REPORT

on

White Mesa Copper Group

by

A. M. Welles

1905
LOCATION. These properties are located on what is known as the "White Mesa" near the north east corner of Coconino County in Arizona, and but about 19 miles from the canon of the Colorado River and from Lees Ferry.

HISTORICAL. The properties of the White Mesa Copper Co. rest within the present boundaries of the Navajo Indian Reservation. Having however been located prior to the extension of said reservation and the enclosing of said claims, the government of the United States caused the same to be officially surveyed described and excluded from the Indian holdings.

PROPERTIES. The properties consist of the following claims, the first mentioned being a fractional of 500' x 600' the second a fractional 600' x 1000', the remainder being full claims of 600' x 1500'.

- Nannie E.
- Green California
- Eli
- Mollie T.
- Ida H. Smythe
- Honest John
- Grand Pacific
- Little Dick
- Yankee Girl
- Joe, Wood
- Velvet
- Wampocob
- Lenore
- Colorado
- Francis
- Mountain View
- Westor
- Keystone
- Mayflower
- Victor
- San Juan
- Marvine
- Durango
- Mare Bell
- Bank
- Happy New Year
- Pluto
- Index
- Oxide
- Little John
None of the foregoing claims are patented but all are held under
possessory title, the same being perfect in so far as determined.

**PHYSICAL CONDITIONS.** These properties are reached from Flagstaff,
the nearest railway point, by wagon trail a distance of about 120 miles.
The grades are easy at all points though much of the way more or less
sand is encountered. Water sufficient for stock purposes and for domes-
tic uses is found at fairly convenient points along the road, and at two
or more points near the property where sufficient exists to care for 100
or more workmen, while this may be augmented no doubt materially with
slight development.

From general indications however water to be obtained directly upon
the ground for extended uses other than domestic appears questionable.
However at no great change of elevation and about ten miles distant there
occurs to all appearances an almost inexhaustible supply of subterranean
water at a shallow depth.

This property, and in fact the entire White Mesa is covered with a
somewhat scattered growth of Pinon trees furnishing fuel in abundance.

Twelve miles from Tuba the Indian agency and school and occurring
upon the drainage of the "Moon Copy" wash exists coal measures of con-
siderable thickness and apparent extent, which though not of an advanced
type would be of much value for certain immediate uses. It is in form a
lignite not highly advanced, and occurs in the Miocene Tertiary in ab-
solutely horizontal strata. There are two veins, the upper not more than
25 ft. beneath the surface is 7 ft. in thickness, the upper half however
being rather impure. Beneath this vein with a parting of about 25 ft.
between the same exists a second vein of more than 10 ft. in thickness,
but very impure throughout as determined from its outcrop about the sides
and head of a lateral canon there having been no openings of any form
made upon this vein. Upon the upper vein referred to considerable work
has been done at one point only; here a room some 12 ft. in width and 40 ft. in length has been extended from the outcrop, the coal extracted having been employed for heating purposes at Tuba.

**Geology.** The formation of the White Mesa covering the properties of which this report treats is a Cretaceous sand stone. The successive edges of its upturned sheets may be traced from west to east a distance of more than 5 miles when it dissapears beneath the superincumbent beds of erosive matter. The dip of this strata is to the east and ranges from 20 to 30 degrees from the horizon; the whole would indicate an aggregate thickness of these beds of some 6000 to 10000 ft.

A short distance to the west of these properties, a descent is made over the upturned edges of these sand stones a vertical distance of about 1000 ft. when a floor of limestone is reached nearly horizontal in its position though appearing the antilene of a great fold and showing plainly its westerly dip, while the easterly is lost to view beneath the uplifted sand stones (see east and west sectional sheet).

Successive upheaval and subsidence, each of a gentle nature has occurred during the final uplifting of these main beds, during which later and additional deposits were made unconformable with the earlier and underlying ones.

**The Ore and its Deposition.** The entire ore occurrence over the entire field is in secondary form, and aside from a slight occurrence of apparent silicates, (Diopside and Chrysocolla) occurs as Malachite. Correcting the above statement it may be said that slight presentations of copper glance are observable in a few of the properties.

The ore further is simply the sand stone sheets enriched through saturation by copper bearing solutions. Yet this enrichment is in no manner uniform, these sediments at the time of subjection were found unequally pervious; where most so the greatest volume of solution found access, and the richest ore occurs; this may be surrounded on all sides
by an utterly impervious field where no enrichment whatever has taken place; or it may blend away or suddenly change into an adjoining body of low grade material.

That the enrichment of these sediments has been brought about by descending currents there is in the case of this deposit more evidence than is usually found. Further that this enrichment occurred during or after the uplifting, and erosion to some extent of these sheets.

Numerous veinlets of segregation, (minature dikes of quartzite) traverse these sand stone sheets; in several instances they are found cutting the sheet parallel with its upturned and fragmentary edge, and transversely with its plane is such instances there is found a complete saturation and enrichment amounting to ore of commercial value, from the apex down to the veinlet referred to which proving an impervious dam or obstruction, perhaps not more than one fourth of an inch in thickness, the solution was arrested, enrichment ceased at this line, and the barren sand stone suddenly appears upon the opposite or lower side thereof.

In the later and unconformable deposits referred to under Geology and which now appear only in isolated patches, no evidence of ore is found; hence their origin must have been subsequent to the action which created the existing ore bodies.

These saturated and enriched volumes of sand stone in so far as exposed and explored appear small; yet they are numerous in the extreme. No exploration or development work of any magnitude has been engaged in; few pits, shafts, or open cuts present a depth of over 12 or 15 ft., these being sunk at such points as ore presented itself either in actual outcrop or through stain appearing upon the surface through shallow coverings of surface matter. Yet they are so numerous and wide spread that from these alone there has been extracted and remains upon the surface from 1000 to 2000 tons of ore of commercial value; while unquestionably hundreds of like exposures scattered over this great field are concealed beneath greater depths of the surface matter referred to many of which may be detected immediately after a heavy rainfall. In addition
to these ore bodies, although numerous, presenting evidence from present exposures of being small, there further so far as at present possible to determine seems to exist no connection between the individual bodies whereby additional ones may be discovered with the least possible outlay and delay; apparently such will be blind work. However development at no point is sufficiently extended to fully determine either this or the possible magnitude of a portion of the bodies at least. So far as the present outcrops or exposures are concerned they are simply those of today. When this mineralization was effected these upturned sheets unquestionably extended hundreds of feet above and beyond their present terminus; hence what we today see was at that time an equal distance beneath the surface; reasoning thus, the theory appears tenable that these ore bodies should be found extending hundreds of feet in depth below their present outcrop.

The sand stone which forms the base of this ore and in which these ore bodies exist is soft and easily extracted yet sufficiently coherent and indestructible to maintain itself throughout large excavations.

**DESCRIPTION OF CLAIMS.**

**NANNIE II.** Opened by shaft 25' in depth, near bottom of which ore bearing sheet 4 ft. in thickness irregularly enriched consists of one fourth ore of commercial value. About 300' westerly is a short cross cut with lateral from breast to left about 10 ft. The mineralization covers about one half of the exposure.

**GREEN.** Has three large openings in face of sand stone cliff each irregularly enriched for about 10' in thickness, the whole forming a very low grade material.

**CALIFORNIA.** Has one hole 10 ft. in depth with mineralized strata; the whole of low grade. There is also one shallow opening which shows a bunch with face about 4 ft. square of an ore which should run about 8% copper.
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J. Has shaft 10 ft. deep which shows 5 ft. of mineralized strata the whole low grade. About 25 ft. distant is open cut 50 ft. in length showing irregular mineralization entire length and for 3 ft. in thickness also low grade apparently.

MOLLIE T. Has shaft 17 ft. in depth with 12 ft. sheet of mineralized material. Nearby is open cut 65 ft. in length showing mineralized strata 10 ft. in thickness for entire length. Each of these openings were sampled. About 25 ft. east of last mentioned opening is another open cut 25 ft. in length with about equal showing.

IDA SMITH. Has two shafts 40 ft. apart each with 3 ft. or more of ore one is low grade the other high. These were sampled together in one general sample. This claim has also two 10 ft. shafts each with about 4 ft. of ore of fair grade.

GRAND PACIFIC. Has shaft 15 ft. in depth of apparently very low grade material which was sampled. Has also another shaft 45 ft. deep not sampled.

LITTLE DICK. Has short tunnel about 75 ft. in length which cuts 5 ft. streak of ore which shows rich ore on east side of tunnel and lower grade on west side. From here average sample was taken. Has also 26 ft. shaft dump of which was sampled shaft being inaccessible. There are also two other shafts of medium depth on this property which show good grade ore. The ore of this claim from all its openings will apparently average the richest of any.

HONEST JOHN. Has two 10 ft. shafts each of which make an indifferent showing.

YANKEE GIRL. Has cut 32 ft. long and 5 ft. deep, which shows 1 ft. streak of low grade ore crossing obliquely.
GEO. WOOD. Has 3 shafts each 10 ft. in depth. One of these is sunk in low grade ore, the remaining two have nothing.

VELVET. Has shaft 10 ft. in depth which passes through layer of ore 3 ft. in thickness near top of shaft and appears to be only a local occurrence. Also has an open cut which shows small amount of ore. Neither of the openings on this claim show ore of commercial value or are extremely promising.

WAMPOL. Has open cut 10 ft. in depth with limited showing or ore. Has another 10 ft. shaft with poor showing, also an 8 ft. shaft with poor showing.

LEADER. Has 55 ft. open cut last 12 ft. of which is in ore sides and breast. Breast 10 ft. wide and 15 ft. in height. On left of face of breast is 2 ft. streak and on right 1 1/2 ft. streak each of good grade; between the two is 6 1/2 ft. of apparently low grade. These grades were sampled separately.

Forty ft. distant from this 55 ft. cut a shaft has been sunk to a depth of 15 ft; and from bottom cross cut has been run into east wall 4 ft, making total width of shaft 10 ft. All sides of this shaft is in ore and from top to bottom although apparently low grade (sampled as a whole).

COLORADO. Has two shallow shafts with no showing of ore; also a shallow trench 35 ft. in length which exposes for a distance of 15 ft; a streak of ore of fair grade and having an average width of 10 inches.

FRANCIS: Has two shafts about 12 ft. apart; each shows from one to three ft. of low grade ore.

MOUNTAIN VIEW. Has open cut 36 ft. in length, last half of which is in ore sides and breast; shows from two to six ft. in thickness (sampled) Also 20 ft. cut on opposite side of ridge with streak from 2 to 4 ft. in thickness entire length although somewhat irregular. There are also two
other openings upon this property which show limited occurrences of good ore.

**NESTOR.** Has open cut 65 ft. in length which shows from 3 to 4 ft. of fair looking ore.

**KEYSTONE.** Has three openings about 15 ft. apart, shows 3 ft. of fair looking ore laying nearly horizontal in one, nothing in other two.

**MAYFLOWER.** Has one shaft 10 ft. in depth with vertical streak of ore from top to bottom irregular but averaging 3 ft. in width which is apparently of good grade (sampled). Has also another shaft 10 ft. in depth of evidently low grade.

**VICTOR.** Has shaft 10 ft. deep nearly the whole of which is in good grade ore (sampled). Also at another point an open cut showing considerable quantities of a lower grade, yet fair ore. Still another shaft 12 ft. in depth showing a 3 ft. streak of fair appearing ore, and a fourth opening 10 ft. deep showing practically no ore. Another shaft 20 ft. deep has no ore, one shaft 10 ft. deep has no ore, while there are five open cuts along foot of sand stone bluffs which show more or less good looking ore and all five of which were sampled in one general sample.

**SAN JUAN.** Has one open cut 50 ft. in length at foot of sand stone cliff which shows large bunches of ore. Another nearby opening shows about 18 inch streak of ore (These were sampled in one general sample) aside from the foregoing there are three 10 ft. shafts which make an indifferent showing.

**MARVINE.** Surrounding a small hill of sand stone are several small openings which show only limited quantities of a very low grade material.

**DURANGO.** Has 23 ft. shaft with ore. A few hundred ft. from this two large openings disclose a mass of very low grade material.
KARE BELT. Has one open pit 14 x 8 x 7 ft. or 1764 cubic ft. out of this one pit was taken and is piled about same over 40 tons of good grade ore. Out of another pit 10 x 12 x 3 1/2 ft. and 75 ft. distant from first was taken 7 tons of ore (Both piles were sampled in one general sample).

BAU. Has large Blowout at one point about 10 ft. diameter in which two holes are sunk each 10 ft. in depth; this blowout is solid ore top to bottom and good grade. At another point 150 ft. distant open cut is run showing horizontal strata 3 ft. in width of good ore (These openings were sampled in one general sample). Still another 10 ft. hole shows very little.

HAPPY NEW YEAR. Very little showing; practically no value.

PIUTE. Has cut 30 ft. long showing 3 ft. of ore on both sides and breast. Sixty feet distant there is shaft 10 ft. deep which shows some ore in irregular form (only the cut was sampled).

INDEX. Has three 10 ft. holes in line the first makes good showing of fair grade ore, the shaft being nearly all in ore; the remaining two make poor showing.

OXIDE. Has four 10 ft. holes, two of which show low grade in considerable quantity and which was sampled. The remaining two show nothing worthy of mention.

LITTLE JOHN. Has three 10 ft. holes and a 4 ft. hole which make fine showings; also two open cuts which do not look quite as well. All these openings are in a line at the foot of a sand stone cliff (and were sampled as a whole in one general sample).

TOMBOY. Has a large pit 10 ft. in depth which shows horizontal sheet of from 3 to 4 ft. of what appears good ore (sampled this). There is also a 10 ft. shaft which shows little of value.
COPPER CROWN. Has large pit 10 ft. in depth sunk in fair grade of ore to bottom. Another 10 ft. shaft however only 10 ft. distant from this shows no ore whatever; as is also the case with still another 10 ft. shaft some 50 ft. distant.

VALLEY VERDE. Has two open cuts one 30 and the other 50 ft; the 30 ft. cut shows a small amount of ore much scattered; the other shows nothing.

WHITE MESA QUEEN. Has one open cut 18 ft. in length. One trench 30 ft. each of which shows ore sparingly. Three 10 ft. holes, two of which show nothing, the other a class of material too low to consider.

BLUE REEF. Has 10 ft. hole which shows a mass of material of so low grade as to render its value questionable. Another 10 ft. hole displays a less quantity of about the same class. Two other 10 ft. holes show practically nothing.

<table>
<thead>
<tr>
<th>Exhibit of Values</th>
<th>Gold</th>
<th>Silver</th>
<th>Copper Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td>Gen. Sample</td>
<td>trace</td>
<td>0.40</td>
</tr>
<tr>
<td>ELI</td>
<td>&quot;</td>
<td></td>
<td>1.30</td>
</tr>
<tr>
<td>MOLLIE T.</td>
<td>&quot;</td>
<td>17&quot;</td>
<td>5.80</td>
</tr>
<tr>
<td>MOLLIE F.</td>
<td>&quot;</td>
<td>open cut</td>
<td>3.70</td>
</tr>
<tr>
<td>IDA BLYTHE.</td>
<td>&quot;</td>
<td>2 shafts</td>
<td>8.10</td>
</tr>
<tr>
<td>GRAND PACIFIC</td>
<td>&quot;</td>
<td>15' shaft</td>
<td>0.30</td>
</tr>
<tr>
<td>LITTLE DICK</td>
<td>&quot;</td>
<td>75' tunnel</td>
<td>0.04</td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>26' shaft</td>
<td>trace</td>
</tr>
<tr>
<td>LENORE</td>
<td>&quot;</td>
<td>15' shaft</td>
<td>0.46</td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>56' cut high grade</td>
<td>8.30</td>
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<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>55' cut low grade</td>
<td>0.50</td>
</tr>
</tbody>
</table>
After determination of values in above samples, the whole (which were of equal weights) were in a finely comminuted state, thoroughly mixed, carefully sampled and assayed showing a result of: Gold ozs-Trace. Silver ozs. 2.50, Copper % Dry 7.4

All of the foregoing determinations of values was by Mr. Albert B. Sanford of 1727 Champa St. Denver Colorado. Assayer for the United

<table>
<thead>
<tr>
<th>MOUNTAIN VIEW</th>
<th>Gen. Sample, 36' cut</th>
<th>Gold. ozs.</th>
<th>Silver. ozs.</th>
<th>Copper % Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td>NESTOR</td>
<td>20' cut</td>
<td>1.50</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>MAYFLOWER</td>
<td>15' shaft</td>
<td>1.30</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>VICTOR</td>
<td>5 open cuts</td>
<td>1.40</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>SAN JUAN</td>
<td>2 open cuts</td>
<td>1.25</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>HARE BELL</td>
<td>blow out &amp; open cut</td>
<td>5.00</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>PIUTE</td>
<td>2-10' shafts</td>
<td>1.40</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>OXIDE</td>
<td>2-10' shafts</td>
<td>0.40</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>LITTLE JOHN</td>
<td>6 openings</td>
<td>0.66</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>TOMBODY</td>
<td>Large pit</td>
<td>1.68</td>
<td>8.3</td>
<td></td>
</tr>
</tbody>
</table>

| BANK | blow out & open cut | 5.00 | 15.3 |
| PIUTE | 30' open cut | 1.40 | 1.0 |
| OXIDE | 2-10' shafts | 0.40 | 0.8 |
| LITTLE JOHN | 6 openings | 0.66 | 4.6 |
| TOMBODY | Large pit | 1.68 | 8.3 |

States Customs.

Careful experiments in the leaching of these ores have been engaged in by the following methods and with the following results:

Equal weights of all samples taken, the whole amounting to 12 1/2 pounds was carefully sampled and assayed showing 7.4 % Dry copper or 8.9 % wet copper. This material was then subjected to leaching in a solution containing 200 pounds of acid per ton for a period of one hour the work being aided by thermal waters and pneumatic agitation. The result was a recovery of 15.6 ozs. of precipitate having a fineness of 79.6% metallic copper and showing a recovery of 99% of the assay values shown. A check upon this was made by assaying the tailings which showed 0.5% wet copper or a loss of 5/89 of the assay value, and a consequent saving of 94.6%.

The excess in extraction determined from first method was possibly due to a slight salting from a previous run of material.
It will be seen from this report that there are in all 36 claims embraced in the White Mesa Group. All but two of these which are fractional are 600 x 1500 ft, or the limit of size allowed by the United States government.

It will further be noticed that for so great a number of claims forming a single group or property, that an inordinate number of them present ores of commercial value.

Presented individually the Mollie T., Ida Smythe, Little Dick, Lenore, Mountain View, Nestor, Mayflower, Victor, San Juan, Hare Bell, Bank, Little John and Tomboy present attractive features. Of these the Mollie T., Little Dick, Lenore, Hare Bell and Little John make remarkable presentations for the work done.

Thus it will be seen that of the 36 locations no less than 13 make good appearance and show ore of commercial value.

A few of the balance of the claims make fairly good showings, but the remainder present nothing that entitles them to consideration except along the line of surface privilege.

The ore as will be seen is of a most desirable kind. The results from leaching would seem to indicate error in the opinion hereinbefore expressed that silicates of copper formed a part; and it is now evident that no appreciable amount of values of this form are present.

The cost of mining the ores of this property may be reduced far below the minimum heretofore existing in the United States in so far as the writers knowledge extends. This for the following reasons: First, the formation embodying the ore together with the ore itself is so easily broken that very little powder will be consumed and little destruction of tools will be suffered. Second, almost unlimited labor, extremely cheap, and of average efficiency under skilled superintendence is available without competition or restraint, through the employment of Moqui and Navajo Indians.
Third, fuel for domestic use and mine timbers of a certain class, for extended operation exists upon the ground in the form of a scattering growth of cedars which covers the entire mesa.

In contradistinction to the foregoing features, appears the remoteness of the property from Railway lines the nearest point being some 120 miles. The limited water supply upon the ground. The apparent lack of magnitude in individual ore bodies, though the same are innumerable and cover a wide area, while in fairness it must be stated that development is insufficiently extended to demonstrate the absolute truth of this opinion regarding individual magnitude; again this belief will find support in the minds of many from the ores occurrence in Arenaceous in place of Calcareous sediments.

Yet the fact remains that through the method of mineralization here presented, (the sand stones being amenable to percolation over sufficient individual areas) it becomes possible for ore bodies of even greater proportions to exist, than those created through destruction of, and substitution in lime.

The coal situated upon a line directly enroute to the nearest Railway point (Flagstaff on the A. T. and S. F. R. R.) though of apparently fair volume and useful as a fuel in many ways, is not a coking coal.

Thus is presented as fairly as possible through conditions at present observable a recapitulation of the merits and demerits of this property.

Dated.

Denver, Colorado.

July 15th 1905.
SECTION EAST AND WEST

19 Miles To Colorado River

Cretaceous Sandstones

Limestone

West

East
PLAN

showing final survey by the United States Government of the claims of the
WHITE MESA COPPER CO.
COCONINO COUNTY
ARIZONA

Scale 2000 feet = One Inch

19 Miles to Colorado River