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NO. 10

An Investigation
of the

TYRRELL MANGANESE DEPOSIT

and

Other Similar Properties
in the

LAKE CREEK DISTRICT, OREGON

by

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Geology and Mineral Industries



1943

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FOREWORD

In the Lake Creek district in Jackson County, Oregon, east of Medford, there are several known occurrences of manganese-bearing volcanic tuff. The most important of these is called the Tyrrell Mine, located on Lost Creek. In World War I this property produced several carloads of metallurgical grade, manganese oxide concentrates. Out of the eighty odd manganese prospects in the State, the Tyrrell is probably the most attractive as regards possible commercial production of manganese.

Some recent exploration at the property, resulting in the discovery of some new ore, indicated that the Tyrrell Mine might possibly become active again. Therefore, a careful job of geologic mapping and investigation by the Department seemed warranted. The investigation and this report, covering the work, were done by Wallace D. Lowry, Junior Geologist of the Department. The author describes other manganese prospects in the district in addition to the Tyrrell, and also includes a discussion of the origin of the ores.

Earl K. Nixon, Director
January 10, 1943

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AND OTHER SIMILAR PROPERTIES IN THE LAKE CREEK DISTRICT, OREGON

by

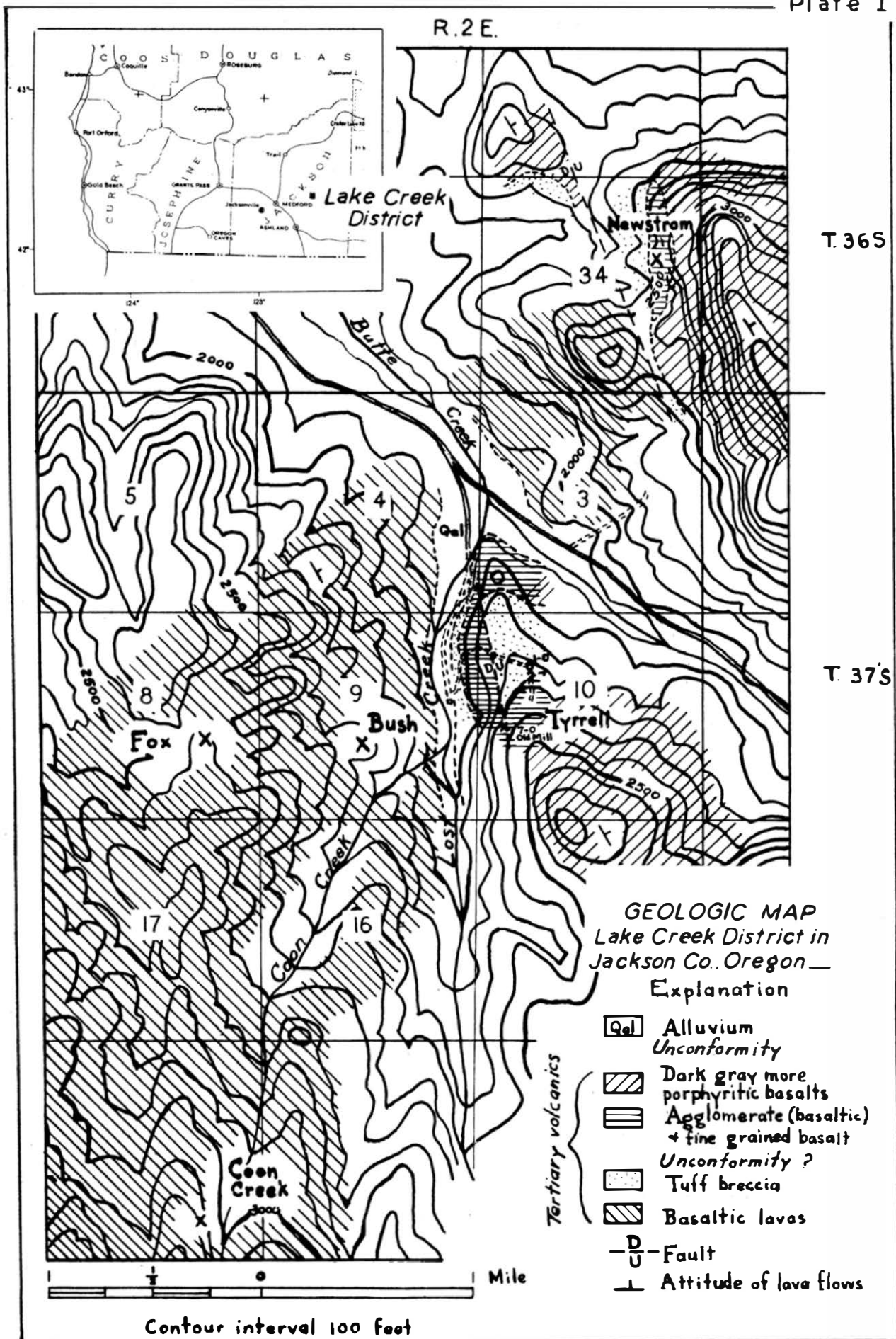
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ABSTRACT

The Lake Creek mining area, about 15 miles east of Medford in Jackson County, southwest Oregon, contains a number of deposits of manganese, one of which, the Tyrrell, was mined and milled during World War I.

The area is underlain by a series of Tertiary volcanic rocks consisting of basaltic lava flows, agglomerates, and tuffs, which dip gently to the east and are faulted by north-south faults.

Manganese occurs mainly as fillings in openings in agglomerate, just above the contact with an underlying fine tuff. The manganese oxides occur as psilomelane, pyrolusite, manganite, and wad. The manganese was originally derived by solution from the manganese-bearing minerals of the basalts which once overlay the agglomerate but have now been largely eroded away. Deposition of the manganese from the circulating meteoric waters probably was caused by oxidation and was accompanied by the formation of colloids. Place of deposition was governed by the position of the water table and the porosity of the rocks, which in turn depended upon the size of the agglomerate fragments, the amount of admixed clay minerals, and the degree of shearing and jointing. The highest degree of mineralization apparently took place at the Tyrrell in the agglomerate just above a relatively impervious tuff.

Other manganese properties are only prospects. The Newstrom has a geologic setting similar to the Tyrrell and, next to the Tyrrell, shows the best mineralization.

INTRODUCTION

Accessibility

This district is 15 miles east of Medford. From Medford it is reached by way of the Crater Lake Highway (Oregon 62) to Eagle Point (11 miles), thence east by improved road to Lake Creek (11 miles). The district is about 5 miles south of Lake Creek. The Tyrrell Mine can be reached from Lake Creek by dirt road the last mile of which is poor, especially in the rainy season.

Location of properties

The properties described in this report are shown on the geologic map, plate 1. They are:

Tyrrell Mine $N\frac{1}{2}$ sec. 10, T. 37 S., R. 2 E., El. ca. 2300'.
Newstrom Prospect $E\frac{1}{2}$ sec. 34, T. 36 S., R. 2 E., El. ca. 2500'.
Coon Creek Prospect $SE\frac{1}{2}$ sec. 20, T. 37 S., R. 2 E., El. ca. 3200'.
Bush Prospect NE corner, $SW\frac{1}{4}$ sec. 9, T. 37 S., R. 2 E., El. ca. 2350'.
Fox Prospect $N\frac{1}{2}$ of $SE\frac{1}{2}$, sec. 8, T. 37 S., R. 2 E., El. ca. 2600'.

Field work

The investigation of these properties was made between July 28 and August 14, 1942 and included the examination of the geological and mineralogical features of all the properties, the sampling of the two most promising ones - the Tyrrell Mine and Newstrom Prospect, and a plane table survey of the Tyrrell Mine. The underground workings of the Tyrrell deposit were mapped by means of Brunton compass and tape.

Acknowledgments

The author desires to express appreciation to Mr. George Holmes, engineer, and Mr. Demartini for their helpful assistance and to Mr. George E. Murphy, Jr. who assisted in the field work and the plane table survey of the Tyrrell deposit. Mr. John Eliot Allen offered many helpful suggestions in preparation of the manuscript.

General features

The Lake Creek district, in which these properties are located, is drained by the south fork of Little Butte Creek and its tributaries. Little Butte Creek empties into the Hogue River west of Eagle Point.

The relief of the district is marked. While the general elevation of the valley areas is 2000 feet, the ridge west of the Tyrrell Mine is over 2800 feet; the ridge to the east and southeast, over 4000 feet. These are northwesterly-southeasterly trending ridges, with steep west slopes and less steep east slopes, separated by creek valleys. Many of the creeks are subsequent, following contacts between lava flows. Some follow the trend of fault displacements.

The climate is mild and is characterized by a dry summer and a somewhat rainy winter season. Scrub oak, madrona, manzanita, chaparral and poison oak are common on the lower slopes. Douglas fir is common at elevations above 3000 feet.

THE TYRRELL MINE

History and Development

According to Pardee (21:218) who visited the property in 1918:

"Development of the Tyrrell deposit by open cut and drilling was begun in the fall of 1917 by the Manganese Metals Co., which later built a concentrating mill capable of treating about 20 tons of crude ore in 24 hours. Prior to July, 1918, the mill operated intermittently and produced about 200 tons of concentrates. Late in the summer of 1918 Victor Rakowsky of Joplin, Mo., prospected by drilling a part of the land controlled by the Manganese Metals Co., on which he had obtained an option."

The old open cut is about 100 feet long and from 20 to 30 feet deep. The main tunnel at the northern end, which is now caved over much of its distance, trended about N. 65° E. for about 110 feet. About 25 feet from the face, a drift along a fault plane runs 20 feet S. 20° E. to a caved winze, then turns S. 80° E. for about 30 feet. At the south end of the open cut, 125 feet south of the main tunnel, another crosscut parallels the north side of a diabase dike in a S. 60° E. direction for about 75 feet.

In May, 1942, George L. Demartini, 1234 Folsom Street, San Francisco, bought the Tyrrell property from B. E. Bush. Since then eleven bulldozer cuts, 12 feet wide and up to 10 feet deep, several prospect pits, and two hand-dug trenches have been excavated. All this new development work lies north of the old mill, open cuts, and tunnels, extending for a distance of about 1800 feet, the bulldozer cuts being from 50 to 200 feet apart along the northern 1000 feet of that distance, and trending east-westerly across the outcrop of the mineralized zone. Most of the old workings have been reopened. At the present time there is no equipment on the property.

The other properties have not produced any manganese ore. Exploration is meager and consists of prospect pits, short open cuts, and one shaft 24 feet deep.

Literature

The Tyrrell property was discussed at some length by Pardee (21:218-220) who visited it in 1918. Engineers working for Hodge (37:10) examined and mapped the deposit in 1937. It was visited and sampled in 1938 by Libbey (42:16) and by Wells (39). A bibliography is given at the end of this paper.

petrology

According to the geologic map of this district (Plate 1), reproduced in part from the geologic map of the Medford quadrangle (Wells, 39), all of the district is immediately underlain by volcanic rocks of Tertiary age. These overlie the Umpqua formation of Eocene age.

The Tyrrell Mine is situated well up on the west slope of a north-south trending ridge east of Lost Creek, a tributary of Coon Creek. The ridge is composed of volcanic rocks that dip several degrees to the east. At the Tyrrell Mine the chief rock-types are brown buff breccia, basaltic agglomerate, capped by basalt flows.

The brown buff breccia has been mapped by Wells (39) as the buff buff member of the Tertiary volcanic rocks. It is described as a buff, fine-grained tuff with fragments of flow rocks. It is believed to be equivalent to the agglomerate formation of the Butte Falls quadrangle to the north (Wilkinson, 41).

One thin section shows this brown buff breccia to be 90% glass (including scoria), 5% feldspar, and 5% magnetite together with other opaque constituents.

The feldspar grains are as much as 1.5 mm. long and have subhedral to anhedral outlines. Albite twinning with extinction angle values of 23° - 26° and 32° - 28° , and an index of refraction of 1.55 - 1.56, indicate labradorite. Magnetite grains vary from subhedral to anhedral in form. The index of refraction of the glass matrix is about 1.535 which is a basic lava value.

Another thin section of the brown breccia is 45% devitrified brown glass, 40% chalcedonic material with minor calcite, 4% feldspar, and 1% magnetite.

The feldspar grains are 2 - 2.5 mm. long and have anhedral outlines. They show albite twinning and give extinction angle values up to 23° . The feldspar has an index of refraction between 1.56 and 1.57 and probably is labradorite. Subhedral to anhedral grains of magnetite make up about 1% of the section. The chalcedonic portion is made up of irregularly outlined masses with both spherulitic and bladed structures; sometimes these are combined, with spherulitic centers. The brown buff breccia is overlain, probably unconformably, by a reddish-stained agglomerate composed of fragments of basalt scoria and associated lithic material. Iron oxides give the rock its red color; the original color was a medium gray. The main manganese mineralization occurs in this agglomerate, which is as much as 35 feet thick and when favorably exposed by erosion forms rough columnar masses.

On the north end of the ridge, this agglomerate has been eroded away, but it crops out south of the old mill site. To the west, it has been faulted down, but may extend under capping flows for some distance to the east. The thickness may vary considerably, as it may have been laid down on an uneven erosion surface.

Thin sections of mineralized portions of this rock show it has a cellular or finely vesicular texture. The cell walls are rough and irregular, with the total cell space making up 25% of the rock volume. The cells may be filled with opaque minerals which are mainly various manganese oxides.

The rock is nearly all glass with an index of refraction value between 1.54 and 1.55. This indicates a basaltic lava. Small laths and microlites of feldspar make up 2% of this glassy matrix and have a rough alignment of their long axes and a rough parallelism to the long dimension of the vesicles. The feldspar laths give albite twinning extinction angle values of 32° - 27° indicating labradorite, and establishing the scoria's basaltic character.

The manganese oxides partly or completely fill the cells and openings in some of the scoria itself as well as the openings between the individual lithic fragments. Further

discussion of this feature is given in the section dealing with mineralization.

The agglomerate is overlain by basaltic flows, which form the top and the eroded back or east dip slope of the ridge. The lowest flow is a dark gray, fine-grained, slightly porphyritic basalt, broken by numerous fractures.

Thin sections of the basalt show a trachytic texture. The phenocrysts make up but 5% of the rock. Labradorite grains, having subhedral to anhedral outlines, anhedral grains of magnetite, and anhedral grains of augite and orthopyroxene are present as phenocrysts. The groundmass is made up of twinned laths of feldspar and grains of a clinopyroxene, constituting 50% of the rock, situated in a micro- to cryptocrystalline matrix which makes up the remaining 45%.

South of the mine proper the ridge rises to the east and southeast and is composed of dark gray, more porphyritic basalts. All the above-mentioned basalts and an associated white tuff belong to the same series.

Structures

The rocks in the area strike about N. 45° W., and dip at low angles (10°±) to the east, and are at times broken by faults. The location of one normal fault is shown in the northeast quarter of the geologic map (plate 1). The displacement is vertical; the west block moved down in relation to the block which now forms the ridge top. Slickensides and numerous fractures and slips shown in the drifts from the Tyrrell mine open-cut indicate that this is a zone of faulting rather than a single fault. The main fault trends N. 20° W. and dips 80° to the west but in places numerous intersecting faults have sheared the basalt rock, converting it in places to a serpentinous-appearing material or "slickentite". There are gouge zones several inches wide as well as a breccia zone eight feet wide. A bench which lies west of this fault, halfway up the west slope of the main ridge, and a spring on the line of faulting are other manifestations of this faulting. Brown tuff breccia capped by dark gray, fine-grained, slightly porphyritic basalt forms the bench block west of the fault and immediately east of Lost Creek. This is a repetition of the sequence to the east of the fault (along the ridge top) which has been produced by the faulting action.

Lost Creek valley with its nearly north-south trend may be in part of fault origin. This trend is not markedly different from the strike trends of the rocks, however, and Lost Creek valley may be mainly erosional in origin. The brown tuff breccia forming its east wall is not a resistant rock. It was not found on the ridge west of Lost Creek which is composed of basalt flows, often amygdaloidal. Contorted platy structures occur in the basalt on this ridge near the Fox prospect. If this platiness indicates flow-planes in the rock, the close "folding" may be primary; if the platiness represents jointing, actual folding of the lava has taken place. At the Fox prospect the rocks are faulted along northwest trending lines. The major axes of these local structural domes and basins have a northerly trend. Judging from their different lithology, attitude, structure and location, these basaltic rocks are older than the flows east of the Tyrrell Mine. They are not the equivalent of the latter, faulted down to the west; as might be the case if Lost Creek were developed along a major fault or fault zone. These basalts are similar in certain ways to other basalts of Eocene age in Oregon.

Age

The basalt flows east of the Tyrrell Mine may be equivalent to Columbia River basalt of Miocene age (Wilkinson, 41). The underlying tuff breccias are thought to be late Eocene or Oligocene. They contain fossil leaves, and Dr. Ethel I. Sanborn (personal communication) states that the flora is quite certainly not a subtropical or tropical one and that it is probably younger than lower Oligocene.

Mineralogy

Manganese minerals of the Tyrrell Mine include psilomelane (49-62% Mn), pyrolusite

(62.3% Mn), manganite, wad, and possibly manganosiderite and manganocalcite (?). Accessory minerals include calcite and aragonite, barite, zeolites, clay minerals, various iron oxides, and probably gypsum (alabaster variety).

The manganese oxides fill openings both within and between fragments of the agglomerate, the latter type being the more important. Rhomboid and columnar forms of manganite are present and at times may be altered to divergent radiating structures characteristic of pyrolusite (see figures below). However psilomelane and pyrolusite are more prevalent than manganite.



Figure 1. Rhomboid forms in manganite, $\text{Mn}_2\text{O}_3 \cdot \text{H}_2\text{O}$

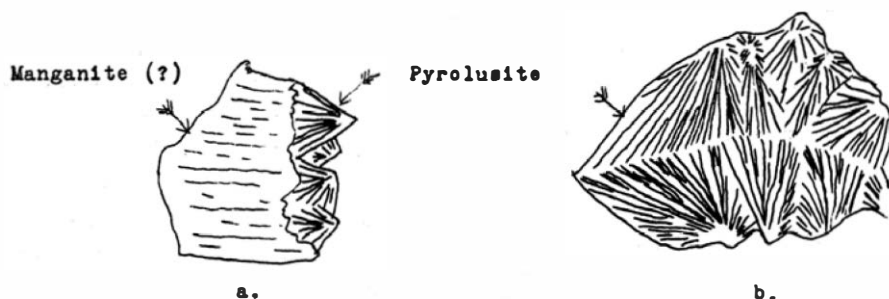


Figure 2. a. Manganite (?) and pyrolusite (formed from manganite)
b. Pyrolusite structure

Psilomelane most simply written as $(\text{MnO}_2 \cdot \text{H}_2\text{O})$ appears against the cavity walls. Next concentrically is an inner layer or layers, commonly of pyrolusite (MnO_2) with divergent radiating structure. Often there remains a central cavity due to incomplete filling. Sometimes pyrolusite alone forms the fillings. Types of fillings are shown by the figures below.

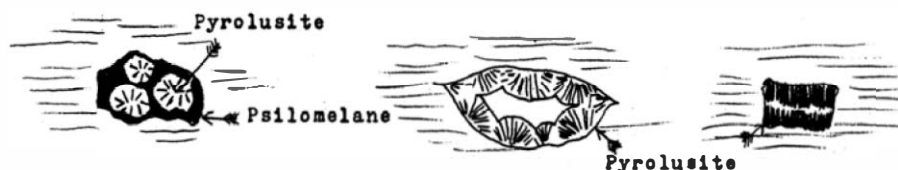


Figure 3. Types of cavity fillings

Botryoidal structures of manganese oxides, largely psilomelane, are common. These have an outer hard layer and an inner soft mass. Wad, an indefinite hydrous manganese oxide (perhaps $\text{MnO}_2 \cdot n\text{MnO} \cdot \text{H}_2\text{O}$, probably grading into psilomelane, $\text{MnO}_2 \cdot \text{H}_2\text{O}$), often accompanies the other manganese oxides, especially pyrolusite and psilomelane.

Barite crystals occur in places along with the manganese oxides. This is a common accessory mineral in many manganese deposits. Calcite and aragonite are also present.

Other carbonates containing iron and manganese, possibly manganocalcite, manganosiderite and siderite, occur with the calcite.

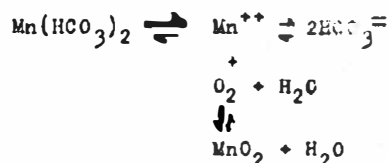
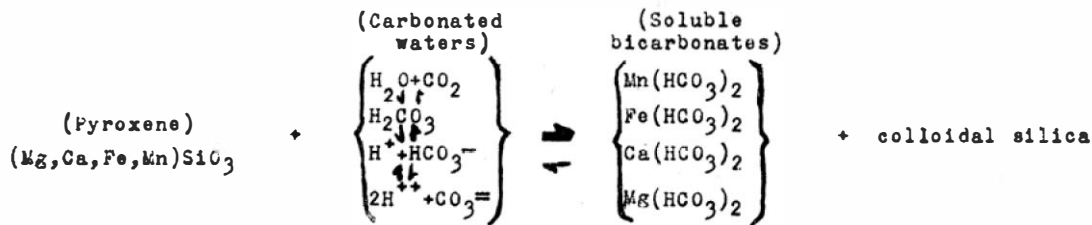
Genesis

The porosity of the agglomerate fragments themselves must originally have been about 25%. The permeability of the rock was further enhanced by its fragmental or breccia-like nature. Cracks and other fractures facilitated the circulation of meteoric waters through the rock mass, allowing it to become thoroughly saturated. The porosity of the agglomerate was decreased by the filling of the various openings by manganese oxides, and carbonates, at points where marked enrichment occurs as in the lower part of the agglomerate and in a portion of the fractured zone.

The lower seven feet of the agglomerate at Station 11-0 (see accompanying map and section) shows manganese minerals forming a considerable portion of the mass. A six foot sample cut from this location assayed 7.35% manganese. The concentration decreases upward and powdery manganese oxides (wad) appear. At the lower contact of the agglomerate with brown tuff breccia at this station (11-0) there is a sharp decrease in the manganese mineralization. While the original porosity of this underlying tuff may have been high, its permeability was reduced by the development of clay minerals which, combined with the smaller sizes of the constituent fragments and less chance to maintain permanent cracks or openings, very likely slowed or stagnated the circulation of meteoric waters. Due to the slowing down of circulation near the contact, the agglomerate must have been mainly in the zone of oxidation, and the tuff in the zone of saturation. The manganese may have been taken into solution by meteoric waters along with iron, calcium, magnesium, and other metals, and was precipitated as an oxide of manganese when free oxygen was present in the water. The oxygen content in the zone of saturation is comparatively low, which may account for the greatly reduced mineralization in the tuff breccia.

Manganite, pyrolusite, psilomelane and wad are always secondary, formed under the influence of weathering even where they descend to considerable depths below the water table (Lindgren, 33:363).

The formation of the various manganese oxides in the openings of the agglomerate is believed to have been substantially as follows. Manganese occurs as a primary constituent of minerals in the basaltic lava and agglomerate, making up a minor percentage of these rocks. A primary manganiferous oxide (manganiferous magnetite) occurs in some portions of the dark gray, fine-grained slightly porphyritic basalt. It has the form of small octahedral grains and may be a syngenetic replacement. Most of the manganese, however, probably originally came from the weathering of the pyroxene minerals occurring as phenocrysts and in the groundmass of the once overlying basalts and the matrix of the agglomerate. When such pyroxene minerals are acted upon by meteoric waters, one of the results may be as follows:



Since the MnO_2 is much less soluble than the bicarbonate, the ionization equilibrium for the bicarbonate will be displaced towards the right, and the manganese

removed from the solution should be precipitated in the form of the relatively insoluble hydrous oxide.

Another type of deposition that may result is deposition as a *gol*, which is discussed by Polynov (37:145) who believes that the manganese may go into solution either as a *sol* or as a manganese bicarbonate, in which latter case, the presence of free carbon dioxide is necessary to maintain it in solution. In manganese deposits such as deep-sea wads, the predominance of manganese over iron is explained by the fact that iron is first precipitated as hydrated ferric oxide and the manganese is retained longer in solution as carbonate.

Lindgren (33:363) agrees that usually the manganese is transported as a bicarbonate, although if ferrous sulphate is present it may dissolve the manganese from the carbonate with precipitation of calcium carbonate; the manganese then being precipitated with excess oxygen. According to Thiel (24:457) the manganese carbonates are more stable than the ferrous carbonate. Lindgren feels that colloid solutions must be formed when the bicarbonate solution is oxidized, as is indicated by the structures in the various manganese minerals.

As may be seen from the above conclusions, it is quite possible that the deposition of the manganese in the agglomerate at the Tyrrell property was a much more complicated process than is indicated by the chemical equilibrium diagrams given above. The oxides were probably originally deposited as colloids (psilomelane) which in some instances crystallized to form columnar manganite or divergent radiating pyrolusite crystals.

Time of mineralization

The deposition of manganese in the agglomerate mass may have occurred at any time subsequent to the extrusion of the basaltic lavas, although possibly some of the manganese was of syngenetic origin. The mineralization in the fault zone took place after the lavas were faulted. This faulting has not been dated nor the age of the basalts ascertained although a Miocene age has been inferred for the latter. The present cycle of weathering could not account for all the mineralization, as the amount of manganese present in the agglomerate represents the leaching from a considerable mass of manganiferous rock. The mineralization is thus thought to have begun when there was still a thick capping of basalts which could supply manganese in quantity to the circulating waters.

If, as indicated at Station 11-0, the manganese concentration in the agglomerate does break off sharply at the contact with the underlying tuff breccia, then some explanation is needed to account for this lower limit of mineralization. Differential permeability rather than chemical conditions is thought to be largely responsible for this. If this be true, mineralization began as soon as erosion permitted circulation of manganiferous waters in the agglomerate mass.

The contact of the agglomerate and tuff breccia is now about 500 feet above the nearest creek. The deposition which probably began soon after the faulting had taken place and erosion had set in is apparently no longer taking place.

Extent of mineralization

The manganese enrichment in the agglomerate at Station 11-0 is fairly uniform in the lower several feet and is poor above a point ten feet from the contact with the underlying tuff. Elsewhere in this agglomerate mass the vertical extent of the manganese mineralization is incompletely exposed. Manganese concentration appears only in the lower several feet and as the contact with the underlying tuff breccia shows in only a few places, the character of the mineralization downward is also incompletely known. Mineralization is probably not uniform, since it is related to or has been facilitated by fault, fracture, and joint structures in the agglomerate.

The lateral extent of the manganese deposition in the agglomerate mass is limited on the west by the ridge slope. On the north the agglomerate has also been eroded away. It is found south of the old mill site but the prospect cuts there show only slight manganese

concentration. The eastern limits are imperfectly known; easterly-dipping basalt flows which cap the agglomerate form the back slope of this ridge. Manganese enrichment of various grades can be traced along the ridge front for a distance of 1300 feet south of Station 1-0.

By the nature of its origin, the agglomerate may be of irregular extent and variable thickness, and if it was laid down upon an erosional surface, as believed, the irregularity would be even greater. Also, the mere occurrence of the agglomerate is no criterion for assuming the presence of manganese mineralization.

A fair estimate of both lateral and vertical extent of the manganese deposition may not be made at the present stage of development.

Manganese concentration in the fault zone appears in the drift and cross-cut at the north end of the southernmost open cut. This mineralization occurs in a fault zone breccia in dark gray, fine-grained basalt. The manganese oxides and accessory barite occur within the most highly brecciated portion of the zone and form two vertical seams of ore each 8 to 12 inches wide. No ore or marked enrichment appears in the continuation of drifts east of this brecciated zone.

A caved winze (see plate 2) is situated in the displacement zone. The depth of the mineralization is unknown. No attempt to follow it to depth along the strike of the zone was ever made. The bottom of the open cut is covered with caved material and could not be examined. The southern end of the open cut and the wall of a drift into the east face there is bounded by a northwest-striking diabase dike. South of this point the dark gray basalt contains in places considerable amounts of manganese in the form of manganiferous magnetite. In places, coatings of manganese oxides, often dendritic in outline, appear on the joint surfaces of the dark gray basalt.

Most of the ore that was mined during World War I came from this mineralized displacement zone and from the adjacent open cut to the south which lies upon its probable continuation.

ASSAYS

Assays of channel samples show that the manganese content varies from a fraction of a percent to 7.35%. Samples cut during the examination and assayed at the State Assay Laboratory, Grants Pass, are as follows (see plate 1 for locations):

- Sample no. I - 6' vertical channel cut at Station 11-0,
above contact with tuff breccia. 7.35% Mn
- Sample no. II - 3' vertical channel cut at Station 9-0, ore
is improving at bottom. 1.70% Mn
- Sample no. III - 4' cut from back and north wall 6' inside
drift near Station 7-0, from mineralized
fault zone. 3.40% Mn

Four samples taken by F. W. Libbey in 1937 were assayed at the State Assay Laboratory, Grants Pass and results are shown below. Checks of separates sent by B. F. Webber to W. A. Markert, Iron River, Michigan, are also given (Holmes, 42):

	<u>State Assay</u>	<u>Markert</u>	
	<u>Mn</u>	<u>Mn</u>	<u>Fe</u>
Sample no. 1	2.47%	2.55%	7.6%
Sample no. 2	0.47%	0.55%	5.1%
Sample no. 3	2.41%	2.44%	7.8%
Sample no. 4	8.20%	7.83%	6.8%

Sample no. 1 was taken near Sample no. II (1942, Sta. 9-0). Sample no. 4, near Sample no. 1 (1942, Sta. 11-0).

The percentages shown on the sections made from the Rakowsky drilling program (see plate 6 - (b)) are:

Between A and D	2.1 % Mn
Between A, B, C	3.13% Mn
Between D and C	4.9 % Mn

An average of 3% manganese seems safe for the lower several feet of the agglomerate where mineralized. As stated before, the extent of mineralization both lateral and vertical is imperfectly known.

OTHER PROPERTIES

Newstrom Prospect

This property is located near the break in slope near the base of the west side of a north-south trending ridge (see plate 1) which lies two miles north of the Tyrrell property. The workings are near the center of the east $\frac{1}{2}$ of sec. 34, T. 36 S., R. 2 E.

The geologic setting is similar to that at the Tyrrell locality. The several prospect outs are situated in a red, scoriaceous, basaltic agglomerate at an elevation of about 2500 feet. This agglomerate is much thicker here than at the Tyrrell mine; some 200 feet is exposed. It forms rude columns and rough blocks, at times more than 20 feet high. As at the Tyrrell Mine this agglomerate is underlain by a tuff breccia, sometimes colored green as well as buff or brown. Above the agglomerate occurs a series of basaltic flows and some tuff which strikes N. 35° W. and dips 5 to 10 degrees to the east.

Manganese concentration occurs in the agglomerate. The upper part of its thickness, though showing some mineralization (powdery oxides, wad), appears to have no commercial significance. The deposition in this upper part is commonly related to fracture zones.

The strongest enrichment is exposed in the lowest prospect out where a thickness of 8 to 10 feet of enriched material is shown. Manganese oxides and much calcite are present. A $3\frac{1}{2}$ foot channel sample from the east face of this cut returned 2.1% Mn. The depth of mineralization cannot be estimated from the available exposures. Although the enrichment is less near the bottom of this out, there is no reason why it may not increase with depth. This cut may be as much as 40 feet above the contact with the underlying tuff breccia. Debris covers the contact but the break in slope and change to a light brown soil indicate the apparent location of the contact.

The agglomerate can be traced 600 feet north of this out, or to the point where the ridge turns east, and it extends some 1000 feet to the south, but no outcrops of the mineralized horizon were seen. The rock of apparently higher horizons shows only slight enrichment.

Coon Creek Prospect

This property is located on the northeast slope of a northward-trending ridge at an elevation of 3200 feet, in the SE $\frac{1}{4}$ of sec. 20, T. 37 S., R. 2 E. The country rock is of basaltic character. Amygdules are common in many of the flows.

Manganese concentration occurs in a red, scoriaceous, basaltic agglomerate. This agglomerate is more than 100 feet thick near this locality and volcanic bombs and ropey lava structures are present, suggesting that this may be a former center of volcanism. The agglomerate is underlain by platy basalt. Although this agglomerate is similar to that at the Tyrrell Mine, the manganese mineralization shown is much lower in grade and is probably less widespread than at the Tyrrell. The manganese oxide is psilomelane, exhibiting a botryoidal structure.

A prospect shaft is 6 ft. by 4 ft. by 24 ft. deep, but at the time of examination (mid-summer) it was filled with water to within ten feet of the top. This shows that the

water level and the zone of saturation, above which oxidation of manganese and resultant precipitation of manganese oxide largely takes place, is close to the surface even in the summer season.

Bush and Fox Prospects

It is not certainly known whether or not the Bush prospect was examined. One long abandoned prospect pit was found near the center of sec. 9, T. 37 S., R. 2 E., in the vicinity of the location indicated for this prospect on the geologic map of the Medford quadrangle. The country rock at this prospect pit is a dark gray, fine-grained basalt; no manganese concentration is present. Dense underbrush may possibly have concealed other pits.

The Fox prospect is located on the west side of a saddle in a north-south-trending ridge composed of basalt flows in the SE $\frac{1}{4}$ of sec. 8, T. 37 S., R. 2 E. One pit 3 ft. by 5 ft. by 5 ft. deep shows no important manganese enrichment. Some scoriaceous basalt occurs near the bottom of the pit. A scoriaceous horizon to the northwest down the slope likewise shows no important mineralization.

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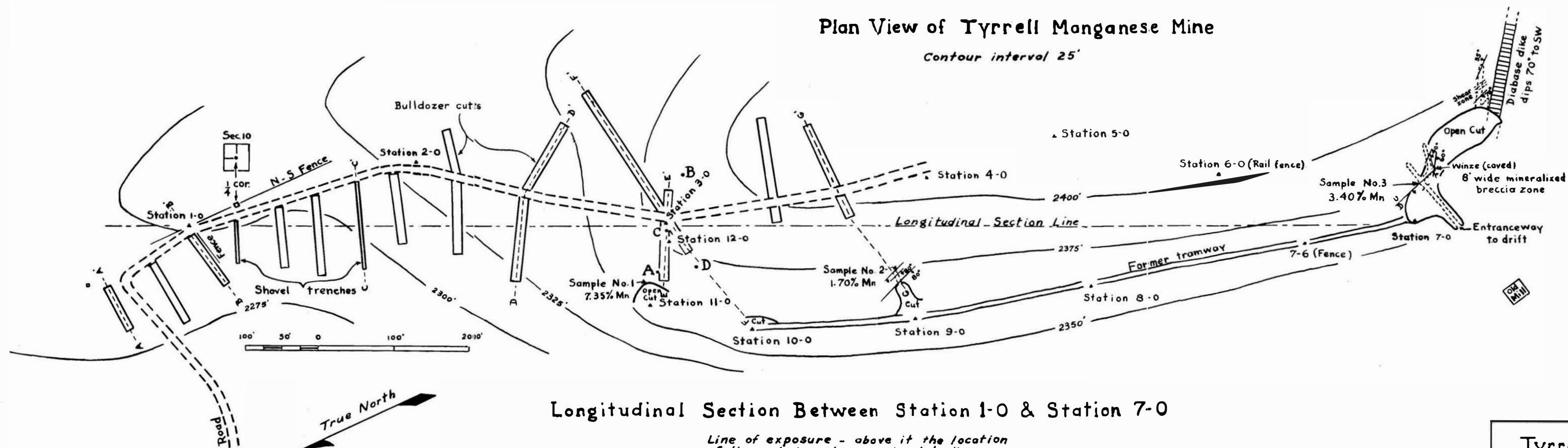
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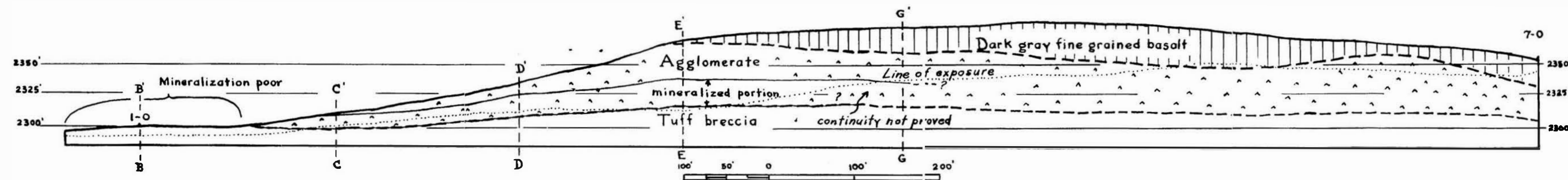
Plan View of Tyrrell Manganese Mine

Contour interval 25'



Longitudinal Section Between Station 1-0 & Station 7-0

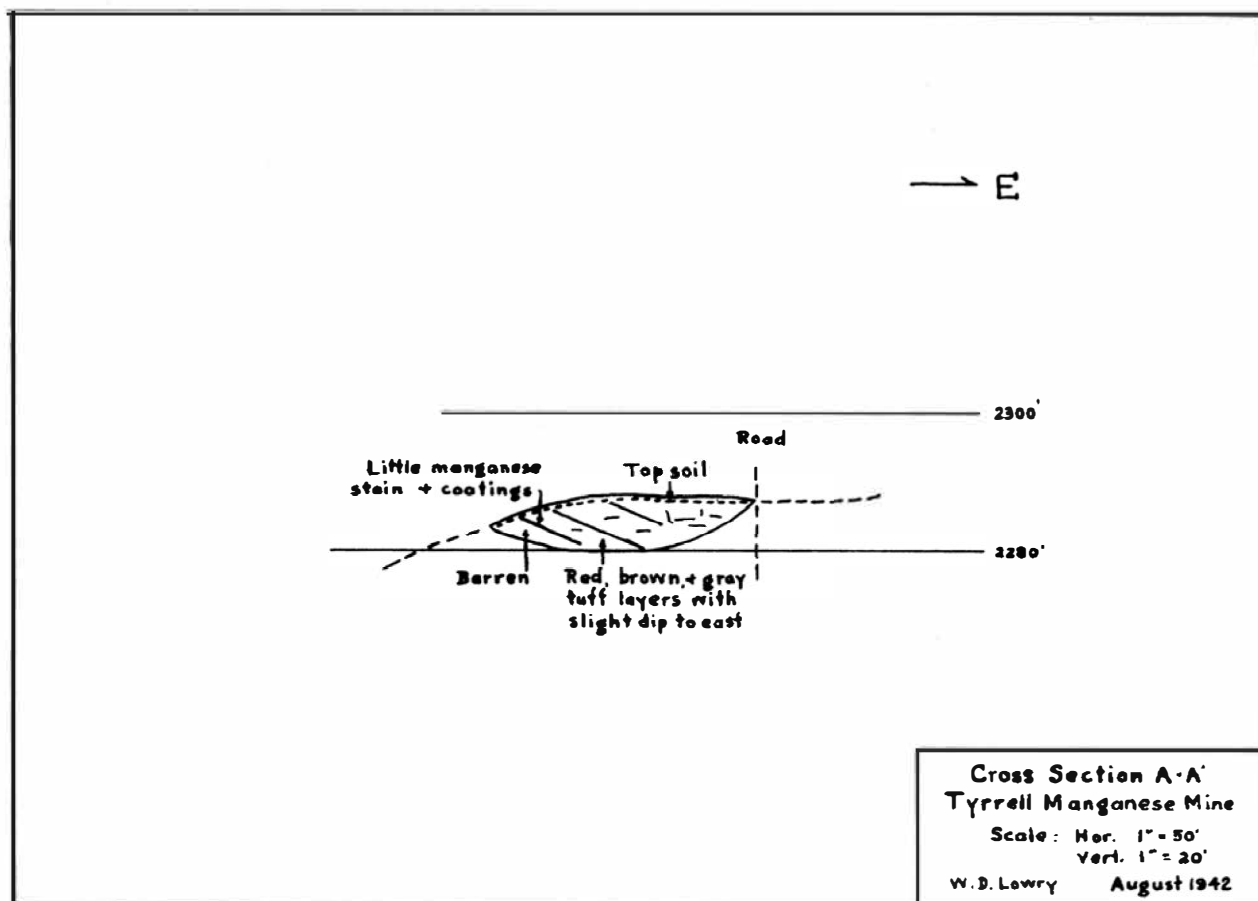
Line of exposure - above it the location of the rock type is approximately known



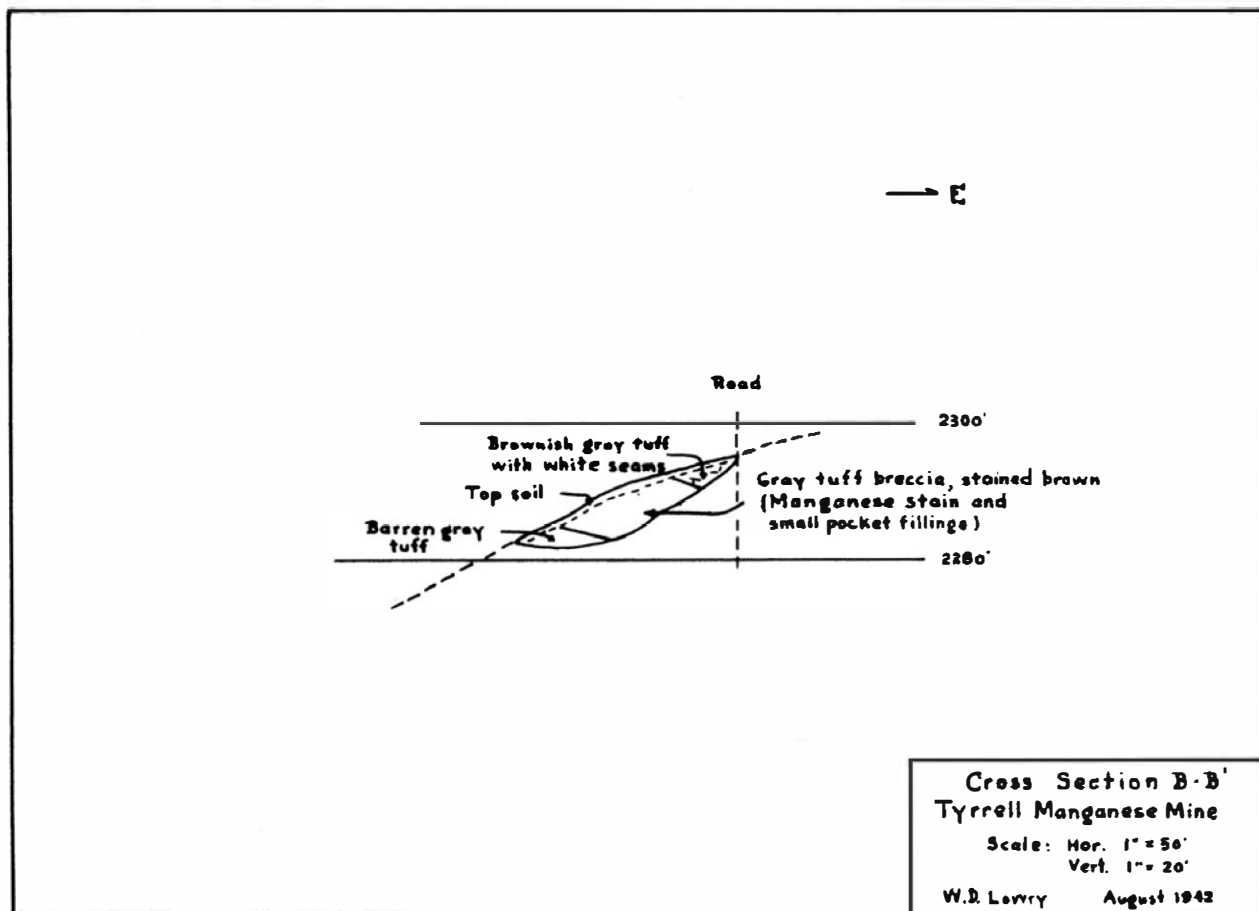
Tyrrell Manganese Mine
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 Lake Cr. District, Jackson Co.

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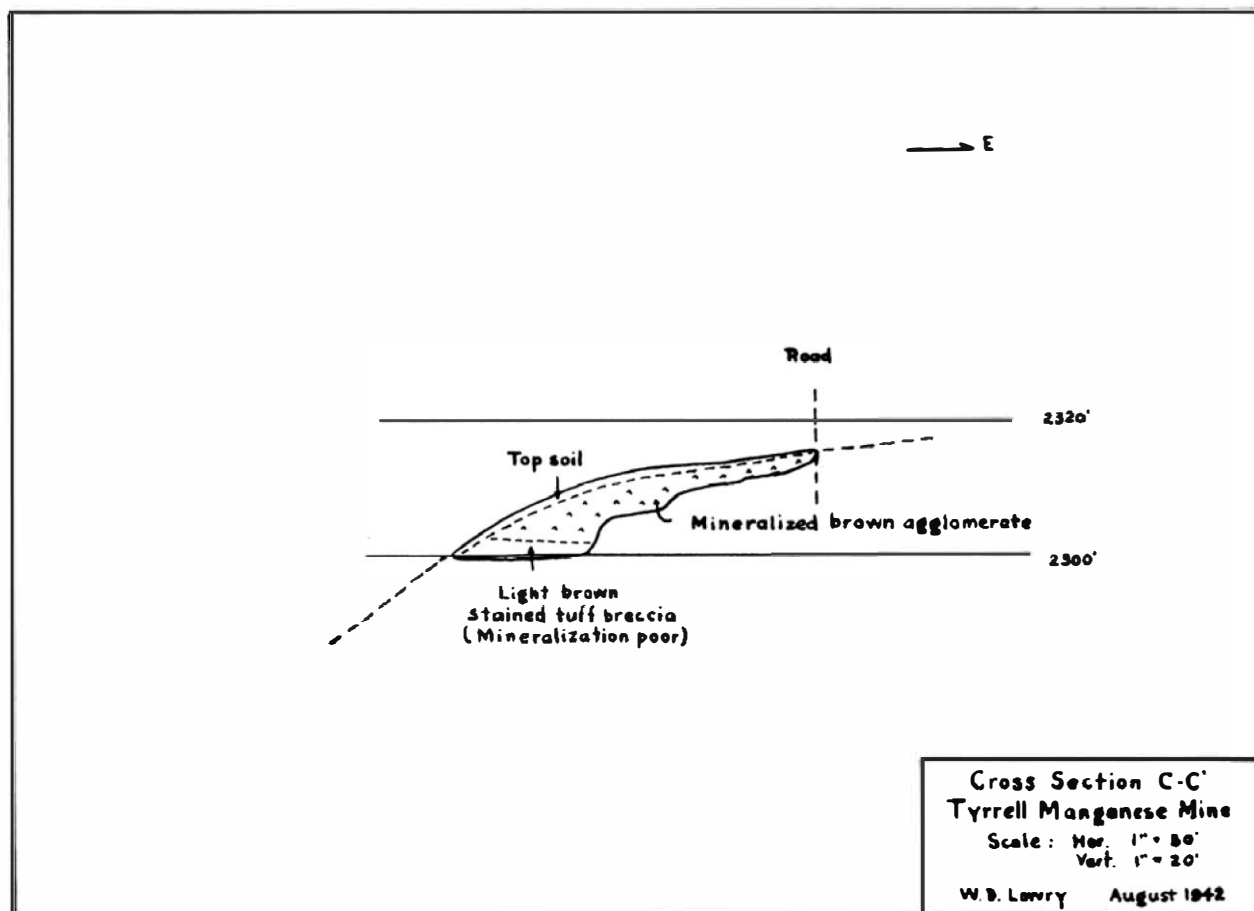
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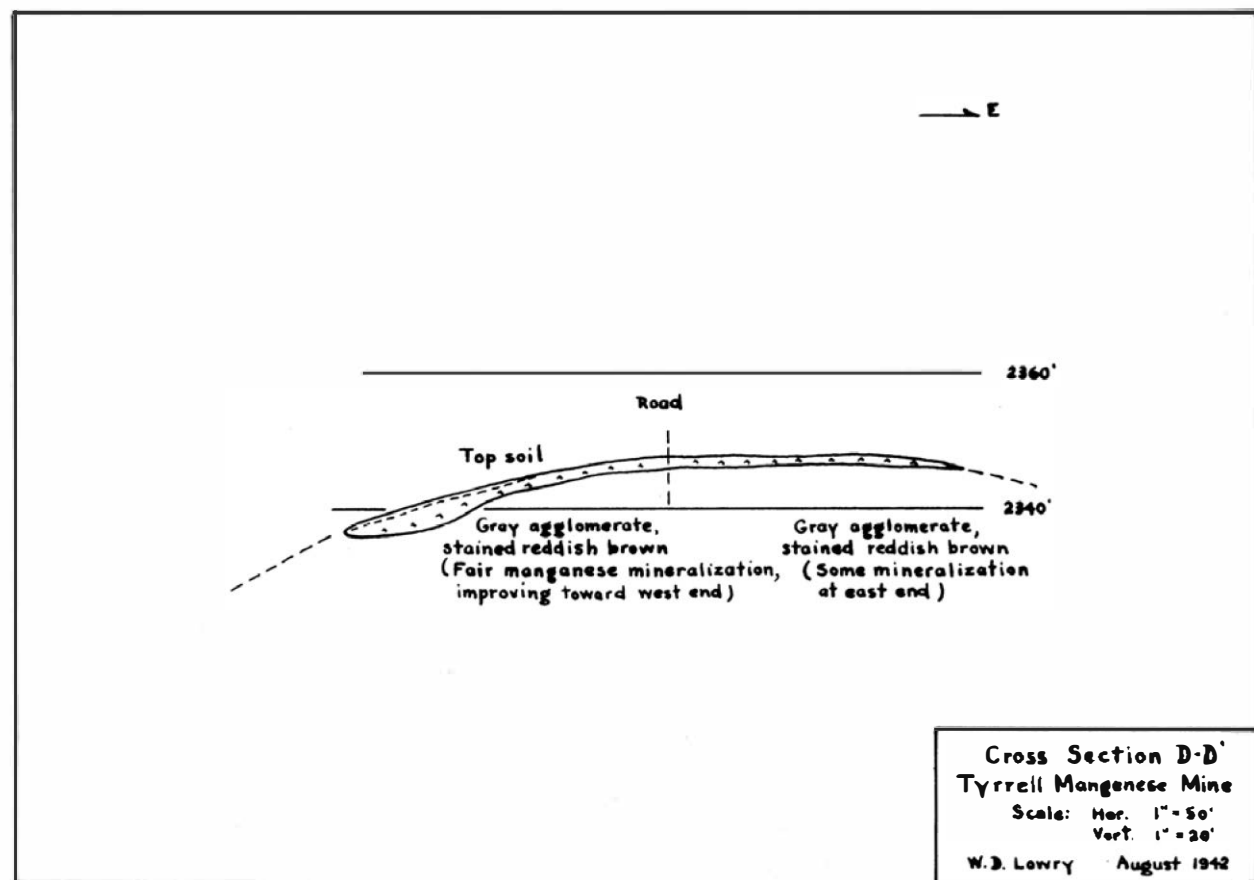
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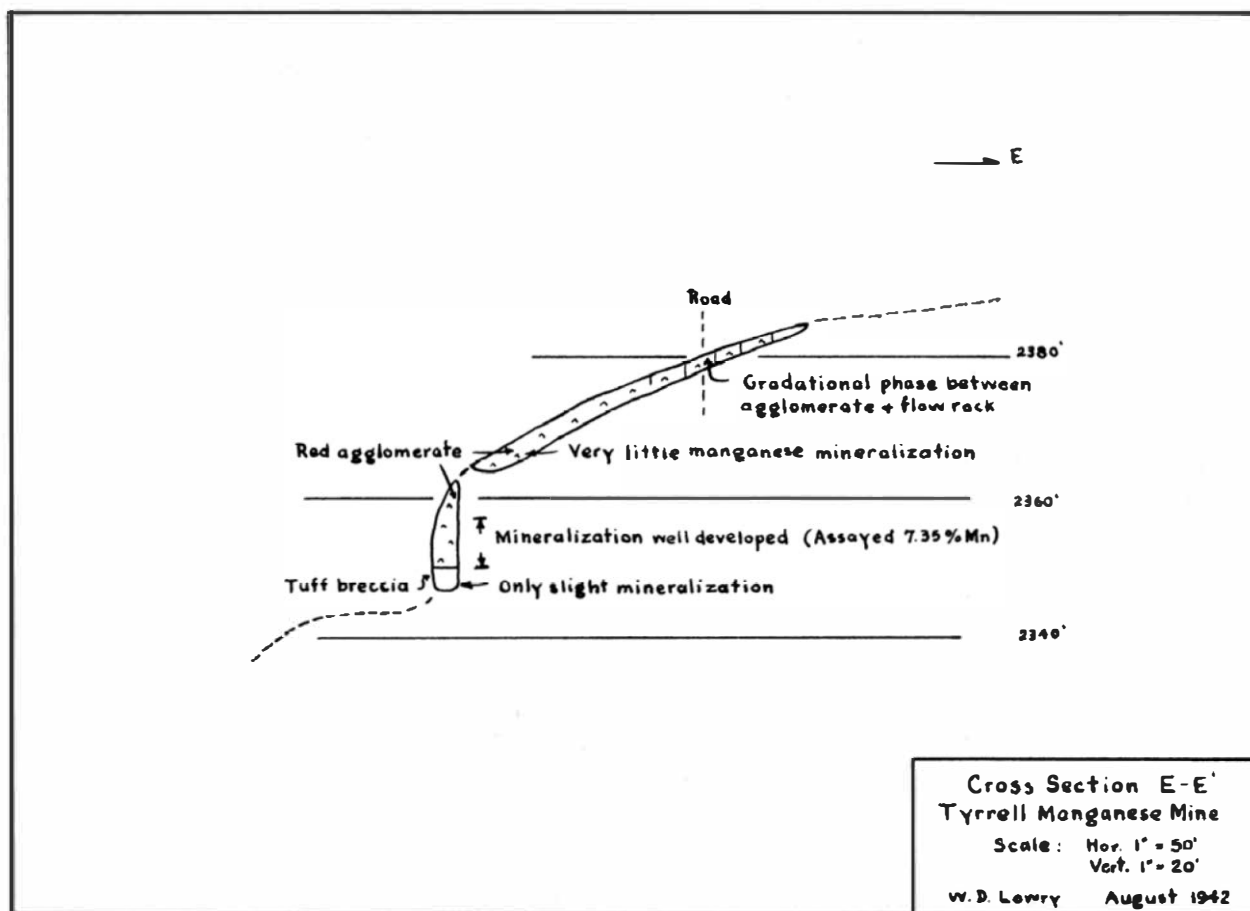
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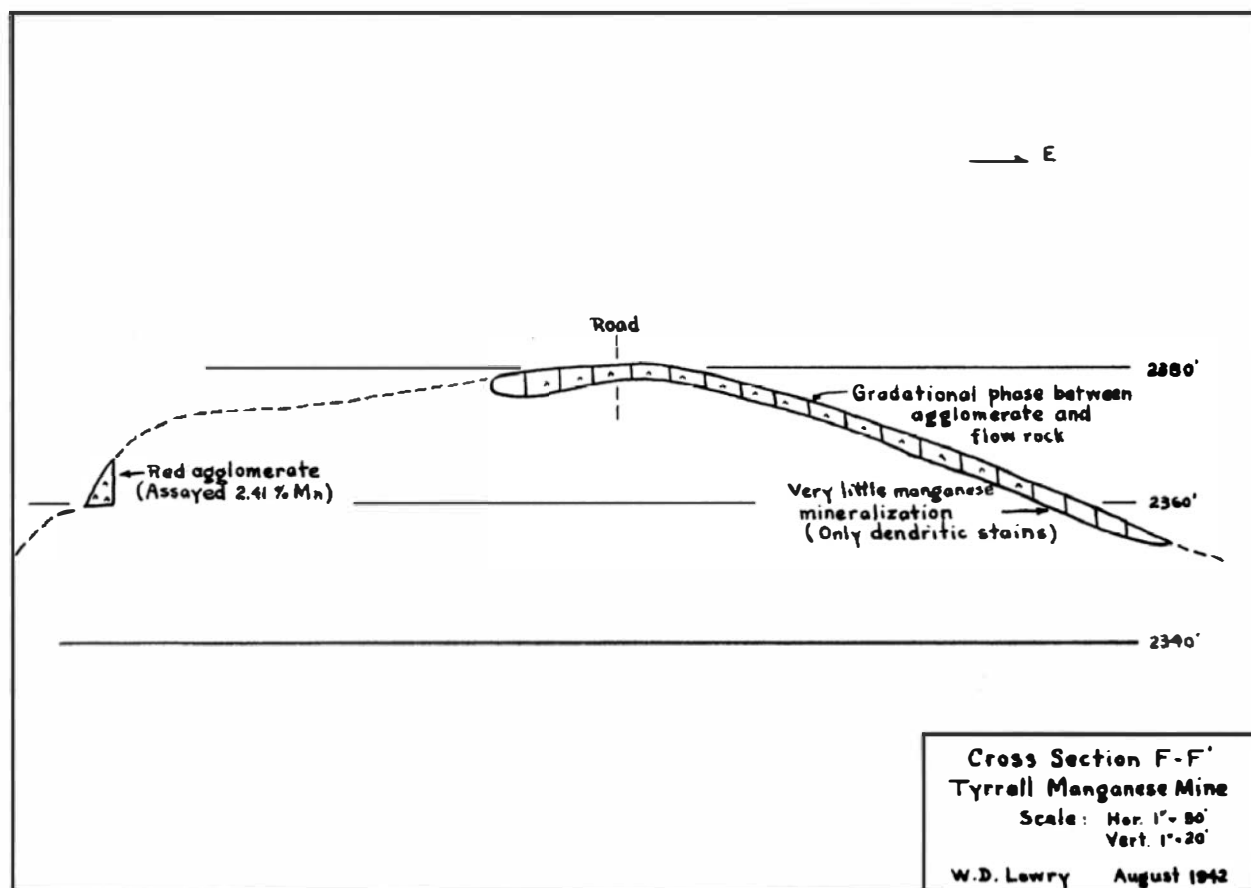
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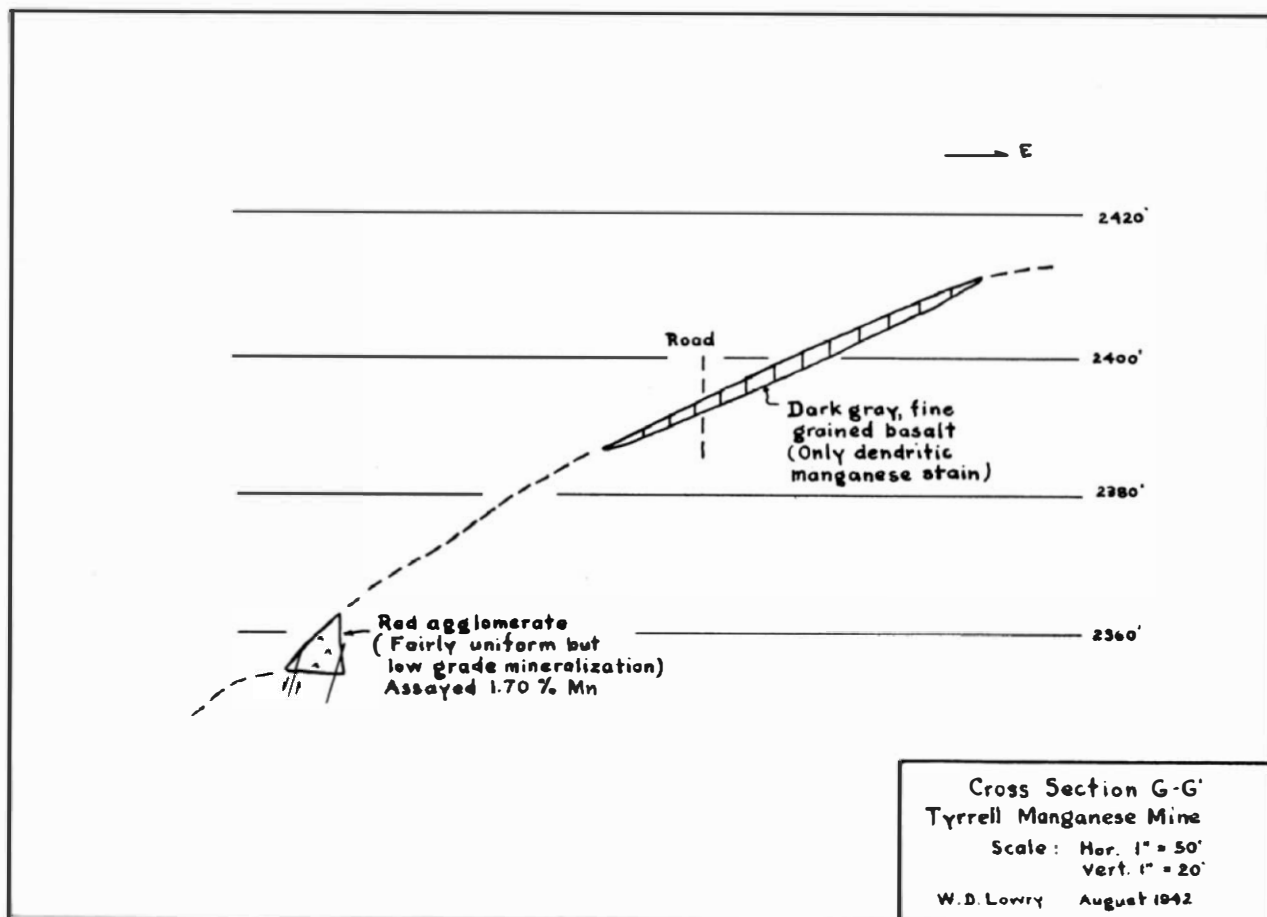
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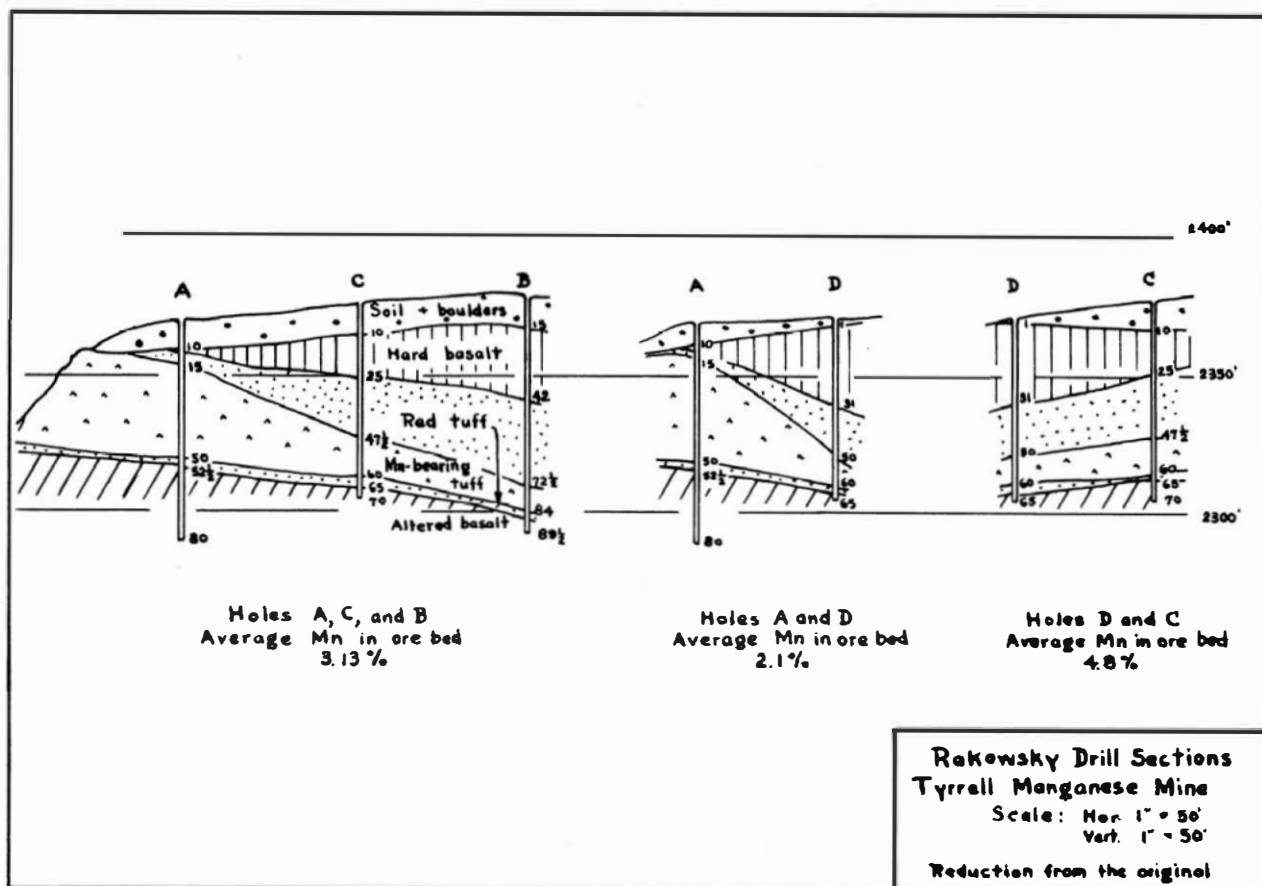
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(b)



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(b)

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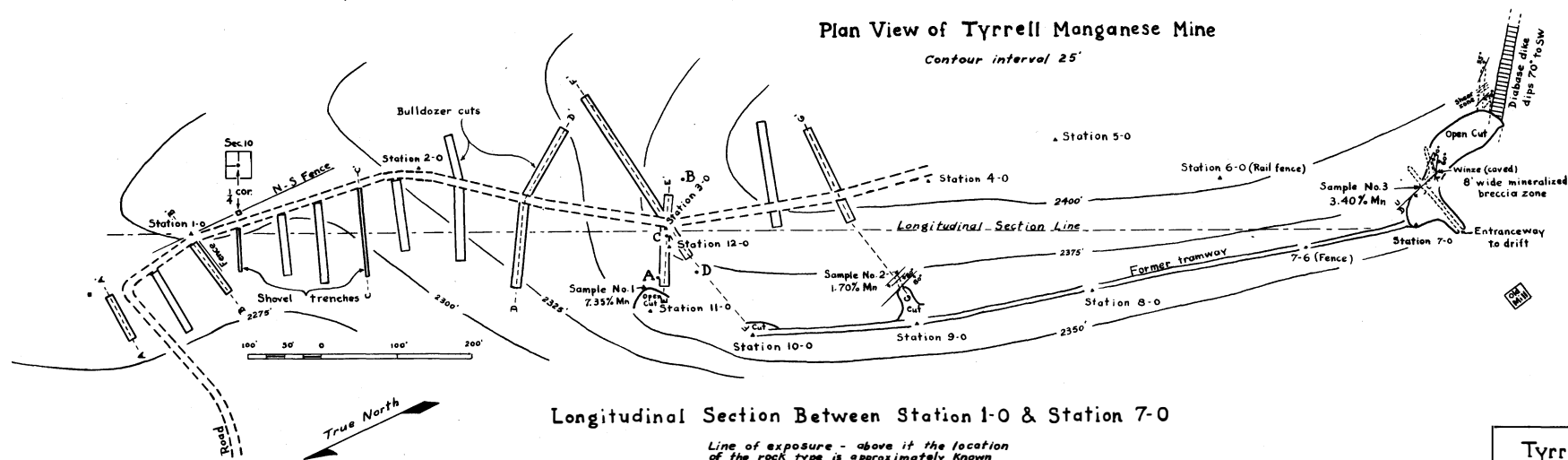
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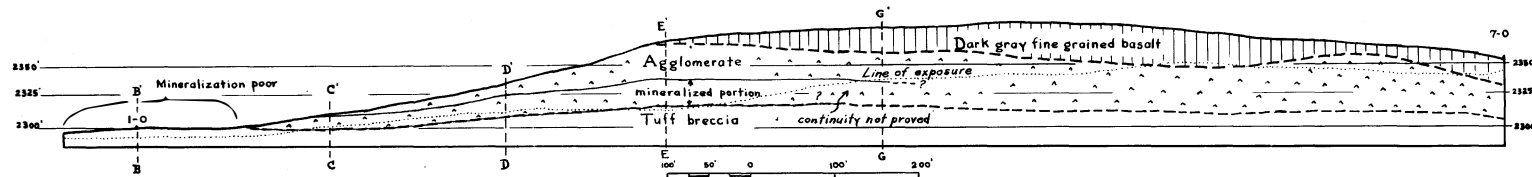
Plan View of Tyrrell Manganese Mine

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Longitudinal Section Between Station 1-0 & Station 7-0

Line of exposure - above it the location of the rock type is approximately known



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W. D. Lowry August 1942