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NOTES RE GRAPEVINE CANYON

COBALT PROSPECT NEAR HUMBOLDT, ARIZONA

From conferences with Bill Snyder June 28th, 1941 and Howard Gentry June 30th, 1941.

Nine contiguous unpatented mining claims extending north and south along Grapevine Wash and covering all surface showings and both upper and lower workings. Owned by George Babbitt of Flagstaff, Gentry, Snyder and Guthrie and all location or assessment work done for current year.

Country is Yavapai Schist with diorite dikes or sills and nearly is intrusion of pinkish granite or altered quartzite, locally known as Bradshaw Granite.

All these rocks are pre-Cambrian. In portions of the diorite much olivine is noted and also specular hematite and some magnetite. Surface showings of copper ores are noted in this vicinity and some copper is reported to have been produced many years ago.

The outcrop of the two cobalt veins which have been prospected shows black-oxide and cobalt bloom, the bloom increases a short distance below the surface and then gives place to sulphide and arsenite (cobaltite and smaltite) which occur as in the veins as developed in the shafts and adits.

At the lower location a short distance above the windmill and on east bank of wash there is an old adit tunnel some 700' long driven to the east. The lower vein crosses this tunnel in the schist or on the contact with a diorite dike about 200' in from the portal. Vein strikes northwest and has been followed back with a drift for 60 or 70' and has a width of some 18" and in places shows

pockets of cobalt ore which assayed 1.49% Cobalt.

The further extension of the tunnel does not again cut the vein which should lie some distance further to the south.

Further up the wash there is an old shaft on the east bank of the wash but this is now caved and no cobalt ore is to be found on the dump.

A mile or more further up the wash the more recent workings are found on the west bank consisting of an adit about 100' long driven to the northwest and evidently started in order to cut the upper vein which outcrops some 900' further up on the hillside to the north-west. This vein strikes north-east and dips about 60 degrees or so to the north-west. It occurs on the contact between diabese and granite and has been traced for some distance on the surface while several parallel stringers or branch veins run into it from the south.

A short adit opens up the vein in one place and near this there is a shaft 30' deep sunk in the footwall. This was cleaned out by the present owners but there was no crosscut to the vein.

In the adit the vein has a width of 18 inches to 24 inches but the cobalt ore seems to be confined to pockets which occur at irregular intervals.

A picked sample from one of these pockets assayed 7.50% cobalt but other and more nearly average samples, some of which were analyzed by the Sheppard Chemical Co. ran from 2.49 to 2.88% cobalt and it might be difficult to produce any large tonnage of ore averaging better than 2.5%.

Apparently this prospect seems to have possibilities and the owners intend to carry on some further exploration which may first

involve crosscutting some 20' from the bottom of the upper shaft to cut the vein and then drifting on same and if this work gives favorable results they might continue the adit and thus cut the vein some 300' lower down.

Rock is very hard and air drills should be used. To carry out a comprehensive program of development would likely cost $15,000 to $30,000 but a preliminary expenditure of $5000 will probably be sufficient to determine if property is worthless and otherwise further financial assistance may be obtainable from other parties.

(Wrote to Babbitt who may wish to have me make examination for which should get $250.00).

file

November 22, 1940

COBALT NOTES

From conference with Alen Scott of M. J. O'Brien, Ltd.

O'Brien owns the Missouri Cobalt Company which owns a large acreage of mineral land near Fredricktown, Missouri formerly operated by North American Lead Company and adjoining the old Mine La Motte holdings in which somewhat similar ore was once found.

In the ground of the Missouri Cobalt Company there were wholly or partially proven between 300,000 and 400,000 tons of ore in a nearly flat seam in the limestone strata some 250' below the surface.

Much of their ground still remains to be explored and there is a good chance that upwards of 1,000,000 tons of ore might be eventually found.

The average grade of the cobalt ore is as follows:

Co.	0.5%
Ni.	0.5%
Cu.	2.00%
Pb.	1.75%

This class of ore gradually gives place to material which eventually contains only copper and lead with very little cobalt and nickel.

The metallurgy of this ore and separation of the cobalt and nickel has always been a problem and O'Brien after spending over $1,000,000 since 1910 gave it up several years ago since it did not then appear that it would be possible to produce cobalt

in competition with the metal obtained from other sources and particularly Africa.

Situation has changed since the outbreak of war and if an economic method of treating this ore could be developed the deposits might form the basis for a very substantial and profitable industry.

O'Brien would be glad to deal with other parties, e.g. A. S. & R., Union Carbide Co., Shepperd Chemical Co. or newcomers in the field.

All old shafts now caved and drowned out and whole area might have to be unwatered unless new shafts were sunk. No fresh sulphide ore now obtainable for test samples unless by breaking open some of the larger lumps of ore in the bins. Surface of these lumps has been weathered and oxidized.

From Mining & Metallurgical Society Bulletin - March 1939

Cobalt used for cobalt steels, stillite etc. required for tool steel and permanent magnets and as a catalyst in the chemical industry. No U.S. production and imports in 1937 were 2,000,000# with demand increasing. Recommend that a military reserve should be accumulated.

Not classed as a strategic or critical metal in Acts of Congress but believed that Bureau of Mines and War Department would be willing to help to stimulate domestic production.

Stated that Western Hemisphere produces 30% of world's demand, probably practically all of this 30% comes from Canada.

Price of metal in 1935 was $1.2375 per lb. and now quoted at about $1.50 per lb. Recent production mainly from Rhodesia and Belgian Congo, Canada, China, Queensland, Burma and Morocco.

Still large supply of cobalt in Canada but ore getting lower grade and hence more expensive to obtain.

Apparently no production from New Caledonia for several years.

Sept. 1903

COBALT MINING IN NEW CALEDONIA

By George M. Colvocoresses

HISTORY:

For many years New Caledonia has been well known to the mining world by reason of its nickel industry and in both English and French much has been written on that subject. In English at least very little has been written concerning the cobalt industry of the island, which at the present moment has attained a very considerable importance and whose product may someday rival in value that of the famous nickel mines.

There sees to be no accurate account of the discovery of cobalt here but the first claim was taken up in 1876 in the southern portion of the island and shortly afterwards other claims were granted in the north and west-center.

The working of the mines was at first very intermittent and on a very small scale so that the first official export figures which I can find are for 1888 when 2595 tons of ore (metric) were shipped. Export figures for the ensuing years are as follows:-

Year	(Ore exported) Metric tons
1889	2185
90	3740
91	1348
92	1927
93	520
94	4156
95	5302
96	6204
97	4570
98	2373
99	3287
1900	2437
01	3123
02	7512

These figures are interesting as showing the remarkably unstable condition which has always prevailed in the market. The quantity of cobalt ore produced and exported depends directly and instantaneously upon any change in the market price since a large proportion of the mines shut down at every considerable fall in value to reopen again as soon as the figure goes up.

At the present moment (Sept. '03) the market is good and there are probably some fifty working mines employing about 1000 men; the great part of the miners being liberes,- French ex-convicts on ticket of leave,- with Kanaka natives and Chinese for the traffic, etc. It should be noted that from 1880 - 84 attempts to smelt the ore here were made by Le Nickel" of Paris and later by the Maletra Company. A small quantity of matte carrying about 20% cobalt was made and also some that carried 35% of nickel and 10% of cobalt. But the smelting did not prove profitable and only a few hundred tons of matte were ever sent away.

FORMATION AND NATURE OF ORE:

The cobalt like the nickel and chrome is found in the serpentine formation. These serpentines are generally supposed to be derived from peridotites which with the serpentine go to make up the Chaine Centrall,- a range of mountains that forms the backbone of New Caledonia,- some peaks attaining a height of 1600 meters. Great spurs from this range and in places a

few detached mountains jut out on either side often to the very edge of the Pacific. It cannot be said that the cobalt deposits show a partiality to any particular locality since they occur in all parts of the Island and even on the new detached Isle of Pines off the south end and the Isle Belek off the north.

Asbolane is the name given to this cobalt ore and it is a cobaltiferous-manganese-oxide or to be more exact, a compound of binoxide of manganese with various protoxides and containing from 2% to 9% protoxide of cobalt (CoO.)

Complete analyses of this ore have rarely been attempted yet I am able to give two examples, the first made by H. Capaux and published by him in the Chemical News for June 19, 1903, the second made by Thomas Moore of Noumea.

(1)		(2)	
H_2O	15.8%	H_2O	9.05%
MnO	38.2	MnO	55.55
CoO	7.9	CoO	8.45
NiO	3.6	NiO	2.66
Fe_2O_3	3.5	Fe_2O_3	3.88
Al_2O_3	18.8	Al	8.80
Alkali and alkeline earth	1.2	Mg.	1.76
Active O	9.4	Ca.	trace
SiO_2 and Chromite	0.5	Active O	7.85
		Insoluable containing chromite	2.06
Total	98.9	Total	100.06

(In some samples traces of zinc and of lithium are found)

Unlike the nickel the cobalt does not impregnate the serpentine nor occur in its fissures but sometimes it rests as a layer upon this rock and more often it is found bunched in the clay above the serpentine and extending up into the ironstone and pebble, i.e. the blanket of hydrated-oxide of iron which in pesolitic form covers the surface. The above mentioned clay is rich in iron and especailly in magnesia and is often traversed by thin bands of quartz and of amorphous silica.

The most extensive cobalt deposits have been found just under plateaux or broad spurs of the mountains, the elevation varying from 400 to 800 meters. The indication of ore is the cobaltization of the iron pebble on the surface which takes on a rich blue-black lustre. Analyses show this cobaltized iron to contain from 0.5% to 1.5% CoO, the latter only over the very rich deposits. "Heads" or showings of coablt ore may be found projecting through the iron,- from which it is barely distinguishable,- and at these points the prospect work is begun, tunnels being driven on the hillside cutting under the heads or shafts being sunk directly on them.

No true-veins or lodes ever reward the search but only pockets and bunches of a most irregular shape and usually very small,- say 4 or 5 tons. From these pockets small stringers run out sometimes leading to other pockets but more often pinching and disappearing or ending in a wall of serpentine. Until recently it was the habit to stope out these pockets follow the stringers to their ends and then abandon the workings at this point to follow the same rule of action at another. Latterly developments in some mines have been conducted on a larger

scale and tunnels have been driven from one pocket to another and advanced under the center of the plateaux or spurs. In at least two of the mines the research work is being carried on by core drills which are a great improvement and economy on the old tunnel and shaft method. The advance into the spurs or under the plateaux has in some cases developed pockets much larger than any near the surface but efforts to follow these ore bodies downward have proved fruitless, for almost immediately the work must cease on enccountering the underlying serpentine.

Many persons have studied these mines with a view to finding a scientific way of working them but so far all efforts have been baffled by the absolute lack of system or regularity in the occurrence of the pockets the finding of which still remains greatly a matter of luck. Here as everywhere experience is of great value and a man used to the work can tell much by the lay of the Serpentine, the color and composition of the earth and clay in the tunnels, etc. He can distinguish roughly between the formations that are barren and those that are likely hunting ground but whether his tunnel or drill will cut a pocket or pass just to one side of it and whether the pocket will prove large or small and in what direction it is best to search for the next one,- these are matters which must be left to chance.

WORKING A MINE:

The working of these mines must of necessity be primitive since even the largest deposits always seem too small to pay for costly installations calculated to save labor and cut working expenses. The tunnels and shafts are left to stand alone as long as possible and then timbered most cheaply, or the sides

and pillars are robbed of ore and the workings allowed to fall in. In one mine rails and dumping cars have lately been put in use, in all the others the ore and waste is taken from the tunnels by wheelbarrows, the waste being dumped down the hillside soon forming a platform for stacking the ore . Frequently the side of a spur especailly of a plateau will be seen fairly honeycombed with these little tunnels. a tiny stack of ore at the mouth of each. Drainage is provided for by driving the tunnels with a slight upward incline or, if they are forced to descend, in following the ore. by digging a small well or sump from which the water is taken by buckets or a hand pump. The ore on the platforms is picked over a bit by hand, sometimes sorted and sized by sieves and loaded in bags it is transported by men or horses to a central point at the top of the aerial tramway. Or better, if the lay of the ground permits short spans of single cable ARE STRETCHED FROM THIS POINT TO THE MOUTHS OF THE principal tunnels and shafts. The bags are sent down these suspended from a roller-grip which is derailed at the foot, the ore bag being thrown against a buffer of brush or old sacking.

The aerial tramway is formed by two parallel cables stretched from the mine top to the fast and thanks to the elevation of the mines, they work by gravity, forming what the French appropriately call a "ni-et-vient." To each lift is attached a drawing rope so that the descending ore will bring up the ~~left~~ lift on the other cable sometimes loaded with pro-

visions for the men (if they live at the mine top) tools, timber sticks for the tunnels, etc. The speed of the voyages is regulated by a brake on the wheel over which the drawing-rope passes. The main cables are anchored at the top and drawn taught by a huge wooden drum at the bottom. They are from 12 to 20 milimetrs in diameter and the drawing rope from 6 to 8 millimeters. Owing to the steepness of the hillsides these cables are unsupported and form a single span up to 1400 meters in length. However, it has been found better not to exceed 1000 meters and from the very high mines, two and sometimes three spans are required to convey the ore to the landing stage at the end of each span the ore bags being shifted by hand to the lift of the next one.

Effort is always made to place this landing stage on the bank of a stream so that the ore mashers can be installed there. The washer consists essentially of a level rectangular sluice-box, 2.5 meters long by 1.25 meters in width into which the stream water is turned by a short ditch the flow being regulated by a gate. The water stands about 5 centimeters high in this box running out over a foot board at the bottom. On one side of the sluice is a platform furnished with a large iron plate and on this the ore bags are emptied and the ore crushed to a fine gravel by a kind of hand "dollie". The object of this crushing is to separate the asbolane from the clay and quartz matter which encrust it and also to reduce it to a fairly uniform size since the ore is found as tiny pebbles or it may be in large blocks that have to be cut up before they can

leave the tunnels. About 300 kilo's of crushed ore is now shovelled into the sluice box and the flow turned on. A man standing in the box agitates the ore contijually with a large shovel and with his feet while the water carries away the light earth and silicious matter leaving the heavier ore and unfortunately much iron also. The washing lasts about 15 minutes when the ore is shovelled out to dry on a draining platform, the box being ready for another charge. The washed product should now exceed 4% of CoO and will often carry up to 7% though the latter is very rich. In bulk it is generally about one fifth of the untreated material but this proportion varies greatly in different mines.

TRANSPORTATION:

The cobalt is now ready for furnace treatment which means for shipment to Europe. But first it must reach the seaport and capital, Noumea, where it passes into the hands of one of the numerous buying concerns and is weighed and sampled the mining company being paid on the analysis and the price following a sliding scale according to tenn CoO.

As New Caledonia is not yet blessed with railroads, except a few short lines at the nickel mines nor even with good wagon roads in most parts, the ore must be taken to the coast and shipped to Noumea by the bi-monthly coast steamer. Fortunately there are many little rivers on the island navigable to small lighters or punts and so a road is cut for a bullock

cart to the nearest of these or if this involves too much work, pack horses carry the sacks over a narrow trail ending at the wharf for the lighter. When it is remembered that New Caledonia is nowhere more than 60 kilometers wide it will be understood that none of the mines are at a really prohibitive distance from the coast, yet the roughness of the country, the difficulty of keeping roads and tracks in repaid and many other causes often make the traffic very expensive. I know of one mine whose transportation from the washout to the coast,- a distance of some 30 km.,- cost nearly $15.00 per ton and such transportation is often altogether stopped by floods and washouts and again in the dry season by lack of water for washing the ore.

From all the foregoing it will be seen how very primitive are the methods of work and how uncertain the production of cobalt in New Caledonia. Nothing certain can be said of its future though from all past developments, it is surely reasonable to presume that new deposits will be found as the present ones decline and that under the stimulus of high prices the ore may be found and worked in many places as yet but little known.

The present prices are high, the last quotations being in Noumea, 240 francs per ton (metric) for 4% ore, 320 francs for 4½% ore and 350 francs for 5% with a rise of 12 francs per

ton for every 1/10% above.

These are the prices paid by the commission house of Noumea and they allow a very fair profit to any but a very poor or very badly situated mine.

The Noumea houses resell and ship by 50 or 100 ton lots mostly to Germany and the demand seems on the increase. It is a pity that there is no market for this ore on the Pacific Coast of the United States as very cheap freights could probably be secured on returning lumber schooners which must now take on ballast here to return to the United States or to cross to Newcastle for a cargo of coal.

S/ G. M. Colvocoresses