Manganese Boulder.

Road to Top of Mtn

Trench - With Manganese
Ore

Manganese
Boulders
outcrop -

Road to Top of Mountain

E. S. WHITE
CONSULTING GEOLOGIST
AND MINE OPERATOR
P. O. BOX 416
MENA, ARK.

Duncan, Dieckman & Duncan Mining Co.
605 Walnut Street
St. Louis, Missouri

Gentlemen:

Enclosed herewith find Geological Report, as per your request, on your property in Sections 3, 4, 5, 8, 9 and 10, Township 4 South, Range 30 West, Polk County, Arkansas.

The sources of information from which the data for this report was compiled, are as follows, viz:

Bulletins and Professional papers of the U.S.G.S.
Publications of the Arkansas State Geological Survey
Reports from the U. S. Bureau of Mines
Seven years of field work by the writer, in prospecting, examining and developing manganese deposits of the Ouachita Mountain area of Arkansas and Oklahoma, including three years research on concentration of manganese ores, using my own pilot plant.

Very respectfully,

E. S. White

July 27th, 1949

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LOCATION

The immediate area, under examination and discussion in this report, lies in Sections 3,4,5,8,9 and 10, T.4S., R. 30 W. Polk Co., Ark., is in the Ouachita National Forest and is covered by the DeQueen quadrangle of the U.S.G.S.

The nearest shipping point is Vandervoort, Ark., on the main line of the Kansas City Southern R.R. and is about 10 miles from the west end of your property.

TOPOGRAPHY, DRAINAGE AND CLIMATE

Lying, as it does, on the southwest flank of the Cossatot Mountains, the topography is characterized by steep sided mountains and narrow valleys, the area having a maximum topographic relief of about 1,000 feet.

The drainage is to the west and south into Cossatot River. Brushy Creek which flows across the west end of your property and empties into Cossatot River, a few miles to the south, will furnish an ample supply of water, all of the year, for milling operations.

The climate of this area is mild and is free from extreme cold in Winter and the nights are cool in the Summer thus making for good working conditions all of the year.

The rainfall is sufficiently abundant to produce a heavy growth of timber over the area and there is an ample supply of good pine and oak on your property for mining and milling operations.

The general area in which your property is situated has good all weather roads leading into the forest and to Mena, the County Seat and to Hatfield, Cove and Vandervoort all on the Kansas City Southern Railroad.

STRATIGRAPHY

The rocks exposed in this immediate area are, in ascending order,: the Blaylock sandstone and Missouri Mountain slate of Silurian age, the Arkansas Novaculite of Devonian age and the Stanley shale of the Lower Carboniferous.

The Blaylock sandstone, which is this area rests unconformably upon the Polk Creek shale, of the Ordovician, is the basal formation of the Silurian and is composed of fine grained gray or green sandstone and dark shale slightly micaceous. Most of the sandstone is hard and quartzitic and occurs in even bedded strata from 1 to 6 inches thick. The shale is much jointed and the joints in both the shale and sandstone are sometimes filled with milky quartz. The thickness in this area is about 600 feet.

The Missouri Mountain slate of the Silurian rests unconformably upon the Blaylock sandstone and consists of soft shale and sandstone, slate and some quartzitic sandstone in layers 3 to 5 inches in thickness. The unweathered shale is gray, green, red or black but when weathered the color is green, buff or dark brown, the slate is mostly soft but in some localities is of fair grade. The thickness of this formation in this area is probably not over 100 feet.

The Arkansas Novaculite of Devonian age rests conformably upon the Missouri Mountain slate. The Novaculite is divided into three members, viz: a lower member of massive white novaculite composed of even bedded layers from 6 inches to 10 feet thick and it has a conchoidal fracture.

The rock is very hard and dense and usually contains 99. or more percent of silica. The color is sometimes brown or gray caused by iron and manganese oxides and carbonaceous materials. In this area its thickness is about 400 feet.

The middle member of the Arkansas Novaculite formation is a hard, black dense cleavable shale and slate and thin bedded dark dense novaculite containing some calcite and pyrite. The thickness of this member, in this area, is probably about 300 feet.

The upper member of the formation is a gray massive hard and somewhat dense calcareous material, usually in beds from a few inches to several feet in thickness and while it retains most of the characteristics of the other members of the formation it is more porous and softer than the others. The thickness of this member, in this area, is about 200 feet.

The Stanley shale of Mississippian age overlies, unconformably, the upper member of the Arkansas Novaculite with usually a basal conglomerate of worn novaculite pebbles. The formation is composed principally of slaty shale and sandstone. The unweathered shale is usually blue black which turns to green or brown upon weathering.

The sandstone is in layers from 2 inches to 3 feet interbedded with the shale and is fine grained bluish gray to gray when unweathered but turns soft, porous and darker when weathered. Thin veins of quartz are usually found in the Stanley shale, its thickness in this area is about 5,000 feet.

GEOLOGIC HISTORY

The Paleozoic sediments, which include the Carboniferous, Devonian and Silurian, of this report, were deposited in a geosynclinal basin that lay north of a land area occupying the present region of Louisiana and East Texas and south of the present Ozark region, which was land during most of Paleozoic time.

The sediments were derived mostly from this southern land mass and the material for the bed of tuff in the Mississippian rocks was ejected from volcanic vents that were active during a probably mountain making epoch on the southern land. The shallow water nature of most of the sediments indicates that the bottom of the geosynclinal basin gradually subsided during their deposition.

The rock strata were deformed by folding and faulting near the middle of the Pensylvanian epoch of the Carboniferous, by compressive movements from the south.

This deformation has compressed the strata into about half of their original horizontal extent.

STRUCTURAL GEOLOGY

In this area the formations due to compressive movements have been intensely folded, resulting in a high order of fracturing and brecciation in the Novaculite formation, a competent formation, and compacting and crumpling in the less competent formations, as the Missouri Mountain slate and the Blaylock sandstone.

This folding has resulted in the development of a steep s ided over turned asymetrical anticline in the north part of Section 3, T.4S., R. 30 W. with a strike about N. 80 W. and extends into the west part of Section 5 where a plunging anticlinal nose seems to be developed. The novaculite formation covers most of this anticline and has a dip to the north and east in the truncated beds on the surface which would be the normal dip

for beds overturned to the south and the original top of the fold eroded.

The value of this fold or anticline to your mining property is that the folding produced a highly factured and brecciated condition in the competent novaculite beds, extending the entire length of your property from east to west, therefore a favorable host rock for the circulation of ground waters and the precipitation by them of the manganese minerals carried in solution, and probably derived from the enormous amount of material which has been eroded from above the present top of the truncated beds which form the novaculite ridges of the area, in this connection the following is quoted from U.S.G.S. Bull. 808 by H. D. Miser and A. H. Pardue "Physigraphic History; The highest ridges of the Ouachita Mountains in the quadrangles attain an elevation of 2360 feet above sea level, but 18,000 feet or more of Paleozoic rocks have been removed from above the crests of these ridges. The available evidence indicates the presence of two peneplains called the Ouachita and Hot Springs".

ECONOMIC GEOLOGY AND ORE DEPOSITION

The Arkansas Novaculite was a competent formation at the time of the intense folding and faulting, attending the compressive movement from the south, during Carboniferous time, when the Ouachita Mountains were formed, and therefore did not compact as the less competent underlying Missouri Mountain slate and Blaylock sandstone did, but instead was sheared and fractured resulting in much faulting, jointing, fracturing and brecciation in the novaculite beds, thus creating a condition in these beds, favorable to the deposition, through the action of surface and ground waters and chemical changes, of manganese and iron minerals, mostly oxides, which were probably derived from minerals in the enormous amount of material eroded from above the present top of the truncated beds, and deposited in the more porous and permeable parts of the novaculite beds, which seems to be the upper part of the lower member of this formation and the upper calcareous part of the upper member of the novaculite formation.

In the published literature there seems to be some difference of opinion as to the origin of the manganese and iron oxide deposits. In the writers opinion there was a concentration of these minerals in the upper part of the upper member and the upper part of the lower member of the Arkansas Novaculite formation subsequent to the fracturing, jointing and brecciation of these beds.

Therefore it seems reasonable to assume that the depth of the manganese ore deposits in the novaculite beds, as they are at the present, taking into consideration the removal by erosion of the material above the present tops of the beds, would depend to a large degree on the position of, particular beds under examination, with reference to whether or not their position on the fold as it was progressively developed, was favorable or not for the folding movement to produce a maximum of faulting, jointing, fracturing or brecciation of the beds and therefore the degree of porosity and permeability to be expected in the present truncated beds.

There are at least two locations, in the Ouachita Mountain area, where continuous manganese ore deposits can be observed and measured at the present time, to a vertical depth of 117 feet and 175 feet respectively.

One is at the North American Manganese Corp'n mine on the Black Springs Lumber Company property in Sec. 7, T.5S., R. 25 W., Pike County, Ark., where ore was stoped out from the 117 foot level to the surface and ore can be observed from the top to the bottom at the ends of the stope.

The other is on an eroded bluff on East Saline Creek, in Sec. 29, T. 4 S., R.28W., Polk Co., Ark., the ore beds in this deposit dip 70 degrees from the horizontal N 5 degrees east and are on the north limb of an over-

turned anticline, overturned to the south.

Your property is on the north limb of an overturned anticline and with the overturn to the south. The location of the two deposits, with reference to the exposed rocks of the underlying Missouri Mountain slate and Blaylock sandstone is about the same.

The position, of the two deposits, on the fold is about the same. The strike and the angle of dip of the beds in the two deposits is about equal therefore in the opinion of the writer it is reasonable to expect similar conditions as to the depth of the two deposits particularly on account of the high degree of fracturing, jointing, brecciation and mineralization of the beds on your property.

The manganese minerals found on your property are the oxides psilomelane and manganite and the dioxide pyrolusite, psilomelane predominating. The psilomelane is a black or blue black mineral with a shell like fracture. It is usually found in a massive non crystalline form and has a density of 3.7-4.7 and a hardness of 5-6 and contains 45-60% Mn. It is difficult to scratch this mineral with a knife and its streak is brownish black shining. Pyrolusite is an iron black mineral with either crystalline or granular structure has a density of 4.75 and hardness of 2-2.5 and often will soil the fingers, steak black or bluish black contains 60-63 Mn. Manganite is a black, brittle massive or crystalline mineral, density 4.2-4.4 hardness 4.0 streak reddish brown or black, contains 62.4 Mn.

The iron oxides found in connection with your manganese ore are the Limonite, density 3.6-4.0, hardness 5-5.5, color brown, streak yellow, Hematite, density 4.9-5.3, hardness 5.5-6.5, brittle, dark steel gray or iron black, streak cherry red or reddish brown.

The manganese ore found on the surface along the top of the novaculite ridges on your property is at the top of the lower member of the formation and is in lumps of from 2-30 lbs. nearly free of rock but the larger amount is found in factured and brecciated boulders and in mineralized ledges in place, some of these ledges stand 10 feet above the surface and some are 15 feet across their strike which is N. 20 W. with a 60 degree dip to the north and east. Following along the ridge where the ore body, in place, is not exposed, float ore will be found either on top of the ridge or down its sides. This condition exists almost without a break for the entire length of your property, about 16,000 feet.

The following is taken from U.S.G.S. Bull. 808 By H. D. Miser and A. H. Purdue "Geology of the DeQueen and Caddo Gap Quadrangles."

MANGANESE ORE.

"Only the general geologic and economic relations of the manganese deposits will be discussed here.

The manganese deposits occur in the mountainous parts of the quadrangles. They are found in the Arkansas novaculite and are mainly confined to two stratigraphic horizons, one in the upper division of the formation and the other near the top of the lower division. Some deposits, however, are found in other parts of the lower division. The Arkansas novaculite and other formations have been thrown into a series of folds whose trend is parallel with the ridges. This formation is very resistant; the upturned edges stand up as ridges on which rock ledges or their debris abound.

The beds at the two ore horizons, which show ore at the surface in many places, <u>may thus be followed for long distances along the slopes</u>, and their outcrops, owing to the numerous folds, are repeated on the slopes or crests of the many parallel ridges, or even on a single ridge. The outcrops of these ore-bearing beds are sometimes called "lodes" or "leads."

The depth to which the ore extends is not known. An 8 ft. vein of solid manganese ore is, however, reported to have been found in the lower tunnel at the North Mountain mine at a distance of about 615 feet from the portal. This tunnel is 250 feet above the road along the south base of North Mountain; it is 530 feet below the crest of the mountain and is 216 feet below the upper tunnel, which penetrates the exposed ore body near its main outcrops.

At other places ore is found only in the present shallow workings. These workings and the outcrops of ore occur at all altitudes on the high ridges, from the level of the streams that cut through them up to their crests, which are even and probably represent a Cretaceous peneplain.

The deposits that have been examined range from 900 to 1800 feet above sea level, but the greatest difference in altitude in any single locality is about 800 feet. This range does not necessarily mean that a shaft sunk from the crest of a mountain would find ore at a depth of 800 feet or that a tunnel driven into the base of a mountain 800 feet below its crest would find ore, for the lower limit of the ore, which may not extend much below water level, may be higher in the mountains than in the valleys, just as the water level is higher in the mountains than in the valleys.

The mode of occurrence of the manganese ores in the Arkansas novaculite are intimately associated. The novaculite is regarded by the writers and some others as being deposited through chemical or organic processes or both, and thus belonging to the class of cherts. The manganese was probably deposited as a manganese-bearing calcite at the two main ore horizons, but some of it was doubtless deposited as carbonate in other parts of the novaculite and in the overlying and underlying shales.

The concentration of the ores has been effected by ground water, which has carried down their constituents from the vast mass of rock that has been eroded from the region. The local concentration of the ores into deposits large enough to be of value appears to have been dependent upon the amount of open space in the Arkansas novaculite, which is hard and compact and usually has no visible openings between the layers or along the joints.

The places where the fissures are largest and most numerous would be most favorable for the circulation of underground water and consequently for the deposition of the ore, little of which replaces the novaculite.

The fissures were formed during the folding, faulting and fracturing of the novaculite late in the Carboniferous period. The ores would be expected to occur in those places where the novaculite has undergone much fracturing and close folding, as on and near faults and at the noses or ends of plunging anticlines. A number of such places where deposits occur have been observed. It is noteworthy that many cold springs, and even the Hot Springs at Hot Springs, Ark., issue on the noses of plunging anticlines, showing that such places are especially favorable for the circulation of ground water.

The manganese deposits have been worked only in a very small way and so far have yielded not more than a few hundred tons of ores that have been sold. Most of the work has been done during two periods of activity, one beginning about 1885 and ending in 1889, and the other beginning in 1915 and still in progress".

DEVELOPMENT

During the Winter of 1948-49, under the writers supervision a number of open cuts and tranches were made on your property in order to ascertain the following information, 1st. The geological and structural aspects of material in place. 2nd. Manganese content of the deposit, 3rd. The extent of the deposits, 4th. The susceptibility of the ore to concentration. The locations of these openings are shown on map 1, of this report and sketches of the openings are shown on map 2, of this report.

No., An open cut, 50 feet in length 5 feet deep and 4 feet wide. The manganese found in this cut is in the form of psilomelane and manganite, the former predominating in quantity, both of these minerals are hard and occur in vertical veins from ½ to 2 inches thick and scattered through the brecciated beds and fractures in the hard thin beds of novaculite, which are in place. Some clay is found associated with the ore. An analysis of an average sample from this cut will be found Assay sheet No. 1, of this report. This cut is still in ore on the South and in floor and walls.

No.1-A, A pit 8 feet long 3 feet deep and 3 feet wide. At the base and a little northwest of a ledge of mineralized novaculite in place and boulders of mineralized boulders, the rocks are about 10 feet high and 12 feet wide are highly brecciated and mineralized and very hard, gray white. An analysis of an average sample from this pit will be found on Assay sheet No. 1, of this report. This pit still in ore in floor, walls and South end.

No. 2, A trench 20 feet in length 5 feet deep and 4 feet wide, primarily dug in attempt to find north wall or hanging wall. No samples taken.

No. 3, An open cut 150 feet South and 50 feet lower in elevation than No. 1, is about 25 feet in length 6 feet wide and 7 feet deep at breast, the ore mostly psilomelane is found in red clay interbedded with comparatively soft gray novaculite with ore in the fractures of the rock, not the same material as in No. 1 and is a separate deposit strike is same but beds have a dip of from 20 degrees at the south side of the deposit to 45 degrees at the breast, beds seemingly in place. This cut still in ore in walls, floor and breast. An analysis of average sample from this cut will be found on Assay sheet No. 1, of this report.

No. 4, An open cut 20 feet in length 8 feet wide and 7 feet deep at breast, the ore is found in red clay beds in the bedding planes of the brecciated and fractured novaculite One strata of ore, nearly free of rock, 1 foot thick cuts across the floor of the cut in an east west direction the same as the strike of the beds and one pocket of high grade ore about 1 foot in diameter is in the breast of the cut near the floor. Most of the ore in this cut is a hard psilomelane with some oxide of iron with it. This deposit is, in my opinion on the same deposit as No. 1 and No. 1-A and is about 1500 feet west of No. 1. An analysis of average ore sample from this cut will be found on Assay sheet No. 1, of this report. This cut still

in ore in floor, walls and breast.
The character of the material and degree and type of fracturing is the same as that in openings 1-A, 1. and 4 seems to be on the same vein.

No. 5, A trench in the SE¼ of the SW¼ of Sec. 6, T. 4 S., R. 30 W., about 8,000 feet along the strike of the ore body from open cut No. 4, is 20 feet in length 5 feet deep and 4 feet wide. The manganese, mostly a hard psilomelane, occurs in thin beds, maximum, 2 inches, of highly fractured and brecciated novaculite, with some red clay. The beds dip about 60 degrees to the north and east. There is a small amount of iron oxide on the South side of the ore body. The analysis of a composite sample from this trench is on assay sheet No. 1, of this report. This trench still in ore, in floor, walls and North end. A good road has just been completed, as shown on map No. 1, of this report, which will enable you to get material and equipment necessary for mining operations up to the top of the Mountain and to bring ore down to the mill.

POTENTIAL ORE RESERVES

An estimate is the correlation of tangible facts susceptible to proof, therefore an estimate of a potential ore reserve, in tons, in place, would have to be based on measurements of length, thickness and width, also the average density of the ore in place, which would be manifestly impossible, unless the ore deposit was 100% homogeneous, which, in the metallic mineral ore deposits, none of it is. Therefore in an estimate there is an assumed average density used that is based upon the known density of composite samples taken from the ore body. A correct or incorrect interpretation and correlation of the geological evidence is also used in arriving at a conclusion or estimate. A correct conclusion depends upon experienced knowledge, integrity and ability to read Nature's geological sign-boards.

A considered opinion, of a potential ore reserve, is an estimate based on the correlation of all tangible facts susceptible to proof and the projection of known facts, by the use of the Laws of dynamic earth movement, sedimentation and mineral deposition. Here too a correct conclusion depends upon experienced knowledge, integrity and ability to read Nature's geological sign-boards.

Development so far, on your property, has proved at five points, widely spaced, along the strike of your ore body, that, at the five opening the ore body has an average thickness of 13 feet with a maximum depth of 7 feet and that there is still ore in the floors, walls and breasts of the openings. These bedded deposits all have approximately the same angle of dip to the North, the entire length of the property, some 16,000 feet, indicating that the same folding movement was operating, with the equal intensity along the entire length of the ridge, upon which your property is located, and producing a uniform degree of fracturing and brecciation in the novaculite, which is 99.% silica, beds and therefore the same degree of porosity and permeability, in the beds, for the action of the circulating waters in their deposition of manganese minerals in these beds.

Manganese minerals are found on the surface, along the ridge with only a few breaks in the line of occurence, where the leaves and debris are thick, either in the form of fractured and mineralized and almost vertical novaculite beds, in place, fractured and mineralized novaculite boulders or fragments of fractured and mineralized novaculite float, either

on the top of the ridge or down its side, the entire length of your property.

It is a known fact that mineralized beds, upon weathering, produce mineralized float and that non-mineralized beds do not produce mineralized float, therefore where fractured mineralized manganese float is found on or on the side of a novaculite ridge, a bed of fractured and mineralized novaculite can be found near or above the position of the float. All of the above mentioned material is fairly uniform as to character of material, fracturing and mineralization.

Therefore, taking the above facts and premises into consideration, my considered opinion is that when you get the deposit opened up to an extent sufficient to mine and deliver to the mill a tonnage of 300 tons of mine run ore daily, that you will have proved up a sufficient reserve of commercial grade ore, at the present or somewhat lower price of manganese, to supply your mill for a long time.

ESTIMATED COST OF OPERATION

Using the combined results of Assay sheet No. 1, of this report, we find that the average metallic manganese content of the ore deposit sampled and assayed, would be 14.5 per cent and using the report of the Bureau of Mines, apart of this report, on their concentration test on ore from this same deposit and same character of ore, but having a metallic manganese content of 24.0 per cent, which would mean a concentration ratio of 3.5:1. In an ore having a metallic manganese content of 14.5 the concentration ratio would be approximately 5 : 1 or in other words it would require 5 tons of mine run ore to produce 1 ton of concentrate, assuming that the mechanical combination of the mineral and gangue in the ore is the same as that of the 24.0 per cent ore used by the Bureau of Mines, which it is.

In their tests the Bureau did not crush below - 10 mesh and only produced 14.4%, containing 10.9% of the total manganese in the head sample, of the head sample as a middling, or included grains, requiring finer crushing to free the mineral from the gangue material. This test proves that your ore is very amenable to gravity concentration, by tabling, which is very important as it indicates that only a small percentage will require fine grinding and flotation concentration.

Using a concentration ratio of 5 : 1, after the ore deposit has been equipped for economical mining and loading into trucks, the costs of producing a ton of concentrate will be;

Mining - labor, power and supplies	5 tons @ $1.00 per ton	$5.00
Mucking into truck loading bins	5 tons @ .25	1.25
Hauling crude ore to mill	5 tons @ .75	3.75
Millin g - labor, fuel and supplies	5 tons @ 1.00	5.00
Hauling concentrate to sintering plant at Railroad		2.00
Sintering - labor, fuel and supplies		2.00
Total cost F.O.B. cars		$ 19.00

In mining from the west end of your property and mucking directly into ore bin at mill, the above estimate will be too high. Less trucking would be $15.25

SUMMARY AND CONCLUSIONS

Prospecting and development work on the property so far has proved:

1. That five places some distance apart, as shown on Map No. 1, along the strike of the ore body, in an east west direction on your property, in Sections 3,4,5,8,9 and 10, T. 4 S., R. 30 W., Polk County, Arkansas, as far as development has been done, prove that ore deposit has sufficient width to permit and justify open cut mining and power mucking.

2. The results of the assays on composite samples from these five openings, shown on Assay sheet No. 1 of this report, on the ore body show a sufficient metallic manganese content of the ore to make it a commercial grade ore and the results of the concentration test by the Bureau of Mines, and given in this report, prove that a high recovery can be made of the manganese in this ore by gravity concentration without excessive crushing, costs and that mining and milling of this ore deposit is justifiable from an economic viewpoint

RECOMMENDATIONS

Now that your road has been built to the top of the mountain, as shown on Map No. 1 of this report, I would recommend that a small portable air compressor be obtained and that development work be continued on openings already started, beginning at No. 4, in order to ascertain the maximum width of minable ore at these points, as I am confident that this added work will show that the minable part is quite a bit wider than the present development shows, and that composite samples be taken from each opening and mixed, making a composite sample of about 700 lbs. to be sent to the Bureau of Mines, at Rolla, Missouri, to find out whether or not they can eliminate any appreciable amount of waste rock without too much loss of manganese, before tabling or crushing for tabling, as it is very important to eliminate as much waste rock as possible, as early as possible, in the flow sheet of a mill, in order to increase capacity and efficiency of machines and cut down crushing costs.

In the event the iron content of the concentrate becomes excessive, you can install a small roasting furnace and magnetic pulley. In that way, you can remove the iron, either in the form of oxide or sulphide, as roasting will render the iron magnetic and then can be removed with the pulley. This would give a magnetic iron product for sale, and a premium grade manganese concentrate.

ENGINEERS
INSPECTIONS and TESTS

No. 1

CHEMISTS
INDUSTRIAL and ANALYTICAL

The Bruce Williams Laboratories

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July 14, 1949

Duncan, Dieckman & Duncan Mining Company
605 Walnut Street
St. Louis, Missouri

Attn: Mr. Wm G. Duncan

551793 Sample #1, Quartered from 100# sample from continuous channel sample 12' in length along wall of open cut #1 by E.S.White 6/30/49.

551794 Sample #1-A, Quartered from 50# continuous channel sample 8' in length from wall of open cut #1-A by E.S.White 6/30/49.

551995 Sample #3-B, Quartered from 110# continuous channel sample 13' in length from floor of open cut #3 by E.S.White 7/8/49.

551996 Sample #4-B, Quartered from 110# continuous channel 13' in length from floor and breast of open cut #4 by E.S.White 7/8/49.

551997 Sample 5-B , Quartered from 120# continuous channel sample 14' in length from floor of open cut #5 by E.S.White 7/8/49.

		551793	551794	551995	551996	551997
Manganese	Mn	14.60	11.30	10.65	22.90	12.55
Iron	Fe	1.20	3.50	5.20	12.00	4.50
Phosphorous	P	0.09	0.15	0.20	0.52	0.16
Silica	SiO_2	66.32	73.84	60.78	39.40	63.11
Alumina	Al_2O_3	4.98	1.70	3.86	1.90	3.14

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E. S. WHITE
CONSULTING GEOLOGIST
224 NORTH STREET
JACKSON, MISSISSIPPI

Mena, Ark. 1/8/49

Messrs. Donald & W.G.Duncan
Waldron
Ark.

Gentlemen:-

Attached hereto is a report of results of development work, up to date, on your mining claims in Twp. 4 South Range 30 West in Polk County, Ark.

Very respectfully

E. S. White

Results of Development Work to 1/8/49.

No.1. A trench, as shown on map accompanying this report, is 50 feet in length 5 feet deep and 4 feet wide and shows a good grade of milling manganese ore with some "free" ore for a distance of about 10 feet in the walls and in the floor of the trench, the ore is found scattered through a hard fractured novaculite and clay gangue.

No.2. A trench about 20 feet in length and about 5 feet deep with only a small showing of ore.

No.3. An open cut about 150 feet south and 50 feet lower in elevation is about 25 feet in length, 7 feet deep and 6 feet wide with good manganese milling ore, with some free manganese ore for a distance of 15 feet in the walls, floor and breast of the cut. The ore and gangue materialan altered and fractured novaculite and red clay seems to be in place and I believe that further development on this deposit will open up a good ore body of considerable length and width and should extend down.

No.4. An open cut 20 feet in length, 8 feet wide and 7 feet in depth at the breast and about 1500 feet west of No. 1 shows good milling manganese ore about 12 feet in width, in an altered and fractured fairly soft novaculite with quite a bit of red clay, seemingly "in place" but showing considerable limonite, this iron may decrease with depth. Nos. 1 to 4 are in the north part of sec. 10 4S. R. 30 W.

No.5. A trench, in the S.E. ¼ of Sec. 5,T. 4 S. R.30 W., 20 feet in length and five feet deep shows good manganese milling ore 12 feet in width in the walls, floor and north end of the trench. The ore is in a highly fractured and altered novaculite brecciated material with a misture of red clay seemingly "in place". This trench is 25 feet lower in elevation than a good manganese exposure about 50 feet east and approximately 300 feet higher in elevation than Brushy Creek about one half mile to the west.

Summary and Recommendations.

In the writers opinion, the ore deposits shown up by development work as above described, have a reasonable chance of extending the entire length of your property, some 15,000 feet and should attain considerable depth as the writer has observed two manganese deposits which show to be continuous to a depth of 135 feet and 175 feet respectively, the first mentioned is on the property of the Black Springs Lumber Co's property about 12 miles west of Glenwood, Pike Co. Arkansas where a shaft was sunk to a depth of 117 feet in good milling and free manganese ore and with a solid body of high grade shipping ore 9 feet in width at the bottom of the shaft, later an upraise was driven into the ore body 18 feet deeper.

The other is on property owned by the writer and situated on East Saline Creek, in a bluff, about 3/4 mile east of Shady Lake, in Sec. 32 T.4.S.R. 28 W. Polk Co. Arkansas, where there is good manganese milling ore with a vertical depth of 175 feet from the top of the ore body to water level in East Saline Creek.

There fore in the writer's opinion there is a strong probability that the ore deposits opened up, on your property will extend down to a considerable depth.

Assuming that the ore deposits, as shown by development work to date, extend from one end of your property to the other, in east west direction which assumption is reasonable from the presence of float manganese ore along the top and sides of the novaculite ridge extending the entire length of your property, and that the ore deposit does not prove to be any wider or deeper than at present stage of development there would be approximately 150,000 tons of good milling ore.

Recommendations.

Would recommend that trenching be continued on the west end of your property, in order to prove the probable depth of the ore body and that then the ore body be cut at the level of the lowest exposure at 1,000 feet easterly along the strike of the ore body and at 2,000 feet easterly along the strike, either by drifting or open cuts and I believe that considering the local topography that this would be more economical than sinking shafts.

This should prove up a much larger body of ore. The erection of a concentration plant on your property which in the writer's opinion should be located on the west end of your property, just east of the road. A plant here would be on a good all weather road and near Brushy Creek which will afford ample for even an extensive operation.

The term milling ore where used in this report is ore that in the writer's opinion, can be mined and milled at a profit.

Very respectfully,

Geologist

A. H. HOLLAND, Pres-Treas. EDMUND E. PHILLIPS, Vice-Pres. and Gen. Mgr. M. E. HOLLAND, Secretary

OUR MOTTO: WHAT THERE IS IN IT, NO MORE, NO LESS.

THE COLORADO ASSAYING COMPANY

(INCORPORATED)

ASSAYERS AND CHEMISTS

2013 WELTON STREET

DENVER, 1, COLORADO. Feb. 18, 1949.

REPORT ON DETERMINATIONS MADE FOR — Mr. Wm. G. Duncan,
St. Louis, Missouri.

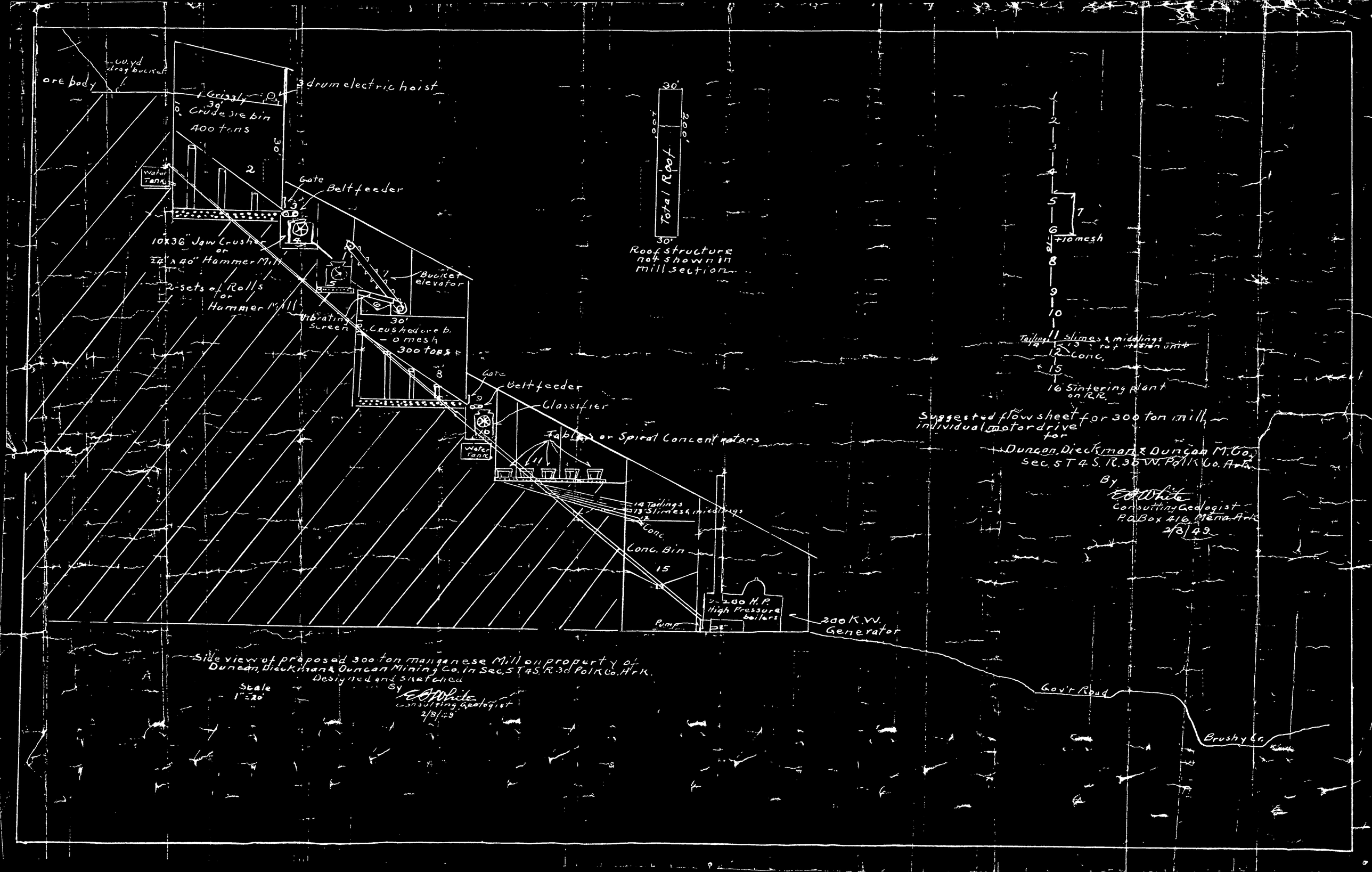
SAMPLE MARKS	METALS	Amount per Ton Ozs.	Amount per Ton Hds.	PER CENT	Value per Ton Dollars	Value per Ton Cents
Trench #1	Manganese			45.50%		
	Iron			8.40		
	Phosphorus			0.504		
	Silica (insoluble)			1.35		
Trench #3	Manganese			45.30		
	Iron			8.15		
	Phosphorus			0.483		
	Silica (insoluble)			1.94		
Trench #4	Manganese			47.85		
	Iron			5.60		
	Phosphorus			0.449		
	Silica (insoluble)			1.65		
Trench #5	Manganese			49.35		
	Iron			2.90		
	Phosphorus			0.366		
	Silica (insoluble)			5.24		

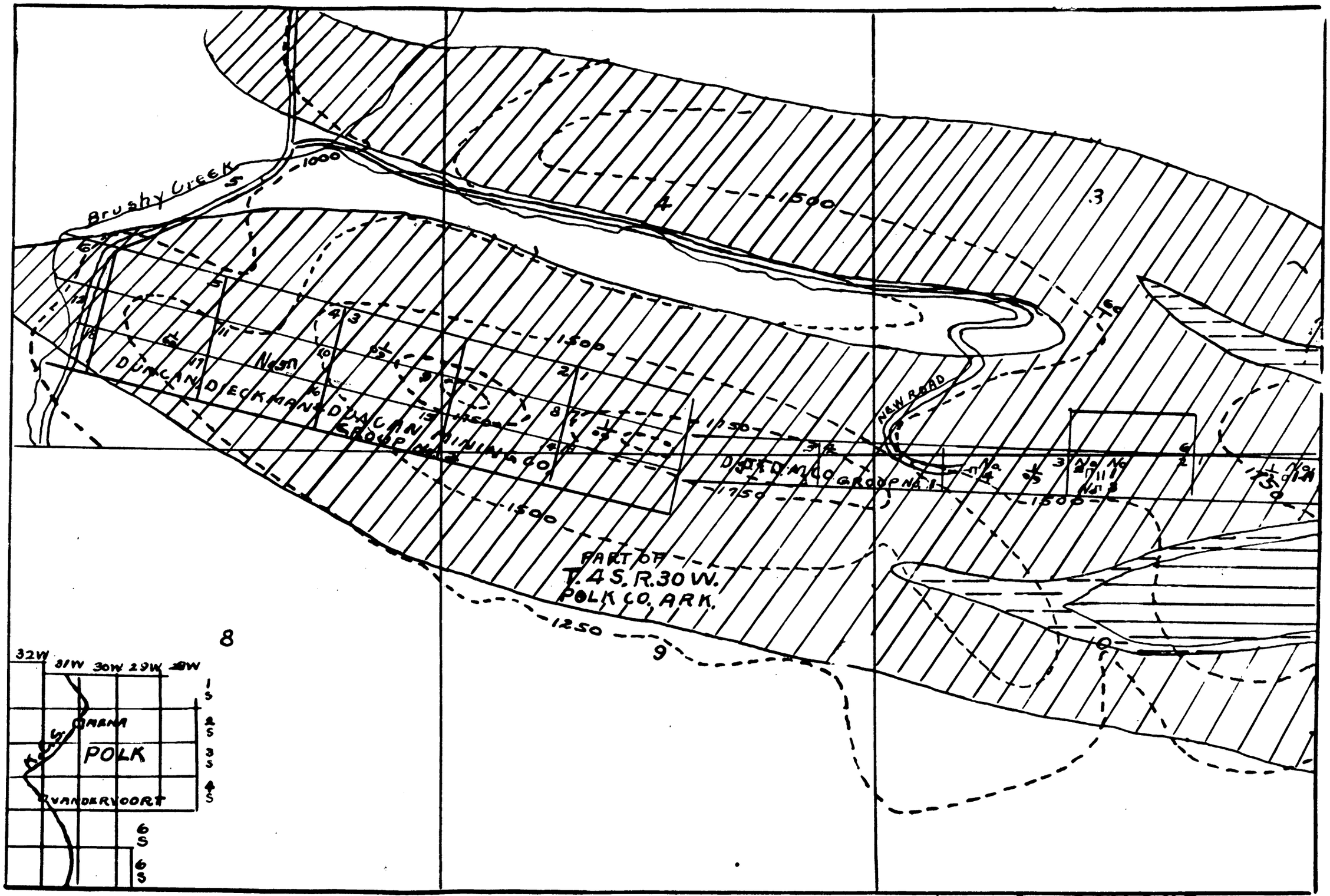
These samples were average = of the High Grade also taken from the Trenches =

GOLD AT [redacted] PER OUNCE SILVER AT _____ PER OUNCE
LEAD AT _____ PER UNIT COPPER AT _____ PER UNIT

THE COLORADO ASSAYING COMPANY

By Edmund Phillips


ore body
1 yd drag bucket
3 drum electric hoist
Grizzly
39'
Crude ore bin
400 tons
30'
2
Water Tank
Gate
Belt feeder
3
4
10x36" Jaw Crusher
or
24" x 40" Hammer Mill
2-sets of Rolls
or
Hammer Mill
5
Bucket elevator
6
7
Vibrating Screen
30'
Crushed ore b.
- 0 mesh
300 tons
8
Gate
Belt feeder
9
Classifier
10
Water Tank
Tables or Spiral Concentrators
11
14 Tailings
13 Slimes & middlings
12
Conc.
Conc. Bin
15
2-200 H.P. High Pressure boilers
Pump
200 K.W. Generator
Gov'r Road
Brushy Cr.
30'
200'
100'
30'
Total Roof
Roof structure not shown in mill section
1
2
3
4
5
6
7
+10 mesh
8
9
10
11
Tailings
14
13
slimes & middlings tot. to next unit
12
Conc.
15
16 Sintering plant on R.R.
Side view of proposed 300 ton manganese Mill on property of Duncan, Dieckman & Duncan Mining Co. in Sec. 5 T 4 S. R. 30 W. Polk Co. Ark.
Designed and sketched
By
E. O. White
Consulting Geologist
2/8/49
Scale
1" = 20'
Suggested flow sheet for 300 ton mill individual motor drive for
Duncan, Dieckman & Duncan M. Co.
Sec. 5 T 4 S. R. 30 W. Polk Co. Ark.
By
E. O. White
Consulting Geologist
P. O. Box 416, Mena, Ark.
2/8/49



LEGEND

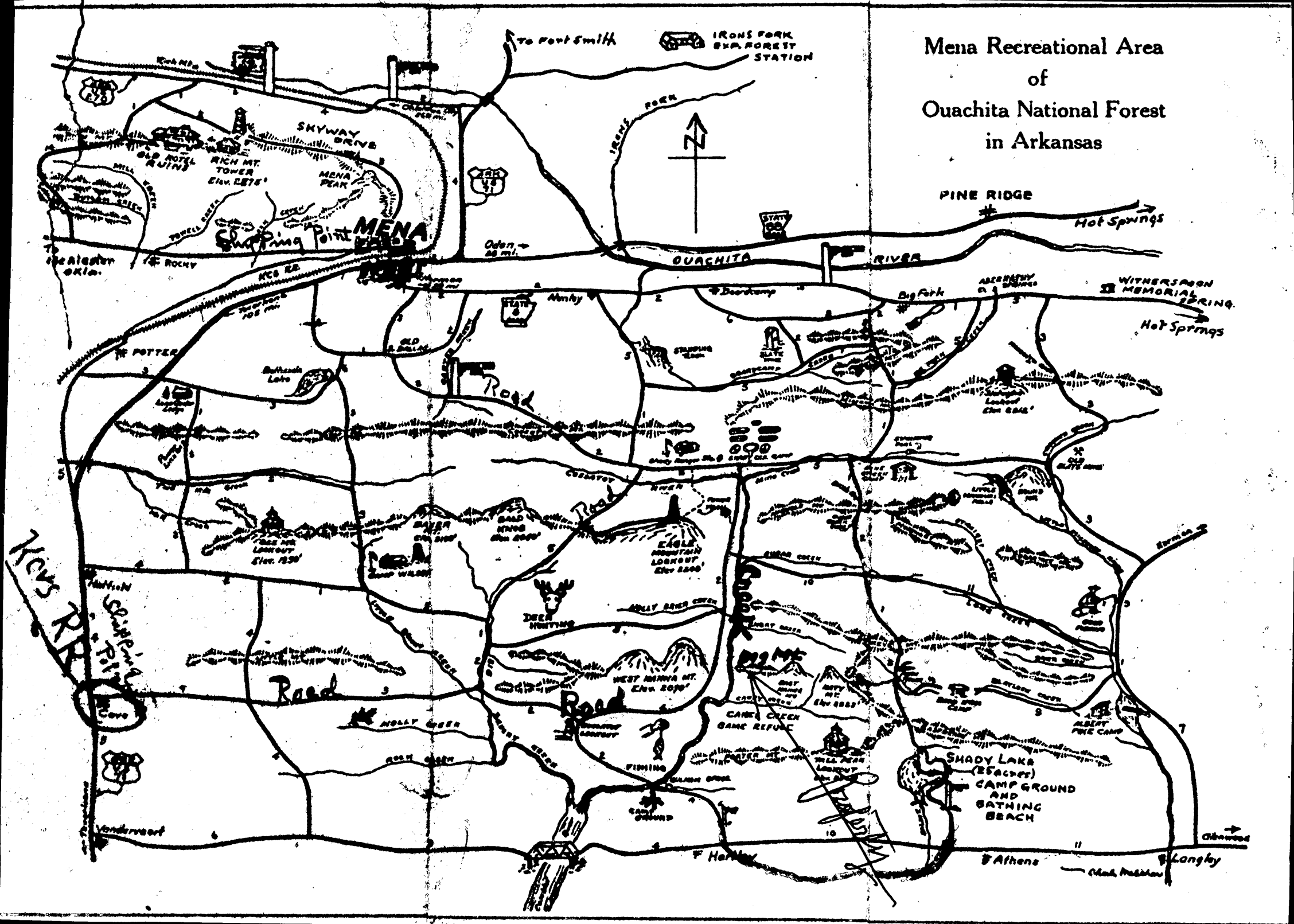
- Stanley Shale
- Arkansas Novaculite
- Missouri Mt. Slate
- Blaylock Sandstone

Scale, 4" = 1 mile

AREAL GEOLOGY AND CONTOURS COPIED FROM PLATE 3, U.S.G.S. BULLETIN 808.

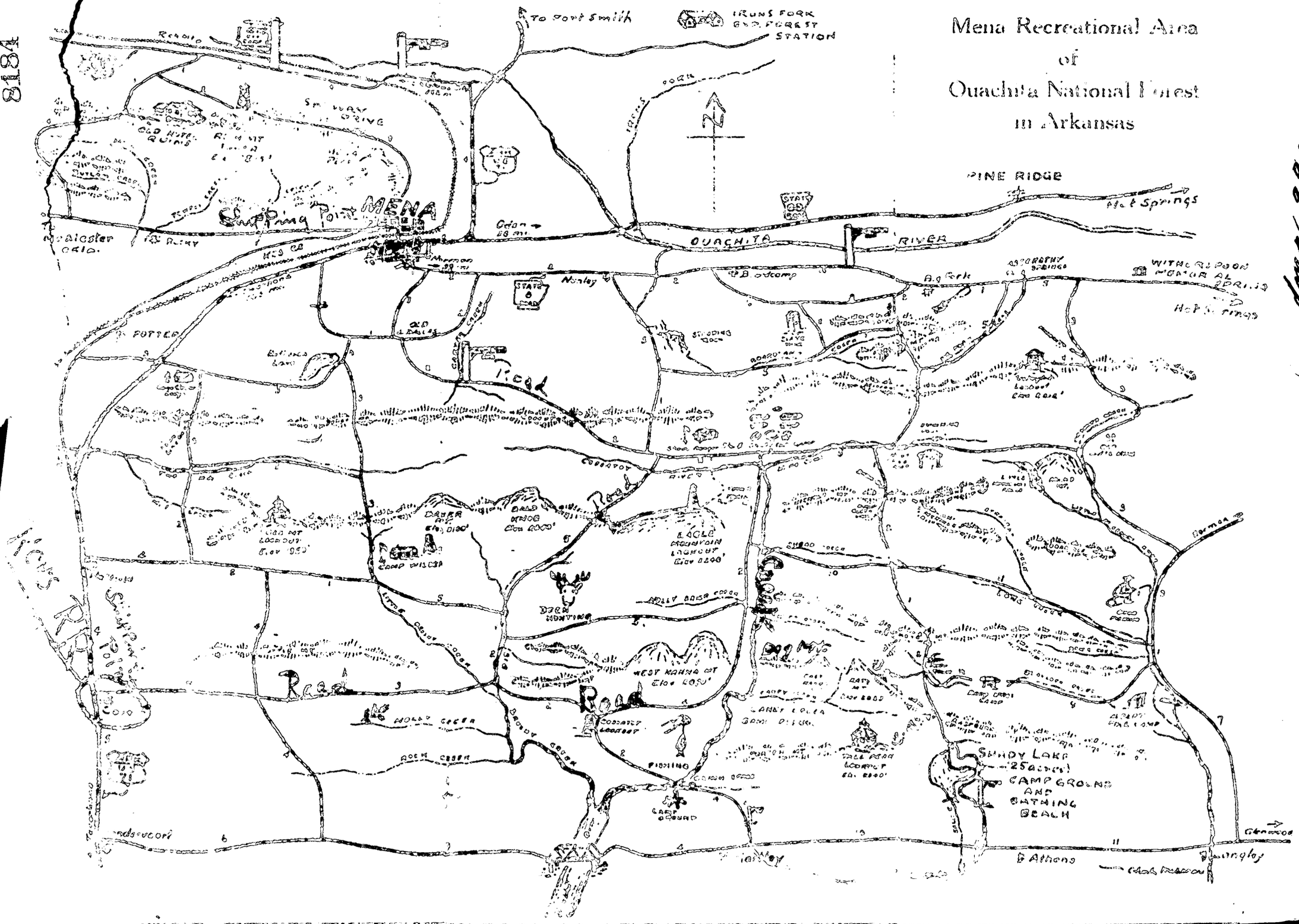
E. O. White
Geologist
July 27th 1949

Mena Recreational Area of Ouachita National Forest in Arkansas



8184

Mena Recreational Area of Ouachita National Forest in Arkansas



dwn 9.90

DUNCAN, BUCKMAN & DUNCAN MINING CO.
A MISSOURI CORPORATION
606 WALNUT ST. ST. LOUIS 2, MO.

OFFICERS:
WM. G. DUNCAN, PRES.
DONALD DUNCAN, V. PRES.
GEO. E. BUCKMAN, SEC. & TREAS.

MANGANESE MINE
MENA, ARK.

April--1--1951.

Report of developing work Just completed.

We have just completed new developing work, on our Mangenese property- at Mena.Ark. which shows much more ore exposure and proves up other reserves.

(1) Along the mountain top the mineralized zone is 70 ft. by 3½ miles long----- At four sections ½ mile apart, we have removed the overburden dirt, rock, etc-with a Bulldozer. Uncovering 50ft. strips across the mineralized zone. Showing several formations of Mangenese ore as follows.

CUT # 1----------Overburden removed exposing one vein 6 feet wide and one 4 feet wide

Cut # 2---------- Overburden removed , showing one 12 foot vein, one 6 foot vein and one 3 foot vein

Cut # 3---------- Overburden removed--Showing good Milling ore all through the clay.

Cut # 4---------- Overburden removed-- exposing several small veins and ore in the clay.----

Depths of these cuts is from 1 to 4 feet and was as far as the Bulldozer could go, because hard formations were encountered which requires a Blasting Crew.

[illegible] three mile strip from hard road to foot [illegible] then on top of mountain a road was worked [illegible] mile to east end of property-- this was done with a bulldozer.

Yours Truly,

Duncan, Dieckman, Duncan, Mining Co.

Wm. H. Duncan,

President.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

ROLLA HEADQUARTERS
1300 BISHOP AVE.—U. S. HIGHWAY 66

ROLLA, MISSOURI

TELEPHONE: 1003
MAIL ADDRESS: P. O. BOX 136

July 27, 1949

Mr. C. E. Dieckman
605 Walnut Street
St. Louis, Missouri

Dear Mr. Dieckman:

We have completed the ore dressing work on the manganese samples from your property in Waldron, Arkansas. The information contained in this letter may be considered a supplement to that previously transmitted in my letter of April 22. All of this work is a part of the Mineral Dressing Section program of the Bureau at Rolla. Mr. M. M. Fine is the Engineer-in-Charge of this section.

The data presented herein were obtained from test work on the lower grade of the two samples which contained 24.0 percent manganese.

A sample of the ore was crushed to minus 10-mesh and treated on the Humphrey's spiral concentrator. The ore was fed in a pulp of about 17 percent solids at the rate of 32 pounds a minute to the spiral. Concentrates were collected from the first few ports, middlings from others and the remainder of the pulp was considered tailings. The spiral failed to make a satisfactory separation on the ore. The recovery of manganese was only 56.5 percent at a grade of 39.4 percent manganese, 2.1 percent iron and 22.4 percent acid insoluble matter. These results are considerably inferior to those obtained by tabling, as may be seen by comparison with the previous data.

Flotation was also briefly investigated. The sample was ground to minus 100-mesh, thickened to 25 percent solids and conditioned with 2.0 pounds of sodium hydroxide and 2.0 pounds of sodium silicate per ton of ore. The conditioned pulp was then floated with 2.0 pounds of oleic acid and 0.5 pound of fuel oil. The rougher manganese froth was cleaned three times with no additional reagents. The results of the test are shown on the following page.

Table 1 - Float-Sink Separation - Sample 2

Product	Weight, percent	Analysis, percent			Percent of total
		Mn	Fe	Acid insoluble	Mn
3/4- to 3/8-inch float	24.2	9.3			7.2
" " " " sink	42.6	44.5	4.2	7.9	62.3
3/8-inch to 4-mesh float	4.7	6.7			1.0
3/8-inch to 4-mesh sink	9.8	42.1	6.6	5.6	13.4
4- to 10-mesh float	3.4	4.3			0.3
" " " " sink	[illegible]	[illegible]	[illegible]	[illegible]	9.8
10- to 28-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0 1/
[illegible]	[illegible]	[illegible]	[illegible]	7.1	1.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0 1/
" " " " sink	[illegible]	[illegible]	14.1	8.0	0.7
Minus 200-mesh	0.7	13.8			0.3
Composite	100.0	30.5			100.0

1/ Values smaller than significant figures

The results of the separations showed that on sample 2 high grade concentrates could be made at sizes as coarse as 3/4-inch, indicating that such unit operations as jigging could be successfully applied.

A similar series of heavy liquid separations on the lower grade sample is presented in Table 2.

Table 2 - Float-Sink Separations - Sample 1

Product	Weight, percent	Analysis, percent			Percent of total
		Mn	Fe	Acid insoluble	Mn
3/4- to 3/8-inch float	26.3	11.4			12.4
" " " " sink	30.0	39.0	2.5	21.1	48.3
3/8-inch to 4-mesh float	10.0	10.6			4.6
3/8-inch to 4-mesh sink	8.2	39.0	2.6	18.9	13.2
4- to 10-mesh float	6.4	6.0			1.7
" " " " sink	6.3	39.3	2.5	16.5	10.3
10- to 28-mesh float	3.4	2.9			0.4
" " " " sink	3.7	39.2	2.4	13.8	5.8
28- to 65-mesh float	1.5	2.0			0.0 1/
" " " " sink	1.4	39.6	2.9	10.6	2.1
65- to 200-mesh float	1.0	1.3			0.0 1/
" " " " sink	0.6	38.1	3.9	10.9	0.8
Minus 200-mesh	1.2	10.7			0.4
Composite	100.0	24.2			100.0

1/ Values smaller than significant figures

The data given on the preceding page showed much less liberation of manganese and gangue in sample 1 than in sample 2. Note that only in the minus 10-mesh sizes was the insoluble content less than 14 percent. It was evident that gravity concentration of sample 1 would be most effective on the finer sizes.

In order to determine the grade and recovery possible with tabling, a representative portion of sample 1 was crushed to minus 10-mesh and hydraulically classified into 4 sand fractions and a slime. Each sand fraction was then tabled to yield a concentrate, middling and tailing. Similar products were combined for analysis. The results of tabling sample 1 are shown in Table 3 below.

Table 3 - Table Test

Product	Weight, percent	Analysis, percent					Percent of total
		Mn	Fe	SiO_2	Al_2O_3	P	Mn
Concentrate	43.5	44.1	1.9	10.8	1.9	0.41	77.8
Middling	14.4	18.9					10.9
Tailing	24.7	2.3					2.4
Slime	17.4	12.9					8.9
Composite	100.0	24.7					100.0

A recovery of 77.8 percent of the manganese was effected in a concentrate containing 44.1 percent manganese, 1.9 percent iron, 10.8 percent silica, 1.9 percent alumina and 0.41 percent phosphorus.

As mentioned previously, the float-sink data indicated that jigging would probably recover little high grade concentrate from the coarse sizes of sample 1. However, the novaculite gangue is so hard that the possibility of rejecting some of it at coarse sizes by jigging or other means is well worth investigating. Unfortunately, there was not enough of sample 1 to investigate that possibility. If sample 1 is regarded as representative of the material to be treated in the mill, enough additional ore (about 500-600 pounds) should be submitted to permit such tests to be conducted.

It must be emphasized that the results of tests given in this letter apply only to material conforming to the samples submitted.

Very truly yours,

R. G. Knickerbocker,
Chief, Rolla Branch,
Metallurgical Division.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
ROLLA, MISSOURI

ROLLA HEADQUARTERS
1380 BISHOP AVE.--U. S. HIGHWAY 66

TELEPHONE: 1083
MAIL ADDRESS: P. O. BOX 136

April 22, 1949

Mr. C. E. Dieckman
605 Walnut Street
St. Louis, Missouri

Dear Mr. Dieckman:

We have been making some ore dressing tests on your manganese ore from Waldron, Arkansas, and this letter will serve as a summary of our findings to date.

Two samples were received, a lower grade sample of about 100 pounds and a higher grade sample of apparently hand picked material weighing about 15 pounds. Both consisted of manganese and iron oxides in a dense novaculite gangue. The chemical analyses of the samples are given below:

	Analysis, percent					
Sample	Mn	Fe	Ba	SiO_2	Al_2O_3	P
1	24.0	1.8	0.62	47.1	1.8	0.19
2	30.9	5.5	1.1	28.4	2.1	0.35

Some idea of the liberation of the manganese oxides from gangue was gained by making heavy liquid separations on sized fractions of each sample. In addition, this information served as an estimate of what could be accomplished by gravity separation. The results of such a test on the higher grade material, sample 2, are detailed in Table 1 on the following page.

Results of Flotation

Product	Weight, percent	Analysis, percent			Percent of total
		Mn	Fe	SiO_2	Mn
Concentrate	41.7	45.8	1.4	6.3	79.9
Middling	13.0	17.5			9.6
Tailing	45.3	5.6			10.5
Composite	100.0	23.9			100.0

A recovery of 79.9 percent was effected in a concentrate containing 45.8 percent manganese, 1.4 percent iron and 6.3 percent silica. The flotation concentrate is too fine to meet size specifications for manganese ore and must be sintered or agglomerated. In the laboratory this was simulated by mixing the flotation concentrate with 10 percent of coke and heating in a muffle furnace at 1000° C. The sintered product had an analysis of 52.9 percent manganese, 1.7 percent iron, 6.3 percent silica, 6.2 percent alumina, 0.25 percent phosphorus and 0.32 percent lead which should be acceptable as manganese concentrates.

This completes our work on the manganese ore from Waldron, Arkansas, and the results obtained apply only to ore conforming to the samples tested. If you have any comments or questions about the work, we will be glad to hear from you.

Very truly yours,

R. G. Knickerbocker,
Chief, Rolla Branch,
Metallurgical Division.

1849 1949
A Century of Conservation

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

ROLLA HEADQUARTERS
1300 BISHOP AVE.--U. S. HIGHWAY 66

ROLLA, MISSOURI

TELEPHONE: 1003
MAIL ADDRESS: P. O. BOX 136

July 27, 1949

Mr. C. E. Dieckman
605 Walnut Street
St. Louis, Missouri

Dear Mr. Dieckman:

We have completed the ore dressing work on the manganese samples from your property in Waldron, Arkansas. The information contained in this letter may be considered a supplement to that previously transmitted in my letter of April 22. All of this work is a part of the Mineral Dressing Section program of the Bureau at Rolla. Mr. M. M. Fine is the Engineer-in-Charge of this Section.

The data presented herein were obtained from test work on the lower grade of the two samples which contained 24.0 percent manganese.

A sample of the ore was crushed to minus 10-mesh and treated on the Humphrey's spiral concentrator. The ore was fed in a pulp of about 17 percent solids at the rate of 32 pounds a minute to the spiral. Concentrates were collected from the first few ports, middlings from others and the remainder of the pulp was considered tailings. The spiral failed to make a satisfactory separation on the ore. The recovery of manganese was only 56.5 percent at a grade of 39.4 percent manganese, 2.1 percent iron and 22.4 percent acid insoluble matter. These results are considerably inferior to those obtained by tabling, as may be seen by comparison with the previous data.

Flotation was also briefly investigated. The sample was ground to minus 100-mesh, thickened to 25 percent solids and conditioned with 2.0 pounds of sodium hydroxide and 2.0 pounds of sodium silicate per ton of ore. The conditioned pulp was then floated with 2.0 pounds of oleic acid and 0.5 pound of fuel oil. The rougher manganese froth was cleaned three times with no additional reagents. The results of the test are shown on the following page.

Table 1 - Float-Sink Separation - Sample 2

Product	Weight, percent	Analysis, percent			Percent of total
		Mn	Fe	Acid insoluble	Mn
3/4- to 3/8-inch float	24.2	9.3			7.2
" " " " sink	42.6	44.5	4.2	7.9	62.3
3/8-inch to 4-mesh float	4.7	6.7			1.0
3/8-inch to 4-mesh sink	9.8	42.1	6.6	8.6	13.4
4- to 10-mesh float	3.4	4.3			0.3
" " " " sink	[illegible]	[illegible]	[illegible]	[illegible]	9.8
10- to 28-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0 1/
[illegible]	[illegible]	[illegible]	[illegible]	7.1	1.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0 1/
" " " " sink	[illegible]	[illegible]	14.1	8.0	0.7
Minus 200-mesh	0.7	13.8			0.3
Composite	100.0	30.5			100.0

1/ Values smaller than significant figures

The results of the separations showed that on sample 2 high grade concentrates could be made at sizes as coarse as 3/4-inch, indicating that such unit operations as jigging could be successfully applied.

A similar series of heavy liquid separations on the lower grade sample is presented in Table 2.

Table 2 - Float-Sink Separations - Sample 1

Product	Weight, percent	Analysis, percent			Percent of total
		Mn	Fe	Acid insoluble	Mn
3/4- to 3/8-inch float	26.3	11.4			12.4
" " " " sink	30.0	39.0	2.5	21.1	48.3
3/8-inch to 4-mesh float	10.0	10.6			4.6
3/8-inch to 4-mesh sink	8.2	39.0	2.6	18.9	13.2
4- to 10-mesh float	6.4	6.0			1.7
" " " " sink	6.3	39.3	2.5	16.5	10.3
10- to 28-mesh float	3.4	2.9			0.4
" " " " sink	3.7	39.2	2.4	13.8	5.8
28- to 65-mesh float	1.5	2.0			0.0 1/
" " " " sink	1.4	39.6	2.9	10.6	2.1
65- to 200-mesh float	1.0	1.3			0.0 1/
" " " " sink	0.6	38.1	3.9	10.9	0.8
Minus 200-mesh	1.2	10.7			0.4
Composite	100.0	24.2			100.0

1/ Values smaller than significant figures

The data given on the preceding page showed much less liberation of manganese and gangue in sample 1 than in sample 2. Note that only in the minus 10-mesh sizes was the insoluble content less than 14 percent. It was evident that gravity concentration of sample 1 would be most effective on the finer sizes.

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Table 3 - Table Test

Product	Weight, percent	Analysis, percent					Percent of total
		Mn	Fe	SiO_2	Al_2O_3	P	Mn
Concentrate	43.5	44.1	1.9	10.8	1.9	0.41	77.8
Middling	14.4	18.9					10.9
Tailing	24.7	2.3					2.4
Slime	17.4	12.9					8.9
Composite	100.0	24.7					100.0

A recovery of 77.8 percent of the manganese was effected in a concentrate containing 44.1 percent manganese, 1.9 percent iron, 10.8 percent silica, 1.9 percent alumina and 0.41 percent phosphorus.

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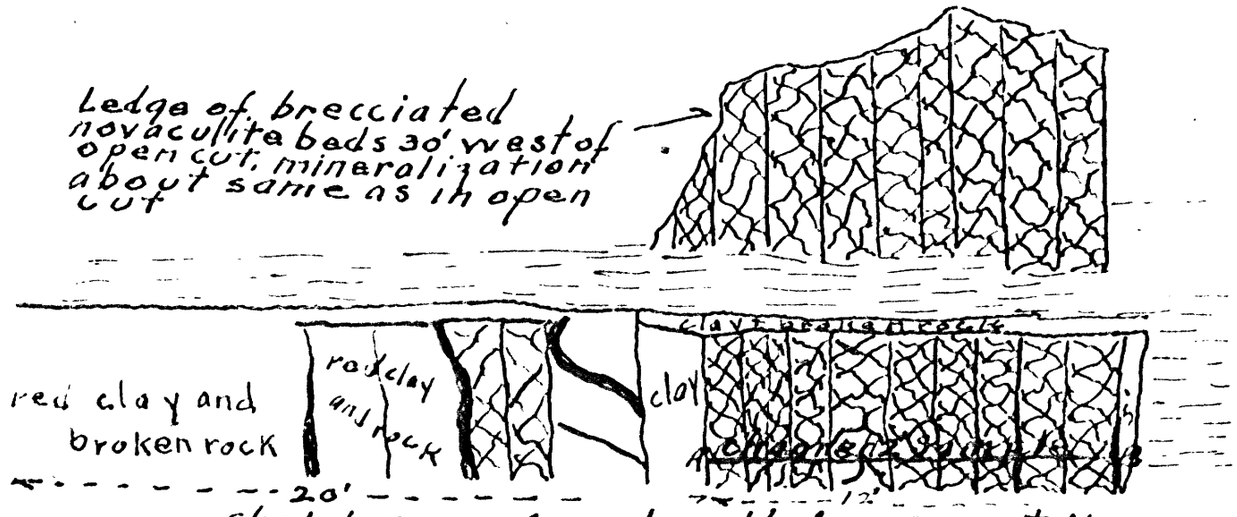
It must be emphasized that the results of tests given in this letter apply only to material conforming to the samples submitted.

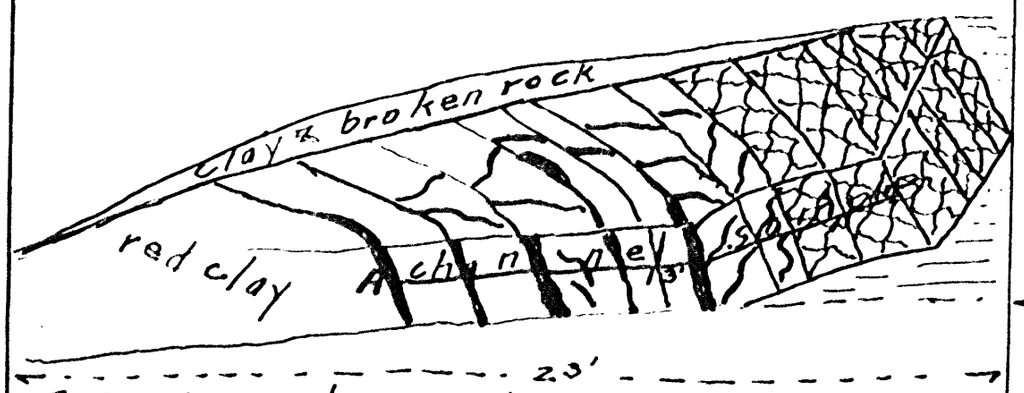
Very truly yours,

R. G. Knickerbocker,
Chief, Rolla Branch,
Metallurgical Division.

A-B channel sample. Sketch map of No. 1-A looking east showing structural position of novaculite beds and occurence of manganese minerals in the cracks & bedding planes, joints of these beds and boulders. Mineral hard psilomelane

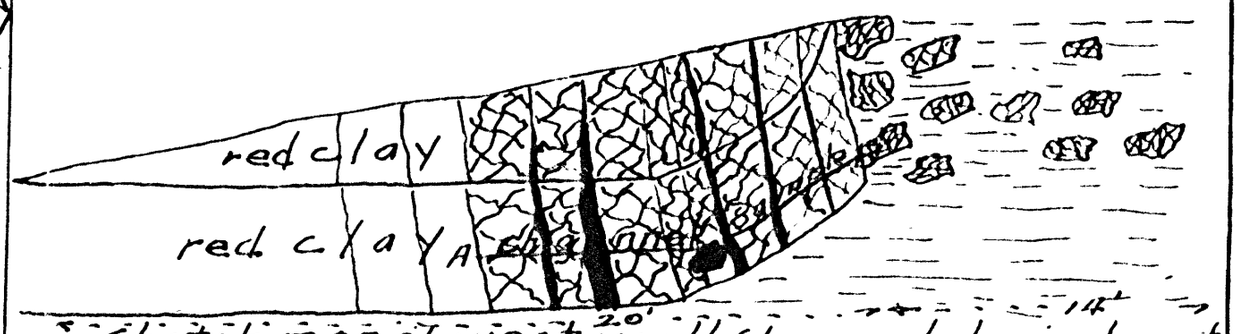


Sketch map of west wall of open cut No. 1 showing structural position of hard white novaculite beds and occurence of manganese minerals in the bedding planes, joints & cracks in these beds. Mineral hard psilomelane

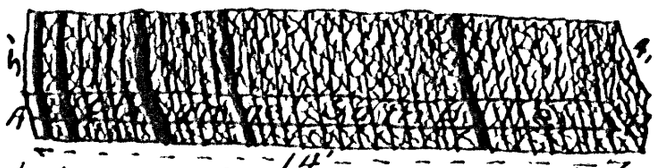


A-B channel sample

Sketch map of west wall, floor & breast of open cut No. 3, showing structural position of fractured soft gray novaculite beds of red clay & ore and fractured & jointed mineralized beds. Mineral rather soft psilomelane, maximum thickness



Sketch map of west wall, floor and sloping breast of No. 4, open cut, showing structural position of fractured and mineralized hard white novaculite beds, red clay with the minerals in the bedding planes, minerals, mostly hard psilomelane with some manganite. Some hematite.

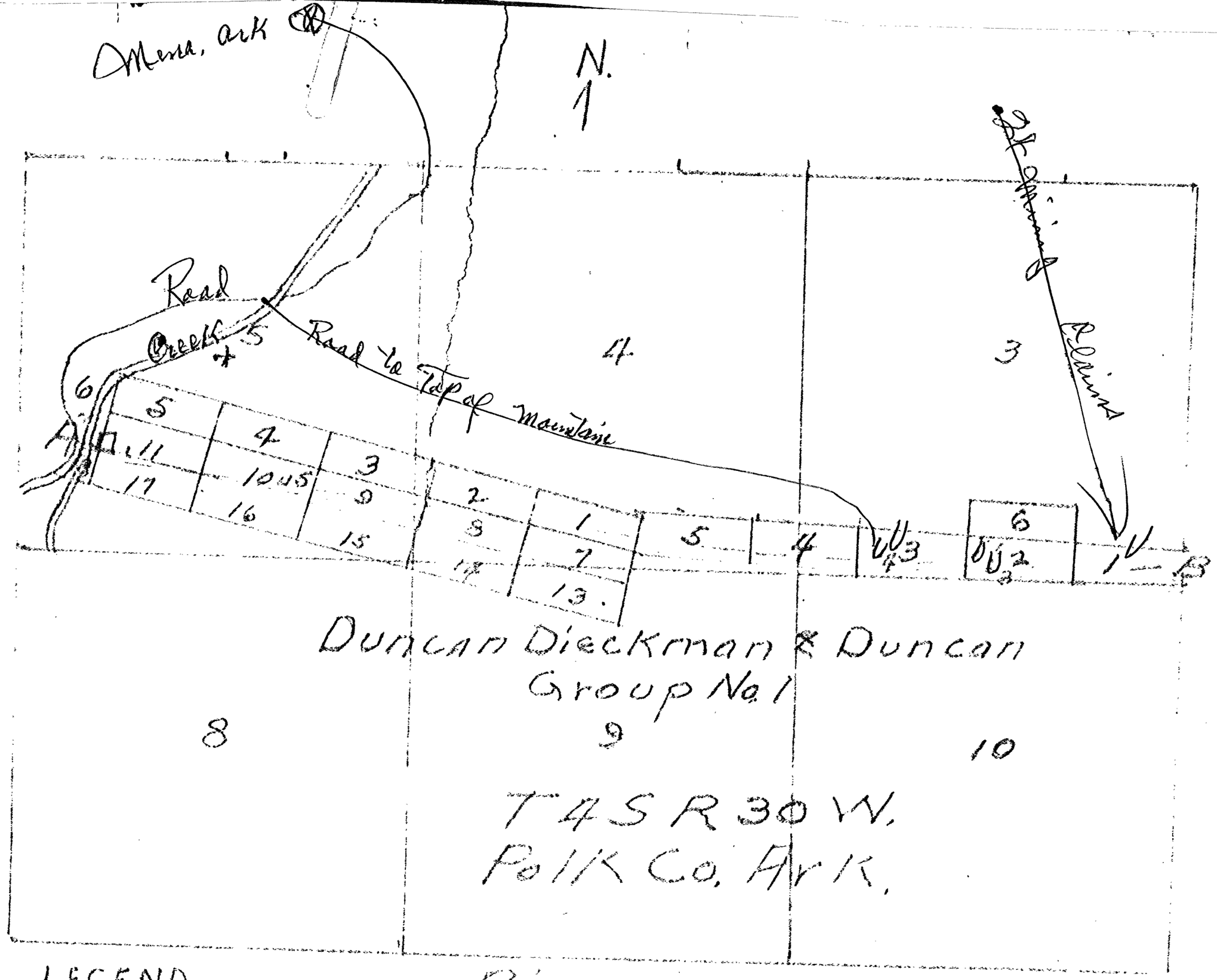


Sketch map of west wall, floor & breast of No. 5 showing structural position of hard white fractured & brecciated novaculite beds, mineral hard psilomelane, maximum thickness 4" in bedding planes and 1/8" up in the brecciated beds.

LEGEND Scale, 1" = 5'

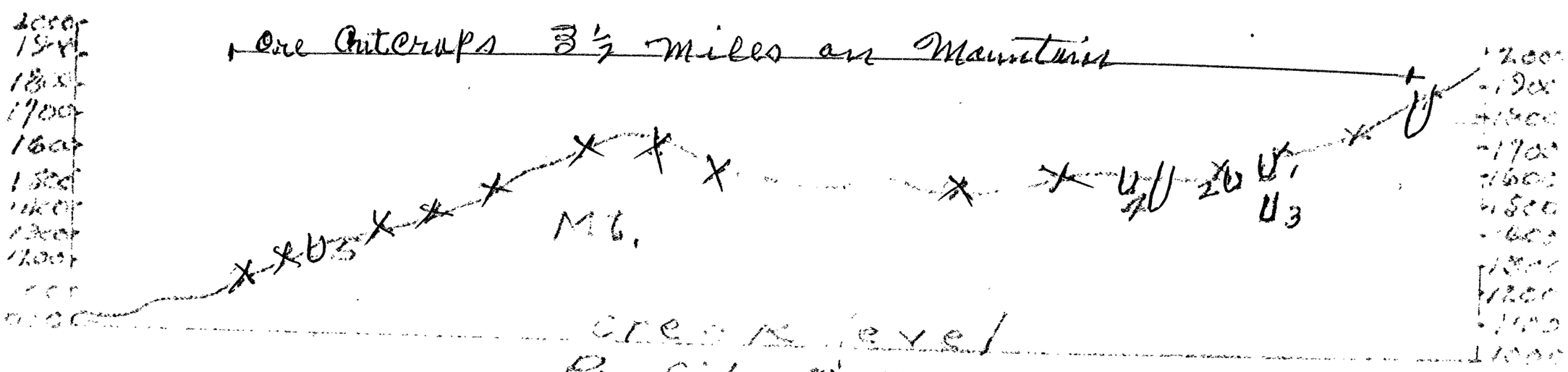
black is manganese mineral.

E. O. White
Geologist
July 27th 1949



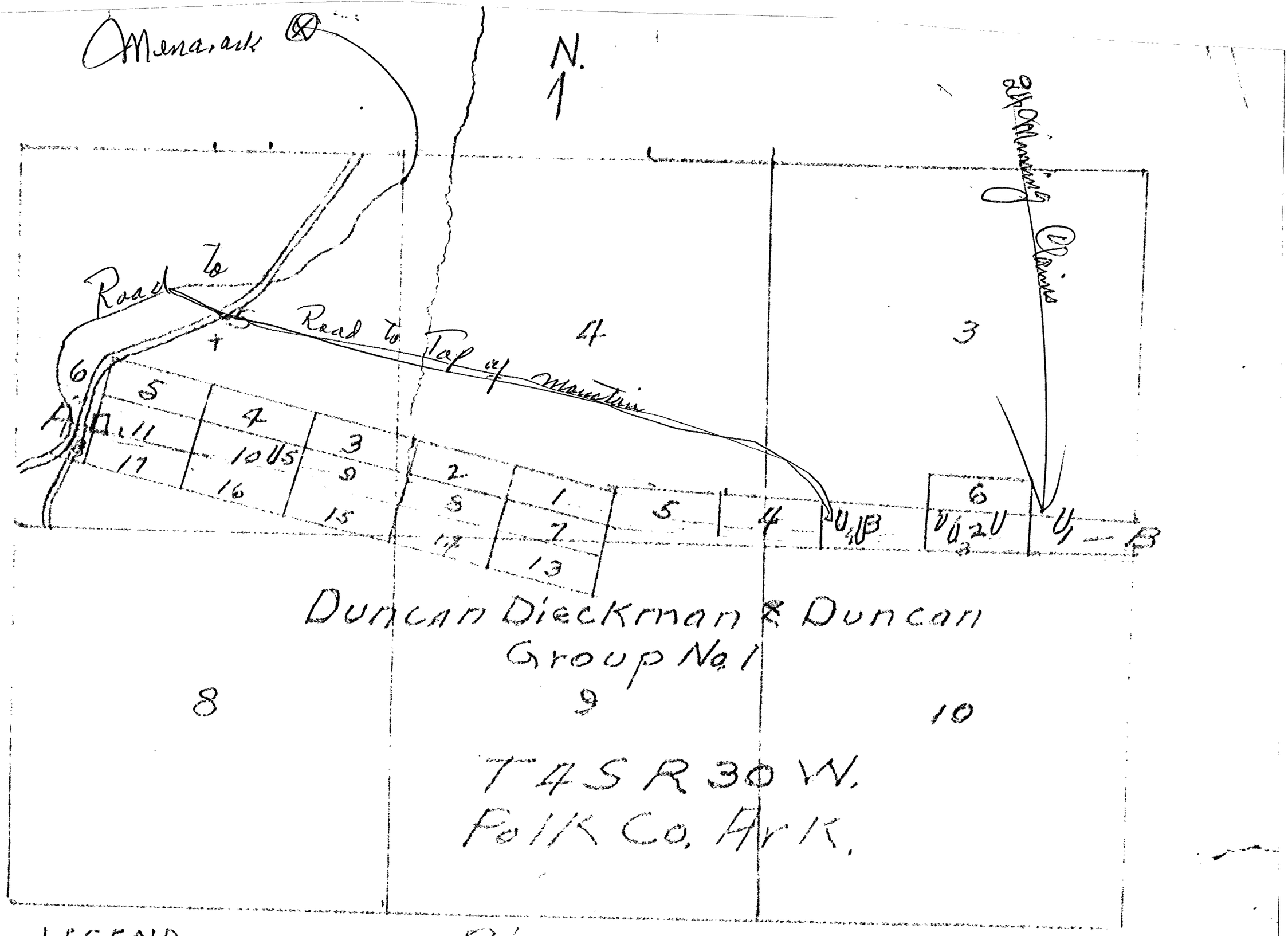
LEGEND
U Open cut in ore.

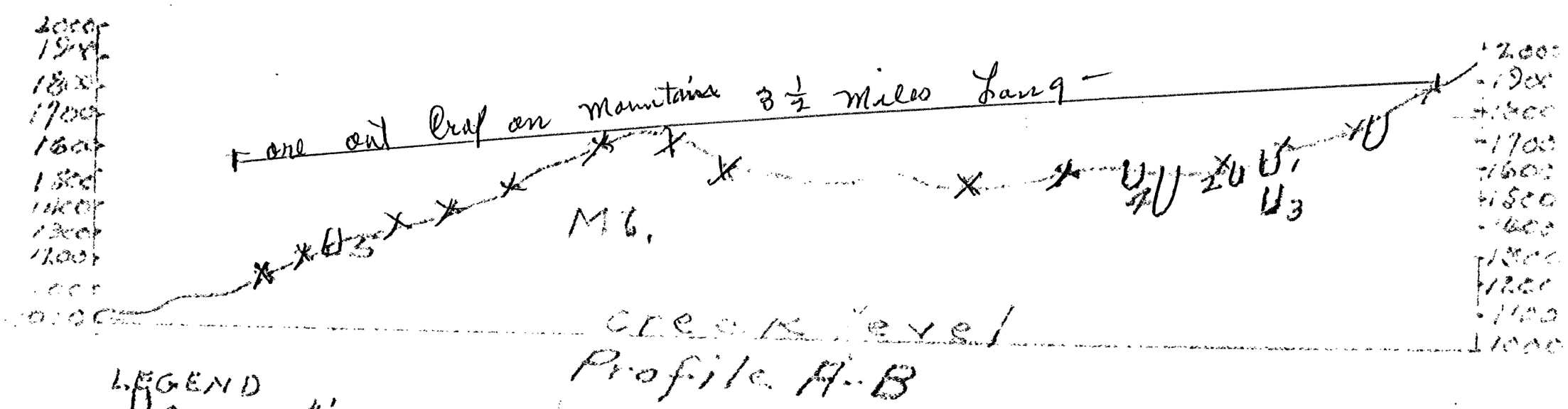
Plan
Scale
2" = 1 mile



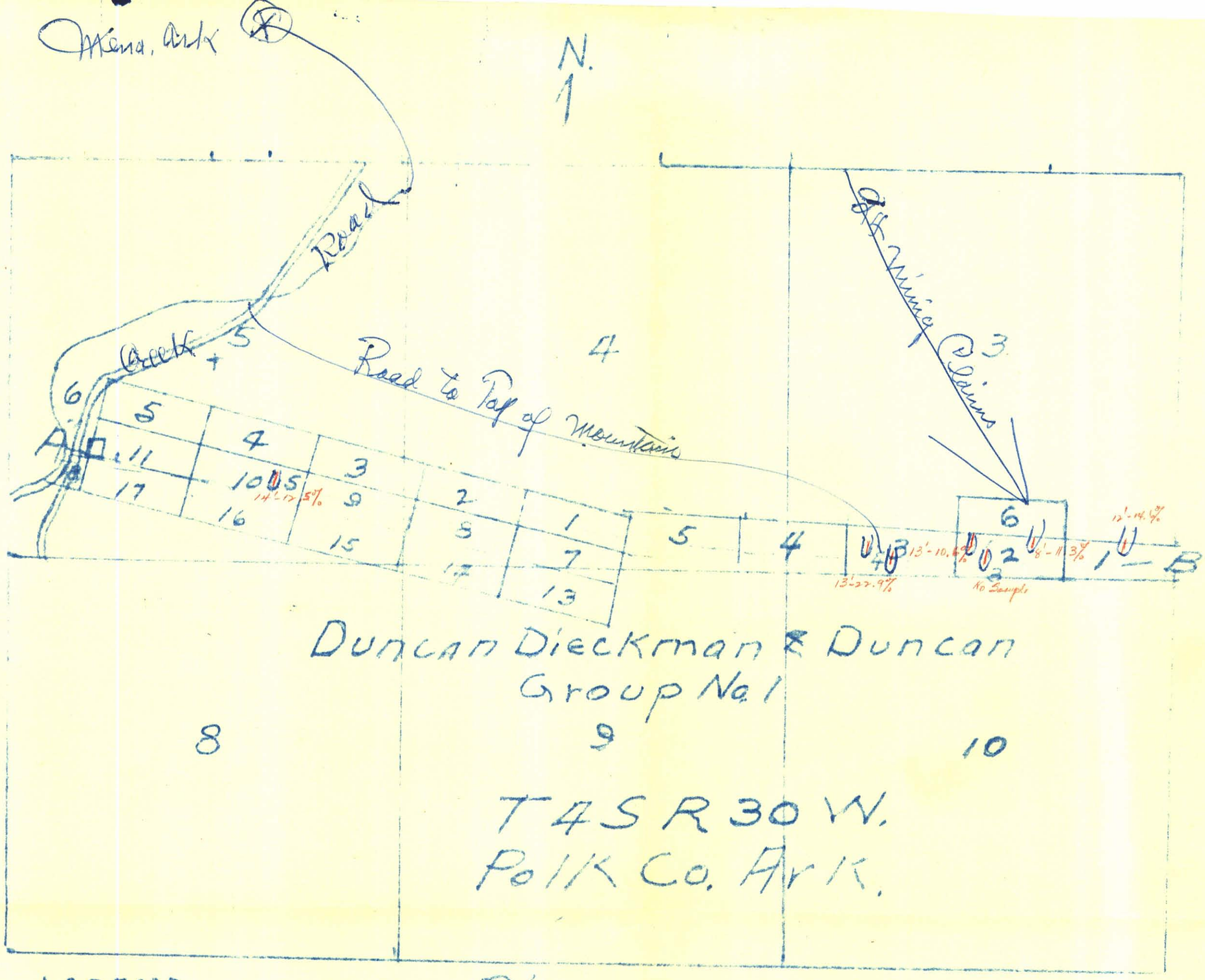
Profile A-B

LEGEND
U open cut in ore
X float ore or ore bldrs


Mena, ark
N.
1
Road To
Road to Top of Mountain
24 Adjoining Claims
4
3
6
5
4
3
11
10
9
17
16
15
2
1
8
7
13
5
4
6
2
Duncan Dieckman & Duncan
Group No. 1
8
9
10
T4S R30W.
Polk Co. Ark.
LEGEND
u Open cut in ore.
Plan
Scale
2" = 1 mile

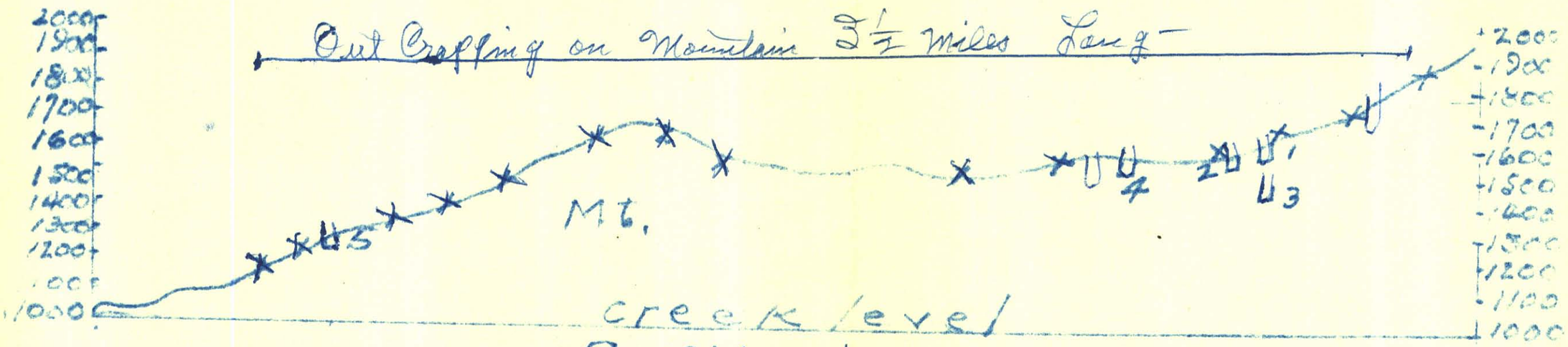

2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
ore out crop on mountain 3 1/2 miles long
M.6.
creek level
Profile A-B
LEGEND
U open cut in ore
X Floor or ⊂ or ore bldrs

Mena, Ark



LEGEND
U Open cut in ore

Plan
Scale
1/2" = 1 mile



Profile A-B

LEGEND
U Open cut in ore
X Float, ore or ore, bldrs

Geologist.