MR-104-02

SOME CHROMITE OCCURRENCES AT RED MOUNTAIN, KENAI PENINSULA, ALASKA

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By

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The chromite occurrences described in this report are confined to the Red Mountain area located on Kenai Peninsula. This area is in the central portion of the southwestern end of the peninsula, and with its elevated position, forms the headwaters of Seldovia and Windy rivers.

The geology of the area and a portion of Kenai Peninsula is described in U. S. Geological Survey bulletin 742 by A. C. Gill.* Contained in this report are short descriptions of the chromite occurrences of Red Mountain. The writer visited the area at the request of the owners of some of the deposits to gain more information and to make detail sketches of individual deposits. It was found during the sketching of individual deposits that the potential possibilities are much greater for the mining of chromite than those represented in the report mentioned above. Rather than numerous scattered occurrences of chromite, the major showings were found to be definitely related to a definite structure, unusual in occurrence, but wholly related to the intrusive mass. This, it is hoped, will be helpful to the owners in their development and to future operators. Further, the sketches of outcrops showing the features in detail, and the results of channel sampling, together with high grade and low grade zones, may be of further help in making estimates and planning future development.

Accessibility to this area is being made comparatively easy by the construction of a truck road from the west shore of Jakolof Bay. The road, beginning at sea level, follows along the west bank of Jakolof Creek for a distance of one and three-quarters miles and to an elevation of 160 feet. Thence a climb of 200 feet is made in a distance of less than half a mile, avoiding a canyon and falls. Thence for a distance of four and a half miles from the bay a low summit is crossed into the valley of Windy River. Thence up Windy River valley for two miles to an elevation of 1,000 feet into the glacial cirque which occupies the center of the Red Mountain dunite mass. Further road building will be required from the starting point out along the shore of Jakolof Bay in order to obtain a deep-water dock site and high bluffs for bunker facilities. Transferring ore from the rock bunkers into ships will probably be accomplished by conveyor belts. Further, the present developments will require facilities for medium grinding of low grade ore for shipment and sorting of the higher or shipping grade of ore. From the end of the road in the upper basin of Windy River, the ore from the major showings is accessible via aerial trams. These, with the aid of a few towers, can be of the gravity type due to the differences of elevation. Mining of the known individual deposits will be from shafts, glory holes and short tunnels. Trucks or caterpillar tractors will be used to convey the ore from Red Mountain to the docks.

*Gill, A. C., "Chromite of Kenai Peninsula," U. S. G. S. Bull. 742.

Geology:

The Red Mountain area consists of an ellipsoidal exposure of peridotite extending 4 miles in a northwesterly-southeasterly direction along its length and 2 miles wide. It is surrounded and in contact with highly metamorphic slates and graywackes regarded as of probable Paleozoic or early Triassic age.* The total area consists of peridotite which covers an area of 7 square miles. The contacts are considerably fractured and have been subject to intensive erosion and now occupy depressions more or less filled with slide rock. Sills, dikes and other minor intrusive features are lacking in the graywackes and slates, however, a definite contact zone shows around the outside borders of the peridotite. This zone is represented by a zone of serpentine, which is the altered phase of the dunite which comprises the greater portion of the peridotites. The numerous fractures in the serpentine are slickensided and filled with a white powdery mineral which appears to be a magnesium carbonate. These fractures and brecciated zones were apparently caused by pressure and movement after the consolidation of the basic magma. The deposition in the fractures is the result of precipitation from solutions, the latter believed to result from the later phases of the crystallizing magma. Most dunite, as viewed under the microscope in thin section, contains innumerable minute channel ways around the olivine crystals, through which the later solutions are believed to have passed, carrying the uncrystallized portions of the magma. This condition in a magma has a tendency to equalize the internal pressure gradually, keeping the magma more or less intact, not causing violent eruptions, and allowing it to flow out into other structures.

The entire peridotite mass of Red Mountain, which now is shown as a much eroded and centrally depressed mass, appears to have been the domed top of a laccolith. At the present time the sides of the laccolith are still unexposed beneath the slate-graywacke sediments. Thus the effect on the sediments during the periods of intrusion was one of gentle uplift rather than violent eruption. Over and above the domed portion of the laccolith, which now is represented by the ellipsoidal peridotite outcrop, the upward thrusting force was greater and caused a greater breaking up of the sediments and these have been removed by erosion.

Chromite appears to have been the only economic mineral deposited in the area and this is confined to the dunite bands of the peridotites. Since there have been no discoveries of chromite ore in the sediments, and the deposits described in this report are wholly within the dunite, a description of the sediments is not herewith contained, but can be obtained in bulletin 587.** The present erosive features of this area and the high basic content of this dunite formation offer an excellent opportunity to observe the internal structure.

*Op. cit., p. 3.
**Martin, G. C., Johnson, B. L. & Grant, U. S., "Geology and Mineral Resources of Kenai Peninsula," U. S. G. S. Bull. 587, pp. 33-35.

Photo slides Nos. show several of the topographic features of the area. Slide No. shows the exposed bluffy section along the left limit of Windy River. The various dunite and pyroxenite bands are shown confined to a structure that shows as distinct stratification in what appears to be a large syncline. The glacier which occupied the large glacial cirque at the head of Windy River has formed the remaining higher ridges into the shape of a large horseshoe.

The greater portion of the exposed ellipsoidal peridotite mass consists of dunite. The outer band along the contact is altered dunite and in many places appears as a serpentine. The dunite occurs in distinct bands. These bands vary from a few feet to several hundred feet in thickness. Intercalated between the dunite bands are bands of pyroxenite. These are much narrower in width with the greater portion of them less than 50 feet in thickness. The darker colored pyroxenite bands are easily distinguished as the outcrops are exposed along the bluffy valley walls of Windy River. The strata of bands gradually become thinner in the upper series, and the pyroxenite bands become more numerous. This is especially noticeable at the tops of the higher pyramidal peaks. While the bands of dunite and pyroxenite, as they occur in ellipsoidal forms, are held to have been formed as pulsation flows of the magma, the origin of the segregation of the pyroxenite bands from the dunite bands is in doubt. Whether the pyroxenite formed at the bottom of the particular flow by magmatic segregation, or was a separate flow, is not known. Due to the equalization in specific gravity of olivine (3.27-3.37), and pyroxenite (3.2-3.38), Spurr* states the differentiation is not due to gravitative settling. Rather he ~~contributes~~ it to gaseous tension and the ralative age of minerals. This is in accord with the gaseous-tension theory:**

> "According to the gaseous tension theory, differentiation would begin whenever the magma is released from external pressure higher than or balancing the highest gaseous-tension forces of the magma. The same unbalancing determines surgence or upward intrusion of the magma. We may imagine, and (from the known facts) believe, that magmas are thus kept inactive at a certain considerable depth. When the excess of pressure from without is replaced by excess of pressure from within (which change may be due to erosion lifting enough of the overlying pressure to turn the scale) then upward surgence, gaining strength as higher horizons are reached, takes place; and whenever a body of magma comes to rest the differentiating process becomes effective, for while the magma is in motion any differentiation will be lost through mechanical mixing."

*Spurr, J. E., "The Ore Magmas," p. 575.
**U. S. G. S. Professional Paper 63, p. 177.

The pyroxenite bands, other than their structural significance, are not held to be associated or genetically related to the chromite deposits. The larger chromite zones and lenses are usually confined to the central portions of the dunite bands. The larger and purer dunite bands appear to contain the largest chromite deposits. While an explanation with regard to the chromite deposits being near the center portions of the dunite bands is not definitely clear, it is accredited to the structural conditions and the close relationship of the chromite with the dunite.

The Juneau No. 1 (104-13) and No. 2, and Widow Maker (104-15) chromite showings on the north side of Windy River, and the Chrome Queen on the south side, were found to be contained in the same dunite band. This band has a width of 500 to 600 feet and represents one of the lower or outer bands. It is distinguished from the other bands by being lighter in color, and is believed to be a purer dunite. The Star 4 claim showing is situated in another dunite band which lies over and above this lower wide band. The Cherokee Chief claim showing is situated in the zone of narrow banding and several small pyroxenite bands are associated near the chromite showings. These chromite showings are, however, much smaller and more widely scattered and show smaller structures and segregations of chromite. Such were the conditions noted in the various showings situated on the higher peaks which are all contained in the higher or zone of narrower banding. Thus it appears that the larger and more persistent chromite segregations will be found in the lower and wider bands of dunite. Since the large glacial valley occupied by Windy River has been cut deeper into and exposed the lower or larger bands, more of the larger chromite showings are exposed in this section than any place in the area. The northern edge of the peridotite mass, situated between the east and west branches of Fish Creek, also shows sections of these wider or outside bands. Several occurrences of chromite were noted in the large light colored dunite band which is exposed along the northern slope. This band, as it turns into the more curved portion of the ellipsoidal or end section, takes on a lesser amount of dip and appears to be rather flat lying. Many sections of this band are covered with talus from the higher peaks. As a result several of the chromite showings may be covered. The entire west side of the area has been subject to much less erosion, and the lower outer bands are not exposed. The chromite showings noted along this side were confined to the upper ridges and within the narrower bands. These are small outcrop showings, and it is very doubtful if they will be of economic size. A similar condition was found on the south end of the mass in the vicinity of Red Mountain. Here the elevations are high and the peridotite exposures are represented by the upper thinly banded series.

For detailed geology of the major chromite showings in the Red Mountain area reference is made to the following descriptions and sketches of the individual showings.

Structure:

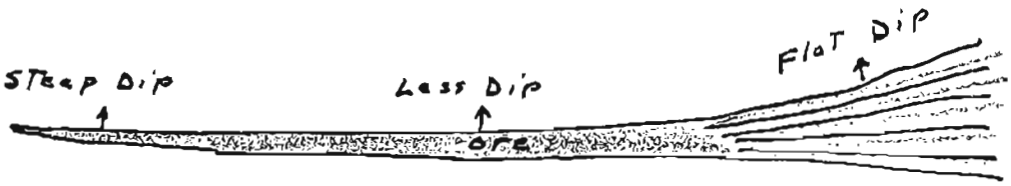
In order to fully understand the minor structures represented by the numerous chromite showings and as represented on the sketches, it is necessary to show the relation of the entire laccolith, both in its mode of occurrence, and the various forces which were active during and after its consolidation. The concentric ellipsoidal banding, as shown by the alternate bands of dunite and pyroxenite, offers the explanation. The pulsative action of the magma by stopping upward flow after flow is believed to have built up the laccolith from the center outward and from the bottom upward. The thicker flows are on the bottom and they also represent the outer flows. In many ultra-basic intrusions of this type, the composition of the magma changes from flow to flow--some more acid than others, and ellipsoidal bands of pyroxenite, dunite and gabbro are known to occur. Usually in these occurrences the dunite forms the central portion of the ellipsoid. The Mt. Burnett area on Cleveland Peninsula in the Ketchikan district, Alaska* is an example of this type of alternate banding with a variable composition of the magma. Spurr**in "The Ore Magmas" shows a sketch of the platinum-bearing district of Taguil in the Ural Mountains of Russia in which a basic intrusive is made up of concentric bands of dunite, pyroxenite, gabbro and diorite, which has been intruded into schists. The time factor in relation to the building up of this laccolith and between flows is not known. However, during the activity the intrusive more or less remained in a viscous or uncrystallized state. One flow through and on top of another apparently kept the entire mass heated until the activity ceased. The original structure of the flows was one in which they were built into a dome and dipped away from the center. Thence came the period of cooling and the relieving of the internal pressure from below. Crystallization and segregation began and the release of internal pressure caused a slow sinking of the central portion of the laccolith. This sinking by gravity during the crystallizing stage of the magma, greatest in the center, with the force gradually radiating out from the center, is the cause for the apparent structure of the chromite deposits. The force as it was applied to the various bands outward from the center changed the dip from outward away from the center to low gentle dips toward the center. The entire action appears to be one of sluff, greatest near the center. Small slippage planes developed within the dunite bands, and the weakest portion of these bands was near the center. These small slippages were generally parallel to the strike and dip of the bands. These small slip planes were apparently immediately filled with chromite from the magmatic segregation action of the cooling magma. Gradual slipping and settling developed

*Geologic sketch, Mt. Burnett area by J. C. R.
**Spurr, J. E., "The Ore Magmas," p. 569.

the low grade zones. Gradually as the magmas became more consolidated, the tension became more concentrated, and the tear lenses* were formed in the hanging wall of the zones.

The reason is not apparent for the location of the structural weakness to be localized in the center of the dunite bands. Normally the planes of weakness would be expected along the contacts of the dunite and pyroxenite bands. Close inspection of these contacts shows them to be lacking in parting planes and to consist of intergrowths of olivine and pyroxenite.

A study of the individual chromite deposits shows many features, which are ~~in~~ common to all. The footwall of the deposit contains a wide zone of dissemination and banding. The hanging wall band is usually set over and apart from the footwall band a few feet. Its width is less, the chromite bands are closer together, and usually a tear lense was formed of a higher grade ore. The peculiar feature of these tear lenses



A Tear Lens

(note figure above) are their shapes. They start from a thin seam of solid chromite with a comparatively steep dip. Gradually the seam increases in width and continues to form a normal lens until a point is reached where it begins to tail out into numerous small bands with altered dunite between. At this point it increases to great width and finally dies out, leaving only a few irregular scattered bunches and seams of chromite. The dip gradually becomes less until at the wide section it is nearly horizontal. The entire lens has a slight curve, and some, due to small displacement-slips at right angle to their strike, have been slightly displaced, giving them the appearance of being folded. Usually two-thirds of the length of the lens is high grade ore. The size of the lenses vary from a few hundred feet in length to less than a hundred. The Star 4, Widow Maker, J. S claim, and Juneau No. 1 showings are examples of tear lenses.

*See following explanation and figure of tear lens.

Another evident feature with regard to these tear lenses is their position with reference to the north or south half of the area. Those which were found on the south half had their low grade end pointing south and the narrower end north. Those on the north half are reversed with respect to ends. Again, these tear lenses were not in evidence on the north or narrow portion of the ellipsoidal structure which outcrops at the head of Fish Creek divide. They appear to be confined to the long sides and rounded corners of the ellipsoidal structure. The deposits noted at the north end or Fish Creek divide were comparatively flat-lying. This is accounted for when the synclinal structure is taken into consideration. The beds of a syncline are more flat-lying at the bottom or ends than on the limbs. However, slippage is likely to be more pronounced at the ends of the ellipsoidal structure and larger, lower grade zones are more apt to have been formed.

Since there has been no underground development on the orebodies to determine rakes and depths of the lenses, the structure on the downward extensions of these lenses and lower grade zones is only assumed. Whether or not these individual tear lenses will be followed in plunge and dip on the zone with successive lenses in depth is not known.

The known facts regarding the lenses in relation to structure are:

1. The higher grade orebodies outcrop as slightly curved lenses, pinching on one end and dispersing over widths on the other
2. The lenses vary in outcrop length from less than 100 feet to over 800 feet.
3. The dips vary from 60° to less than 30° along the individual outcrops.
4. The strike conforms to the strike of the band in general.
5. The lenses have been formed during a process of continual slight wall movement, showing solid and dispersed bands.
6. The walls are free from the ore in the more massive ore of the lenses.

The unproved conditions, but held to be the existing conditions are:

1. The higher grade lenses and low grade zones will continue in depth as curved and distorted lenses and zones up to one-half their exposed individual lengths.
2. Dip and plunge of each individual lens will be generally inclined toward the center of the ellipsoidal structure.
3. The larger and higher grade lenses will be found in the lower thicker band of dunite along the long side of the ellipsoidal structure.
4. The larger lower grade zones will be found in the lower thicker dunite bands along the ends and curved end corners of the ellipsoidal structure.
5. The larger the individual tear lens the higher the grade of ore.

The Major Showings:

Following are short descriptions of the larger chromite showings. There are several other known occurrences of both lenses and low grade zones within the area, the following representing those having the larger outcrops.

Chrome Queen Claim Showings: The Chrome Queen claim lies 2,000 feet within the dunite from the graywacke and slate contact on the right limit of Windy River one and one-fourth miles from its source. This claim is held by W. P. Kearns and D. Cooper. The showings on the claim are located near the northwest end line between elevations of 1120 to 1200 feet. (Note Plate No. 1). Both showings are in the same vicinity along two small tributary streamlets of Windy River. In the south creek (note sketch) several tons of high grade float in small to large angular pieces are distributed from a point at 1200 feet for several hundred feet downstream. Some blocks up to 5 or 6 cubic feet in volume were found at the head of this creek at a point where the float ends. The float consists mainly of high grade chrome ore as shown by sample 929. The second showing is to the north on the larger creek, 80 feet northeast of the upper float pieces. Here several small stringer bands of chromite occur over a 20-foot width along the creek bank. Sample 930 was taken across 27 inches of the better grade portion of the zone.

Subsequent work by the owners that was recommended by the writer at time of visit, according to their report by letter, revealed a high grade lens of chromite under the upper end of the float showing. This lens has been exposed 135 feet and varies from 3 to 14 feet in width. The strike was given as N. 20° W. and dip 62° SW. Portions of the vein were estimated to run 60 per cent Cr_2O_3.

This high grade lens occurs parallel to the lower grade band that outcrops in the north creek. It also occurs on the hanging wall with the lower grade zone on the foot wall. This is similar and in accord with other showings on the Widow Maker, Juneau No. 2, etc. In the position of this showing near the valley of Windy River, it will be noted that it occurs at the lowest elevation, nearly 1,000 feet below the other showings. This showing is one-half mile north of the Star 4 deposit and 1,600 feet lower. This occurrence adds strength to the opinion that chromite deposits will be found in depth in the Red Mountain dunite. However, the depth to which individual lenses or zones will extend is to date an uncertainty, owing to lack of individual development. Further, this deposit with its strike and dip and position, conforms to the ellipsoidal structure, to which the greater number of these occurrences appear to be associated.

The location of these showings, which are low and near the bottom of the valley of Windy River, offer easy transportation since the present road is to be built along Windy River and within 1,000 feet of this location. The owners are of the opinion that this vein will average better than 40 per cent Cr_2O_3. Also, it is the most accessible of any of the Red Mountain deposits.

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Star 4 Claim Showing: The Star 4 claim is situated on the northeastern slope of Red Mountain on a spur ridge ranging from 2500 to 2800 feet in elevation. The major showings on the Star 4 are situated on a level bench which forms the top of this spur ridge. This claim is patented and held by Lass & Whitney interests.

The vein strikes N. 10-12° W. and has a variable dip from 30 to 65° W. The exposed length is traceable on the surface for over 1,000 feet. The width ranges from a few inches at the north end to over 10 feet at the south. On date of visit the showings were covered with several feet of snow and the vein was visible only in the cuts as shown on Plate No. 2. From cut No. 1 to No. 6, inclusive, analyses of channel samples gave values ranging from 41 to 51 per cent Cr_2O_3. In places the vein is slightly displaced by faults. Small parallel seams and veins were noted showing the prevailing structure of tear lenses and shear zones common to other smaller deposits. This deposit is the largest and contains the greater part of the ore thus far discovered in the area. A tonnage of 60,000 tons of high grade ore has been estimated by the Geological Survey.* Its position on the top of this spur ridge, 1500 feet above the valley floor and on the north slope of Red Mountain, will cause difficulty both in mining and transporting the ore. Further, it requires sinking operations to mine and the low dip will require handling in stopes.

The most striking geological feature with reference to this deposit is the great difference in dip from 65° on the north to 30° on the south. Further study, accompanied by development, should reveal the shape, size and structure of the deposit. It has many features which are similar in respect to the smaller deposits. It appears to be evident that due to the difference in dip, this lens will be highly curved and to estimate a depth of one-half the length in terms of ore portions, as determined by assay, may far exceed the actual vertical depth. Conditions indicate a greater plunge of the deposit with a lower angle off horizontal than off vertical. Further discussion of this and other deposits is found under the heading "Structure of Ore Deposits," page 5.

*Press Release, "Chromite Deposits of Kenia Peninsula, Alaska."

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Cherokee Chief Claim Showings: The Cherokee Chief claim is situated at an elevation of 2,000 to 2,500 feet on the left limit of Windy River one mile below its source. It extends along the east slope of a high ridge which forms the divide between Seldovia River and the west fork of Fish Creek. This claim is held by Kearns & Cooper.

Small lenses and numerous stringers of chromite are exposed for a distance of 640 feet and across a width of 40 to 60 feet. Here the chromite bands are associated with numerous parallel pyroxenite bands. The occurrence of these zones containing pyroxenite bands is discussed under "Geology" at page 2.

Two small lenses located between stations Nos. 4 and 6 have outcrop lengths of 80 and 60 feet, respectively. Widths vary from 5 to 23 inches. Several other small veins with widths from 2 to 6 inches are common and traceable for a hundred or two hundred feet. They occur too widely separated to mine as a low grade zone. The lenses and stringers are faulted and very irregular in strike with the dip nearly horizontal. The entire zone has a general strike of N. 25° W. The general dip of both chromite and pyroxenite bands is slightly off horizontal to the southwest. This zone is confined to an upper strata of dunite which contains numerous pyroxenite bands and it is easily distinguished from the thicker strata underneath which are lacking in pyroxenite bands. Due to the erratic and irregular nature of the outcrops of this zone, very little minable ore appears to exist. However, below the zone considerable chrome float is evident in the slide material.

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Juneau No. 1 Claim Showing: The Juneau No. 1 claim is located on the first prominent shelf above the steep bluff along the left limit of Windy River one and a half miles below its source, between elevations of 2200 to 2400 feet. It extends in a northwesterly-southeasterly direction and lies directly above the Widow Maker claim. (Note key sketch). This claim is patented and held by the Lass & Whitney interests.

The showings consist of natural outcrops showing a portion of a banded and slightly broken banded lens of chromite ore and some banded disseminations. Considerable loose rocks and fine material which acts as a cover prohibited a close examination other than of the portion shown on Plate 4, which outcrops. The portion of the lens, as shown, has a length of 80 feet and an average width of 10 feet. This deposit has a strike of N. 60° W. and the dip varies from 45 to 60° SW.

Analyses of the channel samples taken in the cuts and across the outcrop show an average chromium content of over 40 per cent Cr_2O_3.

The south end of the lens is displaced by a small slip fault which shows in the long trench. Due to overburden and lack of development, the amount of displacement and south extension of the ore body has not been exposed. Other small slips and fractures occur in the exposed lens, not shown on plate. These give the effect of a folded lens. Accompanying this high grade lens there is, apparently, a low grade zone, as shown by an outcrop 100 feet southeast of the ore lens and the presence of abundant fine float pieces of chromite. Definite limits of this zone could not be determined and it is not shown on Plate 4. Further surface development would reveal a good tonnage of this low grade and probably more higher grade ore.

This showing is located near the center of the wide light colored dunite band, which contains the Widow Maker, and Juneau No. 2 showings.

Widow Maker Claim Showing: K-1104.15 The Widow Maker Claim is situated between elevations of 1,600 and 2,000 feet on the left limit of Windy River along the steep slope of the valley. This claim is held by Kearns & Cooper. The claim adjoins the south end of Juneau No. 1 claim and contains the southern continuation of the light colored dunite band and the same apparent structural zone.

The showing consists of a low grade zone with numerous small veinlets of chromite traceable for a distance 240 feet and containing two lenses of medium grade ore. The larger lens has a length over 100 feet and a width from a seam to 5 feet. (Note Plate No. 5). The upper or smaller lens has a length of 40 feet and a width from one to two feet. The lenses are approximately 100 feet apart. In between these lenses and mainly in the footwall numerous small stringers and disseminations of chromite outcrop. The zone and lenses have a northwesterly strike and a variable medium dip to the southwest. The ore is thinly banded in both lenses and the chromite crystals are of a fine regular size. Between the thin chromite bands thin seams of decomposed and altered dunite occur. This, when exposed to the surface, becomes soft and disintegrates readily. A small slip fault, striking NE. and dipping 50° SE., displaces the larger lenses 5 feet. Slip faults of this nature were noticed in other chromite deposits in the area. Usually the displacement is in the same direction. They represent, as explained under structure, the later adjustments after the dunite had become consolidated, the magmatic segregation stopped and movement along the seams was discontinued. Due to the small displacement, they will offer little difficulty in mining.

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Juneau No. 2 Claim Showing: The Juneau No. 2 claim is situated on the main ridge between Windy River and the east fork of Fish Creek above and adjoining the Juneau No. 1 claim. The elevations of the claim range from 2,600 to 2,900 feet where the showings break over the top ridge. The claim is patented and held by Lass & Whitney interests.

The showings are contained near the center of the wide light colored dunite band. The higher grade showing consists of a banded lens which outcrops on the south crest of the two parallel crests which top the ridge. Its exposed length is 110 feet, as shown by the outcrop and in six shallow rock trenches. While this lens is somewhat broken and contorted out of its original form by small slips, the general strike is N. 75 to 80° W. The dip is low, varying from 35 to 42° S. The width of ore as exposed in the cuts varies from 5 to 9 feet. Analyses of the channel samples taken in the various cuts (note Plate 6) vary from 31 to 44 per cent chromium as Cr_2O_3.

The major showing on this claim is a low grade zone located a few feet in the footwall with reference to the higher grade lens. This zone is traceable on both slopes and across the top of the divide for a distance of 600 feet. While this zone has not been sufficiently opened up for exact determination of dip and width, it appears to average 8 to 9 feet in width and to have a dip which corresponds to the higher grade lens. This zone of thinly banded seams of chromite and considerable dissemination has been broken up and slightly offset by numerous slip faults. On the northwesterly slope, two small blocks of higher grade ore were noted. Due to various slips and the broken condition of bedrock and heavy talus, it could not be determined whether or not another higher grade lens occurs in this vicinity. However, its existence is strongly suspected. Two channel samples were taken from hanging wall to footwall in a cut on this zone which gave a chromium content of 24 per cent Cr_2O_3. This low grade zone was the largest noted in the area, and one which contains a large tonnage of milling ore. Due to lack of development work no estimates of tonnage or grade were made. The structure is well shown in these deposits as they are exposed on both slopes and across the top of the divide. This deposit does not have a definite true strike, but rather corresponds to a section of an arc. The strike of this zone, which is nearly east-west, and located on the northern section of the ellipsoidal structure of the entire mountain, represents a section of the radial or peripheral structure. Deposits located on the ends of the ellipsoidal structure should, due to the flexures, have lower dips and show greater movement, and form more extensive and lower grade ore bodies than along the more parallel sides of the ellipsoid. This deposit appears to bear out this condition in its relative position. Since this low grade zone has a good length, a greater depth is to be expected.

The J. S. Mineral Claim Showings: The J. S. Mineral claim showing is located along the left limit of Windy River, one and a half miles down from its source, and extends up and down the valley wall between elevations of 1460 and 1800 feet. It lies parallel to and partly along the east side of the Widow Maker claim. This claim is held by R. Rutledge.

The showings outcrop from the top of the talus slide upward along rather bluffy terrain. They consist of numerous small stringers and lenses exposed in a zone 220 feet in length and 80 feet in width. The largest lens has a length of 150 feet and has a maximum width of 14 inches. The strike of this zone and lens is N. 30° W. and the dip varies from 38 to 48° SW. Analyses of four channel samples across this lens gave results of 33 to 36 per cent of chromium oxide (Cr_2O_3). Small slips showing displacements of 2 to 3 feet are evident across this lens. They are also evident in the small stringers. This claim showing appears to be one of the smaller weaker structures parallel to and with similar features to the Juneau No. 1 and No. 2 claim structures to the west. The amounts of ore, judged from surface outcrops, appear to be small, however, the outcrop may represent only the upper portion of a larger zone, or may represent the lower or roots of a larger deposit, which has been eroded. This can only be determined by further development.

Conclusion and Recommendations:

Minable quantities of both high grade chromium shipping ore and low grade concentrating ore exist in the Red Mountain area. To estimate tonnages from surface outcrops, when the bodies are of lenticular form and shape, is a policy not to be followed by reputable engineers. Estimates of this nature result in inaccuracies which in many instances react unfavorably for the future operator and for the district as a whole.

Further prospecting and exploration should reveal additional ore bodies, particularly in the west and south sections of the area. All the deposits described in this report are accessible by gravity tram to the completed road into upper Windy River valley, which eliminates the transportation hazard. Careful mining of the high grade lenses, and concentrating facilities for the low grade ore, with provision for sorting, should be considered. To mine only high grade, and not utilize the low grade zones at the same time, would be very poor policy. The greatest amount of chromium is contained in the extensive lower grade zones. More attention and development devoted to them is recommended.

The development of this area at this particular time is strongly recommended. The development of each particular deposit to the extent of obtaining the minable ore is advised. Geophysical surveys in the area, particularly in the west and southern sections, which are covered with slide rock, are recommended. The use of the magnetometer should prove feasible on this chromite ore which, with the contained iron oxides, should offer sufficient attraction to easily locate chromite bodies covered with slide and other loose material. Surveys in the area could be conducted with rapidity due to lack of growth and other features within the area.

In conclusion it may be stated that with the growing importance of the element chromium, and its variable uses and distinctive qualities, these deposits in Alaska should be given just consideration and development, not only for the particular need it fills in National defense, but for the good of the Territory.