs.	Silver Ozs.	Copper Per Cent	Lead %	Zinc	Total Value
119302	A-1	Surface N Side	.12	0.6				4.66
			4.20	0.46				
119303	B-2	N. Side	Trace	0.5	.72			
			--	0.39	1.30			1.69
119304	C-3	"	.01	265.1	5.67	11.3		
			0.35	205.63	10.37	9.04		226.39
119305	4-D	"	.01	290.4	6.48	33.3	3.0	
			0.35	225.26	11.66	26.64	2.58	266.49
119306	5-E	"	.01	292.6	5.88	30.4	1.4	
			0.35	226.97	10.58	24.32	1.20	263.42
119307	6-F	"	.15	298.5	15.60	29.0	Trace	288.08
			5.25	231.55	28.08	23.20	---	288.08
						Iron	Manganese	
119308	7-G	" SEend	.01	5.7		2.2	221.8	4.76
			0.35	4.41				
119309	A-1	S Side	.16	2.0				
			5.60	1.55				8.15
119310	B-2	"	.08	0.6	.44			
			2.80	0.46	0.84			4.10
119311	C-3	"	1.04	Trace	.48			
			1.40	--	0.86			2.26
119312	D-4	"	.06	0.4	.48			
			2.10	0.31	0.86			3.27

			Barium Sulfate
119313	Barite		80.8

Values quoted:

Gold	:	$35.00 per ounce
Silver	:	.77 " "
Copper	:	.09 per pound
Lead	:	.04 " "
Zinc	:	.043 " "

Date 3/20/36 W. E. Hawley Assayer.

Gold-Silver

Ed. Eisenhauer, Jr.
320-322 So. San Pedro St.
Los Angeles, California

Phone Vandike 9328

ASSAY CERTIFICATE

Los Angeles, Calif., Nov.4, 1936

I hereby Certify that the samples described below, received from E. T. Eckel, 303 Phoenix National Bank Bldg. assays as follows:

OWNERS MARK AND SAMPLE	Gold ozs. per ton	Value	Silver	Total value
A1 Wolframite	.01	$ .35		$ .35
B2 Hubnerite	.015	.53		$ .53
C2 Sheelite	.02	.70		$ .70

A1 Wolframite	Tungstic Oxide (WO_3)	71.80%
B2 Hubnerite	" "	71.42%
C3 Sheelite	" "	41.82%
	Molybdic Oxide (MoO_3)	1.03%

Gold @ $35.pp per oz.

SIGNED ED EISENHAUER, JR.

ASSAYER

Hawley and Hawley

119507 Hubnerite	51.9		$830.40 Total Value
119529 "	Gen. Sample	8.1	129.60

Signed by W. E. Hawley

Phelps Dodge Mining Corp.

Tungsten as Wo3	18.4	$295.12
Wolframite Wo3	62.7	960.00

Claude E. McLean

14092 Woefnite tungsten Brushy Basin, Tungsten Ore #1, Wo 30.73%
14092 Hubernite tungsten, #1 5.05%

Motz Engineering

No. 4 Hubernite Wo3	65.1%	$1941.60
Wolframite "	69.3%	1108.80

Hawley and Hawley

119507 Hubnerite	51.9	830.40 Total
119529 "	Gen. Sample 8.1	129.60

Signed by W. E. Hawley

Phelps Dodge Mining Corp.

Tungston as Wo3	18.4	295.13
Wolframite "	62.7	960.00
Hubernite "	31.6	50.56

Claude E. McLean

14092 Woefnite tungsten Brush Basin Tungsten ore #1 Wo3 30.72%
17093 Hubernite " #1 Double Jack, 5.50%

Motz Engineering

D No. 4 Hubernite Wo3	65.1%	$1041.60
Wolframite W03	69.3%	1108.80

COPY OF ARIZONA TESTING LAB. 6/21/35 for R. J. Cook
c/o E. E. Wiley, Hillside Arizona

14092	Brushy Basin	Tungsten, tri-oxide	30;73%
14093	Tungsten #1	" " "	5.05%
14094	Double Jack	" " "	0.50%

(SIGNED) Claude E McLean
assayer

A complete Qualitative spectographic analysis was made on sample marked "D Combination" which shows the main constituents to be aluminum, iron, and silica, with tungsten as shown above (Tri-Oxide WO_3 2.80) calcium, sodium, and potassium, and a small amount of copper, bismuth, lead, manganese, molybdenum, together with the merest traces of cobalt, chromium, magnesium, hickel, titanium, vanadium, beryllium, barium, silver, and tin. Aside from the tungsten, nothing of commercial importance.

(signed) John Herman, chemist

****

E. T. Eckel 6/7/35

Lab. #13881	Gold	Silver	Copper
Sample #1A	0.16 $4.60		
Sample #2B		1.80 $1.39	
Sample #3c			2.53%

Claude E. McLean
ASSAYER

****

E. T. Eckel 6/10/35

Gold	Silver	Copper	Total
.22 $7.70	1.5 $1.15	1.4 $2.52	$11.37

John Herman Lab.
per John Herman

COPY OF ARIZONA TESTING LAB. 6/21/35 for R. J. Cook
c/o E. E. Wiley, Hillside Arizona

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John Herman Lab.
per John Herman

E. T. Eckel
c/o

PALMER & CORNELIUS
ATTORNEYS AT LAW

Phone,
44739-

R. H. CORNELIUS

TITLE & TRUST BUILDING
PHOENIX, ARIZONA

WATCHES -- DIAMONDS -- SILVERWARE

N. Friedman

Manufacturing Jewelers

1-3 W. WASHINGTON
PHOENIX

PHONE 4-2704

Hellside Mine
Hellside - Ariz
July 28-37-

Mr Gil Calvocoressis-
Phoenix - Ariz -

Dear Sir-

There is a tungsten property recently discovered near here by an Italian whom I have known for some years. And it looks more than good - It is in Granite (Pegmatite) thirty feet wide - both stringers through the Entire width -
It would probably go 1% tungsten -
Coarse Crushing, and a jig would in my opinion do for milling -
Being on Boulder Creek insures plenty of water -
The main drawback is three miles of road through a rough Country.
I think - in fact I am sure it would pay you to have a look at it - The terms would be Easy. Maybe a monthly payment to the owner - Enough for him to get along on -
If you decide to Come, let me know so I can meet you, or have the owner do so -
If you have not been over this road, the following directions would serve as a guide.
After passing Pikes Service Station this side of the Santa Maria, You will see a plastered house on your right. then about five miles from there on your left a framed tent inside a fence - about two hundred

Yards beyond that take a dirt road to the right. Then its only a short distance to the new road built by the Hillside Co- At the junction of these roads is a rather large building- (Dance Hall and Bar)- If you enquire there for Julius- the Italian mentioned- they can direct you to his Camp- which is only about a half mile further on but not in sight from the road—

Yours Sincerely

J.R. Robertson

Notes on the Tungsten Ores of the Southwest

By H. H. TAFT.*

There is probably no mineral, commercially valuable, that takes so many forms differing so radically in appearance as the ores of tungsten. To the ordinary observer there is no connection except the unusual weight between the black ferberite and the light colored, sometimes white, scheelite. Every miner when shown the ore exclaims: I have seen that before, somewhere; then rakes over his memory for the place, and when he goes to it finds that it is something else, or that some one else is there. In visiting various tungsten mining districts one is impressed with two things: That there is very little mineral coming from places that have not been known to someone for a long time. A claim carrying hubnerite was patented in Colorado in 1877, and the specimens were discussed in scientific papers in the early eighties, yet is still unknown commercially; and the ease which the various minerals may be overlooked, scheelite particularly, would not be recognized in the course of an ordinary mine examination, unless made specifically for that mineral.

New mining regions pass through a cycle of development; experienced mine operators are a conservative lot, and are generally the last to take hold. One first sees those who stake everything in sight, and the consequent troubles that result from the skimping and avoidance of the legal assessment work; then the raw-hide period sets in, and it does one good to see the honest effort on the part of those whose means are very limited, but whose knowledge of ore dressing is good. In the Dragoon mountains in Arizona one can now see the almost forgotten rocker and pan and hand jigs augmented by gasoline driven crushers. The next stage is an old battery from some abandoned silver or, worse, gold mill, and a table. The loss in slimes in these mills is very great.

The prospector generally asks where to look for the ore, and is generally told to look for quartz veins in granite or pegmatite dikes. At White Oaks, New Mexico, the ore is in a crushed zone in rhyolite; at Hatchita the ore is in limestone. In the Dragoons the veins are quartz with a little fluorspar in granite, but the larger production is from placers, and they would suggest a country rock rather than vein mineralization, for the quartz veins are thin and the placer area is considerable. In the Wheatstone mountains near Benson, the ore is altered granite. The feldspar is not apparent to the eye, and the mica is light colored, instead of the not unfrequent magnetic iron; it carries ferberite. Near Nogales, where both wolframite and scheelite are found, the country rock is granite, or some of its modifications. In Sonora scheelite is occasionally seen in the concentrating copper ores at Nacozari, and farther south a green-colored scheelite comes from a copper mine. Again in Sonora ore identical with that of the Gigas is found; this same ore can hardly be distinguished from that from Bisma.

What is likely to prove an important tungsten area is the Gigas (quartz) mountains, near Arivaca, about 70 miles south of Tucson, Ariz., and 20 miles from the Southern Pacific railroad at Amada station. This is a range of hills rather than mountains, about 8 miles long and 2 or 3 miles wide; not over 800 ft. higher than the surrounding country, and having its greater elongation northwest and southeast. To the south flows Arivaca creek, that has surface water for 3 or 4 miles all of the year through. The stream on the northerly side only flows after a heavy rain, but has a considerable drainage in the gravel that can be reached by shallow wells.

The northwest end of the Gigas is granite, but the middle and southeasterly portion is of more recent eruptives, commonly known as porphyry, but not yet named. Through the range are a number of dikes of a dark green rock, perhaps diorite. The veins are of white quartz and are very prominent, dipping nearly vertically and strike with the mountain range. A secondary smaller series crosses the mountain. These veins are from thin seams to 5 or 6 ft. in thickness. Often there is a foot or two of quartz, a foot or two of country rock, a smaller seam of quartz, more country rock; another seam of quartz, etc. In all making a vein 10 ft. or more thick. The quartz is a typical gold quartz, carrying a small amount of the usual pyrites, chalcopyrites, galena, etc. Sometimes the country rock in the vein is mineralized better than the quartz itself.

The quartz veins at the northwest extremity of the range and for 3 or 4 miles east and south, are remarkable for the cystals of hubnerite; sometimes pin-head specks, and again beautiful crystals several inches long radiating like the fingers of an open hand, reminding one first of stibnite. These crystals are frozen to the quartz, making hand dressing impossible, unless roasting is resorted to. The present practice is to break (spall) the ore and pick out the best for shipment. There is a stamp mill equipped with tables at the lower end of the mountain.

At Campo Bonito, near Oracle, about 40 miles north of Tucson, is another tungsten area. The mineral is a salmon-colored scheelite. The principal vein is that of the Cody-Dyer Gold Mining Co., and is a fracture zone in the sedimentaries, limestone, shales, etc. The underlaying rock is granite, and in the neighborhood the same mineral occurs in quartz veins in granite and in granite diorite contacts.

Rigid laws do not apply to nature very well. While most of the tungsten is found in granite and with quartz, it is found associated with many other rocks.

*Denver, Colo.

Ferberite seems to favor small seams, and to make breccia fillings as in Boulder county, Colorado; hubnerite or wolframite, as crystals in quartz, neither mineral shows any regularity; a stope looks good today, tomorrow it may show no ore at all. Sheelite is the easiest mineral to pass over, and is the most irregular in its occurrence; it is never low grade in the sense of being intimately mixed with other minerals, but occurs pure in irregular masses or small fragments. Two or three hundred pounds have been found about 10 miles northeast of Nogales. The pits from which it was taken are the ordinary assessment holes dug in searching for gold-copper-bearing quartz. The mineral was in sharp-angled fragments of practically pure scheelite, imbedded in the soft granite of the veins. Even now one can pan the dumps and obtain particles of the mineral about the size of a grain of wheat. These particles, while the mineral is markedly crystalline, rarely show crystal faces, and are not rounded at all. In some instances they are probably pseudomorphs; more likely they are simply fillings of small rough vuggs.

It might almost be given as a rule that all unprofitable gold mines should be looked over for tungsten minerals. All valuable high-grade ore has a habit of being very irregular in its occurrence. One sees a great many unfortunate investments in the way of gold mines, that have been induced by occasional bunches or pockets of rich ore in fine-looking quartz veins, that do not yield enough low-grade material between the rich pockets to sustain the expense of operating, or a sufficient number of pockets to make selective mining profitable. It must be an agreeable surprise to some of the owners to find that they have a profitable tungsten mine.

All the tungsten ores are very brittle; crush the ore to ¼-in. and then jig or screen through a 20 or 30-mesh screen, and nearly all the mineral will be obtained, this fact and its high specific gravity, makes it possible to obtain a marketable product with hand appliances. It slimes badly. The writer has seen it floating like mosquito larvae on the water of a pool below a rocker where placer ground was being washed. The addition of a concentrating table to an old stamp mill is an economic plant in the matter of initial cost. If a stamp mill is to be used, slime equipment will be required. It is much better to reduce the proportion of slimes by using slow moving rolls. Eventually, when the price of tungsten declines, it will be found necessary to devise some plan to save the gold, thereby gaining an income from both metals. It appears sometimes that there is an inverse ratio between the gold and tungsten, when the tungsten content of the vein becomes low, the gold is likely to increase.

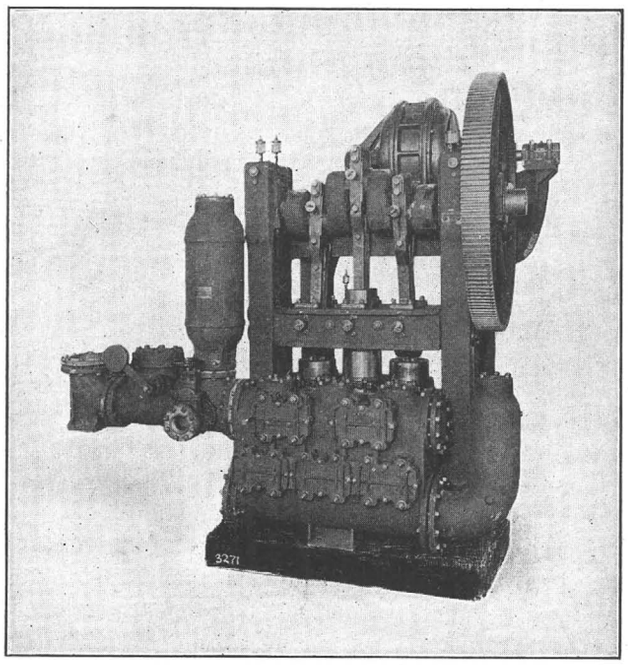
Sylvanite, sometimes called graphic tellurium, is a telluride of gold and silver. It sometimes contains lead and antimony.

An advertised brand is of itself a guarantee.

Modern High Economy Pumps for the Zinc Districts.

Companies in the lead-zinc mining districts, whose equipment in former years was notoriously crude and inefficient, are now installing pumps of the most modern type. The one shown in the cut, which has a maximum capacity of 1000 gals. per minute and was built for the Monmouth Zinc Mining Co., Hazel Green, Wis., offers an excellent illustration of this tendency.

It consists of a 11 by 12-in. Aldrich vertical triplex, outside-packed plunger electric pump of the divided water end type, single reduction, direct geared. Provision is made for mounting the motor on the top, as shown. The pump has also been furnished with two



ALDRICH ELECTRICALLY OPERATED PUMP.

pinions, one for giving a capacity of 850 gals. per minute at 58 rpm., and the other to deliver 1000 gals. per minute at 68 rpm., against a total working head of 240 ft. It is fitted with split hub and rim-cast steel, spur-cut gear, forged-steel motor pinion, cotboard bearing for extended motor shaft, check and by-pass valves, 12-in. suction and 8-in. discharge openings, bronze-lined throats, babbitt metallic packing, and a cast-iron pump base.

The pump is operated by a 75-hp., 3-phase, 60-cycle, 220-volt, General Electric squirrel cage induction motor. It has an extended motor shaft and is without bed plate or pulley, but complete with hand starting box. The synchronous speed is 600 rpm.; approximate full load speed, 570 rpm.

This installation is being watched with interest by the managers of other properties in the district and will undoubtedly be followed by others.

Pure metals are usually more malleable than their alloys.

Geology of Tungsten Deposits

By J. J. Runner*

† ALTHOUGH relatively a rare metal, tungsten is, contrary to popular opinion, widely distributed in nature. It is known to occur, although not in commercially important quantities in 19 of our States and in Alaska.

Tungsten occurs chiefly as the tungstates of iron and manganese, or of calcium, in the minerals, ferberite, wolframite, hübnerite, and scheelite. The difference between the first three of these minerals is of scientific rather than technical value; hence they will be discussed together.

Ferberite, wolframite, and hübnerite form an isomorphous series from $FeWO_4$ to $MnWO_4$. When the mineral is pure $FeWO_4$, or contains only a small percentage of manganese, it is called ferberite. Hübnerite is pure $MnWO_4$ or may contain a small percentage of iron. Wolframite is $(FeMn)WO_4$, in which the ratio of iron to manganese is more nearly 1:1 than in either of the other two. The following analyses will serve to illustrate:

	Tungstic oxide.	Ferrous oxide.	Manganous oxide.
Ferberite	75.68	24.47	0.12
Wolframite	76.00	16.00	7.70
Hübnerite	75.58	0.25	23.40

It will be noted that in all of these the percentage of tungstic oxide is nearly 76.

The minerals of this series vary from dark-brown in the varieties high in manganese to nearly black in the ones rich in iron. The streaks are dark-reddish brown to brownish-black. The common forms are tabular masses, disseminated grains, and in columnar crystals. Cleavage is perfect in one direction at right angles to the direction of elongation in the tabular forms. The hardness is about that of ordinary glass, the hardest being those rich in manganese. Specific gravity ranges from 7.2 to 7.5, the varieties high in iron being the heaviest. Lustres are sub-metallic. Among minerals frequently mistaken for the minerals of the wolframite series are hematite, magnetite, graphite, columbite, and cassiterite. The first three may be readily distinguished by their inferior weight and the last two by their inferior cleavage.

Scheelite, the tungstate of lime, $CaWO_4$, occurs in double-ended square pyramids and in massive forms. In color it is white, pale yellow, pale brown, greenish, or reddish. Its lustre is vitreous; the cleavage fairly good in four directions; the hardness is about 5 or less than that of ordinary glass; specific gravity about 6. Most specimens are translucent or transparent. It may be distinguished from the other minerals resembling it in color by its superior weight.

Other minerals of tungsten are:

Cupro-tungstite, $CuWO_4$, tungstate of copper.

Cupro-scheelite, $CuCaWO_4$, tungstate of copper and calcium.

Stolzite, $PbWO_4$, tungstate of lead.

Powellite, $Ca(MoW)O_4$, tungstate and molybdate of calcium.

Tungstite, WO_3, oxide of tungsten.

Meymacite, hydrous-oxide of tungsten.

The world's commercially important deposits of tungsten are almost wholly confined to the following five modes of occurrence: (1) quartz veins; (2) pegmatite dikes and tin-stone veins; (3) placers; (4) contact zones on the borders of intrusive igneous rocks; and (5) replacement deposits. Of these the first three are far the most important.

Among rocks, granite, granitic gneiss, and their fine-grained equivalents, are by far the most common associates of tungsten deposits. In some cases the orebodies lie wholly within these rocks, in other cases they extend into slate, quartzite or other rocks at the side, but in a majority of cases igneous rocks of the acidic type are to be found near-by. This applies with equal truth to each of the five types of occurrence. Tungsten deposits are usually in or in close proximity to metamorphic rocks also, such as slate, schist, quartzite, or crystalline limestone, for the very intrusion of the granite itself has in many cases brought about the metamorphism.

The mineral associates of tungsten also are well defined and characteristic. It is commonly accompanied by one or more of the following: quartz, muscovite, cassiterite, topaz, tourmaline, fluorite, beryl, biotite, bismuth, molybdenite, pyrite, arseno-pyrite, chalcopyrite, galena, sphalerite, gold, silver, and graphite. In the orebodies the tungsten minerals may occur finely disseminated and scattered through the gangue; they may occur in masses of various sizes up to a weight of many pounds, irregularly distributed throughout the orebody, or they may appear as crystals lining cavities. Many veins exhibit a banded structure with the tungsten minerals concentrated in definite layers, especially along the vein-walls.

Some interesting characteristics of a few of the commercially important deposits are as follows:

Those of Boulder county, Colorado, the principal source of tungsten in the United States, lie on the eastern slope of the Front range of the Rocky Mountains, about 30 miles north-west of Denver. The veins are

*Professor of Mineralogy, South Dakota School of Mines, Rapid City.

†Abstract from *The Pahasapa Quarterly.*

narrow fissures in granite and in porphyry dikes, accompanied in places by breccia. The ore-mineral is ferberite, finely disseminated through quartz or lining cavities. The deposits have been opened to a depth of 600 ft. and are said to show no signs of impoverishment.

Second in importance among American occurrences are the deposits of Atolia, in San Bernardino county, California. Here the ore-mineral is scheelite, in seams and veins varying from thin stringers to widths of four feet, in grano-diorite and schist. The gangue consists of quartz, calcite, and crushed country-rock. The ore is at present being mined down to 600 feet.

In the Dragoon mountains of Arizona hübnerite occurs in vertical quartz veins in granite, with a little muscovite and fluorite. The hübnerite occurs distributed through the quartz in tabular masses, some reported to weigh 500 lb., and in layers along the vein-walls. In the Arivaca district of the same State, hübnerite occurs in tabular masses and blade-like crystals in gold-bearing quartz veins.

In White Pine county, Nevada, hübnerite and scheelite occur in quartz veins occupying fault-fissures, associated with fluorite, pyrite, muscovite, and minerals of copper, lead, zinc, and silver. The veins range from thin stringers to thicknesses of 11 or 12 ft.; some are very rich.

In the northern Black Hills of South Dakota deposits of wolframite lie in the Cambrian dolomite, associated with the flat-lying masses of refractory silicious ores, north of Lead, and on the divide between Yellow and Whitewood creeks south-east of Lead. The wolframite appears in flat, horizontal, but irregular masses, and in many places seems to form a rim around the silicious ore-shoots, except on the under side. In other places it is found in thin stringers. Its mineral associates are pyrite, fluorite, barite, and occasionally gypsum.

Near the granitic area of Harney Peak in the southern Black Hills, wolframite exists in pegmatite. Similar occurrences have been found near Tinton in the Nigger Hill district. In the southern hills also, quartz veins bearing wolframite, tourmaline, muscovite, and graphite are being worked for their tungsten content. The veins dip steeply, cut across the bedding of the slate for the most part, in lenticular masses from a few inches to 2 or 3 ft. wide. The wolframite is inter-grown with quartz in tabular masses in places estimated to weigh 8 or 10 lb. Many of the veins show a banding parallel with the walls.

In Burma and the Shan States, which have become the world's greatest producers of tungsten, the ore is wolframite, found as nodules and granules in alluvial deposits. The parent lodes lie at the northward extension of the granitic backbone of the Malay Peninsula, which farther south has furnished the great tin deposits of the Malay States. In these lodes the wolframite is associated with quartz and tin-stone. At present mining is confined to the placers.

In Portugal, which ranks third as a producer, wolframite is accompanied by scheelite and tungstite, in veins and stockworks, with cassiterite, pyrite, chalcopyrite, arseno-pyrite, and often mica, tourmaline, and fluorite.

In Cornwall, greenstones and slates have been intruded by granite, and these in turn by dikes of quartz-porphyry. The mineral-bearing lodes are for the most part parallel with the dikes, and in many places occupy fault-fissures. Impregnations of country-rock along the lodes are common. Within the lodes the ore is irregularly distributed in bunches and pipe-like masses. The ore mineral is chiefly wolframite, with which is found cassiterite, pyrite, arseno-pyrite, chalcopyrite, quartz, feldspar, and tourmaline. Locally, ores of nickel, cobalt, lead, zinc, and uranium are found in the higher levels, while antimony, bismuth, and molybdenum have been produced in commercial quantities. The wolframite follows contacts between granite and slate.

In Spain deposits of wolframite are found in quartz veins with scheelite, cassiterite, mica, rutile, and feldspar cutting gneiss and gneissic granite, and in alluvial deposits derived therefrom.

In Bolivia wolframite is found in veins associated with cassiterite, bismuth, copper, and silver.

In Peru hübnerite occurs in veins following contacts of granite with slate and quartzite.

In Queensland and New South Wales wolframite occurs in quartz veins, in greisen, and in placers with chlorite, muscovite, biotite, topaz, fluorite, beryl, cassiterite, and bismuth and molybdenum minerals. The production of these two Australian States is of considerable importance.

The persistence of tungsten deposits in depth and the maintenance of metal-content are questions of vital importance. Unfortunately but few deposits have been developed sufficiently to determine their true nature, so that we have not enough data upon which to base definite conclusions.

CALUMET & HECLA drilling practice, with the Carr bits on hollow inch steel used in mounted hammer-drills, employs a $\frac{1}{16}$-in. difference of gauge for each 22-in. change of steel, says the *Canadian Mining Journal*. On the Osceola lode, the difference in gauge for $\frac{7}{8}$-in. steel is only $\frac{1}{16}$-in. for every second change or 44 in. For the tough, irregular conglomerate ore, as distinguished from drilling in amygdaloid and trap-rock, piston-drills are retained; the gauge is changed $\frac{1}{16}$-in. every foot, and a 'cross-Carr' bit has been devised for the conglomerate in which the single bit tends to fitcher. These improvements have increased the efficiency of the miners 40%, as the drilling speed varies inversely with the volume of rock cut or as the square of the diameter of the hole, and the reduced gauge has made it possible to start a hole with a much smaller diameter. Apart from this, the Carr bit drills but little faster than the ordinary cross-bit. No lugs are used on the steel for mounted hammer-drills but anvil-block chucks and plain shanks are employed. By drilling deeper holes for stoping (12, 14, and 16 ft. in amygdaloid and 10 ft. in conglomerate) a saving of 20% is made in dynamite.

Tungsten file

December 3rd, 1935

Mr. Joe Strotjust
Camp Wood Route
Prescott, Arizona

Dear Mr. Strotjust:

I am enclosing a couple of photographs recently taken at your ranch in which you will have no difficulty in recognizing your pet doe and Mrs. Strotjust. The man standing beside the automobile is Mr. Harbauer who accompanied me on my trip and I am glad that these pictures turned out so nicely.

Since last seeing you I went hunting in the Mogollons but could only get away at the end of the season and did not have much luck with the deer or turkey.

I hope that things are going well with you and that there is some activity in the development and operation of the tungsten properties in your vicinity. If the prospects on your claims and those of Mr. Eckels should be opened up to some extent and any substantial ore bodies developed I would be glad to hear from you, as I might find opportunity to come up your way again.

With personal regards to you and to Mrs. Strotjust.

Sincerely,

GMC:DF