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REPORT FOR FORD MOTOR COMPANY ON A RECONNAISSANCE MAGNETOMETER SURVEY FOR IRON ORE IN PERSHING COUNTY, NEVADA.
by E. L. Stephenson (July 1951)

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REPORT FOR FORD MOTOR COMPANY

ON A RECONNAISSANCE MAGNETOMETER SURVEY FOR IRON ORE

IN PERSHING COUNTY, NEVADA

By

E. L. Stephenson
Consulting Geophysicist

Reno, Nevada
July 1951

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Illustrations

NO PLATES INCLUDED!

REPORT FOR FORD MOTOR COMPANY ON A RECONNAISSANCE MAGNETOMETER SURVEY FOR IRON ORE IN PERSHING COUNTY, NEVADA

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INTRODUCTION

This report presents the results of a reconnaissance magnetometer survey for iron ore, made for the Ford Motor Company, on land located in southern Pershing County, Nevada. The survey covered four and one-quarter sections of railroad grant land owned by the Southern Pacific Railway Company, and optioned for mineral rights by the Ford Motor Company. As shown on the accompanying plan map, the sections are 5, 9, 21, N.W. ¼ 23, and W. ½ 27, T. 25 N., R. 34 E.; and N. ½ 29, T. 26 N., R. 34 E. In addition, during the course of the survey a few magnetometer lines were run in section 22, T. 25 N., R. 34 E.

The purpose of the survey was to prospect for magnetic indications of economic deposits of high grade iron ore, in a general area known to contain such deposits. As the bed rock in these sections is partly or completely covered by alluvium, the magnetometer offers the quickest and most positive means of determining areas of iron mineralization. The survey was reconnaissance in nature, to give general tests of broad areas, and except in one small area no detail measurements were made.

In order to furnish a permanent reference point, magnetic base No. 1 was established in magnetically neutral ground in the southwest

part of section 3, as shown on the plan map. The field work was done during June and early July 1951. All measurements were made with a standard Askania vertical magnetometer having a sensitivity of thirty gammas[1/] per scale division.

The accompanying maps and sheets of magnetic profiles constitute the principal parts of this report, and, as they present the specific magnetic data, no long written discussion is necessary. In summary, no magnetic indications of economic iron ore deposits were found in sections 5 or 9, T. 25 N., R. 34 E., nor in section 29, T. 26 N., R. 34 E. In section 21, magnetometer traverses in the northern part, and a general geologic reconnaissance, indicate that only the northeast corner of this section is of interest. In section 23 one small magnetic anomaly occurs in the southern part of the northwest quarter, and the tests show the edge of a stronger anomaly centering in the adjoining section 22. The west half of section 27 shows very strong magnetic reactions, and much iron ore float and a few outcrops of iron ore were noted. Similar conditions were found in the western part of section 22, but this is not a railway section and is not at present held by the Ford Motor Company. In general, the magnetic findings indicate that the northern two and one-half sections should be eliminated from further consideration, but that the northeast quarter of section 21, the northwest quarter of section 23, and the west half of section 27 should be held. These recommendations were transmitted by phone to the Company at the end of June. It also was suggested that consideration be given to the southwest quarter of section 23 and to section 22.

1/ 1 gamma = 0.00001 gauss, the unit of magnetic intensity. The earth's magnetic field has a total intensity of approximately 0.6 gauss, or 60,000 gammas.

GEOLOGY

The chief country rock in the iron-bearing area is a coarse-grained diorite, and all of the known ore bodies occur in this rock. The deposits are irregular and disconnected replacement bodies occurring along structural breaks in the diorite. In addition to wide horizontal distribution, the deposits occupy a fairly large vertical range in the country rock. They vary in size from small lenses of a few tons to bodies containing many thousands of tons.

In the vicinity of the deposits the surrounding diorite generally is impregnated with grains, stringers, and small veinlets of magnetite, and rather strong magnetic anomalies occur over fairly broad areas. Although a certain amount of hematite has been noted in places, essentially all of the larger iron bodies consist of hard black magnetite, and they produce very strong distortions or anomalies in the earth's magnetic field.

MAGNETOMETER SURVEY

Plan of the survey

The general plan of the magnetometer survey is shown on the accompanying plan map. The corners of the sections to be surveyed were located in the field, control lines were established and staked with transit and tape, and most of the magnetic traverses were run from the control lines. For the most part, the traverses were run in a north-south direction at intervals of 500 feet. In order to conserve magnetic stations and obtain the most advantageous coverage, in certain areas, as in sections 5 and 21, a wider spacing was used or rather large areas were skipped where spot checks and geologic determinations indicated a general lack of mineralization.

To obtain closer magnetic ties, and to check possible north-south trends of structure or mineralization, a certain number of east-west traverses were run, particularly in the southern part of the survey area. Most of these traverses were run on the section lines or the quarter lines. In addition, in section 23 a few short traverses were run at intervals of 100 feet, to outline more closely a magnetic anomaly encountered there. On all of the lines, magnetic measurements were made at intervals of 100 feet, and in places intermediate 50-foot stations were added to obtain more magnetic detail. In all, 60 magnetometer traverses were run, and approximately 2500 stations were occupied. All of the readings were made in reference to a single fixed value at magnetic base No. 1.

Results of the survey

The results of the magnetometer survey are shown on the accompanying sheets of magnetic profiles, which show the exact variations in the magnetic field along each traverse line, and on the map showing zones of greatest magnetic intensity in the southern part of the survey area. Strong positive readings indicate concentrations of magnetite in the underlying rocks, and these positive anomalies generally are bordered by magnetically low zones caused by the local distortion in the magnetic field. As already noted, zones of magnetite enrichment in the diorite produce quite strong positive anomalies, although these zones, as such, in no sense can be considered as of present economic importance. The ore shoots or bodies themselves for the most part occur in or near the strongly magnetic zones, and where they are near the surface they produce still sharper and stronger localized positive anomalies.

The magnetic readings do not give specific information as to grade of ore, and no exact value can be assigned as the dividing line between commercial and non-commercial material, since the total magnetic change varies with the size and depth of burial of the body. As the positive anomalies are direct indicators of magnetite concentrations, however, they delineate the local areas within which any further exploration or development work should be done.

Section 29, T. 26 N., R. 34 E. The north half of this section was covered by a series of north-south traverses spaced at intervals of 500 feet, and by traverses run along the north section line and the east-west quarter line. The Blair-Thomas ore deposit, now being mined,

lies in the southwest quarter of the section, a few hundreds of feet south of the end of traverse 22. Float indicates that the eastern part of the section is underlain by massive gray limestone, but coarse diorite occupies the western part.

The magnetic profiles show only weak variations, and there is no indication of commercial ore, nor of any appreciable magnetite enrichment in the country rocks. The west end of traverse 12 and the south ends of traverses 22 and 23 show a broad magnetic low which presumably is the north edge of the magnetic anomaly associated with the Blair-Thomas deposit. This half section may be eliminated from any further consideration.

Section 5, T. 25 N., R. 34 E. This section was tested by six north-south traverse lines spaced as shown on the plan map. The four easternmost magnetic profiles are essentially featureless. Traverses 37 and 38 show one rather broad positive anomaly in the northwest quarter, trending northwestward and increasing in strength to the west. This anomaly indicates a zone of increased magnetite content, but it is not believed to be of present economic importance at least in section 5. This section also may be classified here as of no economic interest.

Section 9, T. 25 N., R. 34 E. Section 9 was covered by nine north-south traverses spaced at 500-foot intervals, and by a short traverse run along the southern part of the east section line. As in the other northern sections, the readings show only weak magnetic variations, and no indication of commercial ore was found. The western part of the section, particularly along traverse 25, shows a large number of

local magnetic variations that apparently are associated with a basalt flow overlying the older rocks. Section 9 also may be eliminated as a potential source of iron ore.

Section 23, T. 25 N., R. 34 E. The northwest quarter of section 23 was covered by a series of north-south traverses spaced at 500-foot intervals, and by traverses run along the north section line and the east-west quarter line. Lines also were run eastward at distances of 2200 feet south of the north section line, at 3000 feet, and at 3500 feet. Traverse 29, on the west section line, was extended to 3500 south, traverse 34 to 3000 south, and traverse 35 to 3000 south. In addition, seven short traverses were run at 100-foot intervals between the 2200S and 3000S lines, to check a magnetic anomaly.

The magnetic profiles show no significant variations over most of the northwest quarter of section 23, but a sharp positive anomaly occurs in the south central part on traverses 30, 34, and 47. These lines and the detail lines show that the anomaly extends for several hundred feet in a southeasterly direction and merges into a variably high magnetic zone near the east end of traverse 47. The anomaly is not especially strong magnetically, but its character suggests the presence of a vein of magnetic material of possible ore grade. It seems doubtful that this body could be mined under present conditions, but because of its presence and the presence of an anomaly to the south, as well as for reasons of access, it was recommended that the northwest quarter of section 23 be held.

Traverses 29 and 48 show the east or northeast edge of a much larger and stronger anomaly that apparently centers in the southeast

quarter of section 22. High grade iron ore float and small outcrops occur in this area, but the scope of the present survey did not permit further delineation of the anomaly in section 22. Although this area has not been mapped, it is believed to be held under mining claim locations by Mr. Wayne Stoker, of Lovelock, Nevada.

Section 21, T. 25 N., R. 34 E. The first traverses in section 21 were run on the east and the north section lines. These lines, traverses 26 and 41, show the presence of strongly magnetic material in the northeast corner of the section, but they also indicate that to the south and west the magnetic intensity drops off sharply. In addition, traverse 42, in the northwest corner of the section, shows only very weak magnetic variations. Because of these results, and because geologic observations indicate a general lack of iron mineralization, only three additional traverses were run in section 21. They were run at 500-foot intervals in the eastern part of the section, as shown on the plan map.

The very high magnetic readings on the north end of traverse 26 and the east end of traverse 41 are associated with an ore body that crops out a short distance to the east on the line between sections 15 and 22. The readings indicate that the ore extends some 300 feet southward along the east line of section 21 and something under 100 feet into that section. The ore is bordered on the south and west by rather strongly magnetic diorite, which cuts off sharply at 1400W on traverse 41. Traverses 26, 43, 50, and 51 also show sharp terminations of this magnetic zone near 1000S.

Traverses 26, 43, and 50 each show one other fairly strong positive anomaly, and these may indicate a single rather narrow magnetic

zone of northwestward trend. It is probable that a certain amount of iron ore occurs in this zone, although the magnetic values do not indicate any large bodies. Because of these magnetic results, it was recommended that the northeast quarter of section 21 be held.

Section 22, T. 25 N., R. 34 E. During the course of the survey it became feasible to run three long traverses in section 22, spaced at 500-foot intervals eastward from traverse 26. These lines show very strong positive anomalies, particularly in the southwestern part of the section on traverses 53 and 56. The three strongest sharp anomalies, which reach very high magnetic values, are associated with outcrops of iron ore. They occur within a broad zone of strongly magnetic rock, which extends southward into the west half of section 27. Although section 22 was not formally included in the survey, and no attempt was made to detail the positive anomalies, the three lines permit much better delineation of a main zone of high magnetic intensity.

Section 27, T. 25 N., R. 34 E. Most of the west half of section 27 was covered by north-south traverses spaced at intervals of approximately 500 feet, and by three east-west traverses run on or near the north and south section lines and the quarter line. Some of these lines were laid out by compass, and the strong magnetic deviations in the area caused the lines to vary somewhat in bearing, as shown on the plan map.

The profiles show that much of the west half of section 27 is underlain by very magnetic rocks. Most of the magnetic values along traverse 27, on the west section line, are negative or very weakly positive, and the line shows only one small positive anomaly, but at short

distances to the east traverses 44, 28, and 58 all show sharp, strong increases in magnetic intensity. This strongly and variably magnetic zone extends nearly to the north-south quarter line, and on traverse 58 it extends beyond the quarter corner. Traverses 54, 55, and 60 show a relatively high level of magnetic intensity, although they do not show any strong positive anomalies. The other lines, particularly traverses 45, 56, and 59, show generally high magnetic intensities, many very sharp magnetic breaks, and several very strong positive anomalies. The sharp positive peak at 12000 on traverse 45 is associated with a small outcrop of high grade iron ore, and outcrops of high grade ore also occur west of the strongly positive zone on traverse 59. Boulders of iron ore were noted in the general vicinity of the central part of traverse 45, and a large amount of high grade float occurs in the south central part of the section, along and near the south part of traverse 59 and the east end of traverse 58.

Measurements made on outcrops of iron ore have shown that the larger bodies all show sharp and very strong magnetic variations, due to polarization, structural breaks, and other factors. Thus the strong and closely associated magnetic variations can be considered as the indicators of mineralization, rather than the positive anomalies alone, although the latter in general indicate the most favorable locations within a zone. Although no specific magnetic value can be assigned to the iron ore as such, most or all of the sharp positive anomalies exceeding 6000 gammas probably indicate ore of commercial grade, and it also is probable that some of the anomalies of lower value may indicate ore. The scope of the present survey did not permit the making of detail measurements in section 27 to further outline the anomalies.

Zones of high magnetic intensity. As an aid in presenting the general magnetic picture in the southern part of the survey area, there is included herewith a map showing the zones of greatest magnetic intensity. As arbitrary working limits, values of 3000 gammas and 6000 gammas were selected to outline the zones. In addition to small outlying areas, the map indicates the presence of a broad zone of high magnetic intensity extending from the west central part of section 22 through the south quarter corner of section 27. Most of the rock within this zone is simply highly magnetic diorite, but the magnetic readings, outcrops, and float also show the presence of bodies of iron ore of commercial grade. Detail measurements would be necessary to estimate the size or probable depth extent of the deposits.

Although detail measurements or additional reconnaissance traverses no doubt would modify the map, the presence of rather sharply defined areas of increased magnetic intensity now is well established. These results may indicate that there are two distinct phases of the intrusive diorite, one of which is much more magnetic than the other, or they simply may indicate zones of secondary magnetite enrichment in the diorite. In either event, the map shows the locations, within the general survey area, in which any further prospecting should be concentrated.

CONCLUSIONS

The results of this reconnaissance magnetometer survey show that no iron ore deposits of commercial size may be expected near the surface in sections 5 or 9, T. 25 N., R. 34 E., nor in the north half of section 29, T. 26 N., R. 34 E. It is recommended that no further consideration be given to these sections.

The measurements indicate the presence of iron ore in the northeast corner of section 21, apparently the western part of a high-grade body that crops out to the east on the line between sections 15 and 22. As section 15 now is leased to another party, and section 22 is not railroad ground and is covered by valid mining claims held by individuals, it probably would be necessary to deal with these private owners before it would be feasible to mine this ore. In the northwest quarter of section 23 there is one small positive anomaly, which may indicate a small body of commercial grade, and stronger anomalies occur to the south and west. Because of these magnetic findings, and for reasons of access, it is recommended that the northeast quarter of section 21 and the northwest quarter of section 23 be held, at least for the time being.

By far the strongest and most promising positive magnetic anomalies, as well as outcrops of high grade ore, occur in the southwestern part of section 22 and the west half of section 27. The latter half-section has been under option to The Ford Motor Company, and it should be held. Some of the southwestern part of section 22 probably already is covered by mining claims, but some may be open ground that could be staked.

If the Company should decide to further develop these areas, detailed magnetometer measurements should first be made in and near the favorable areas indicated by the reconnaissance tests, and in conjunction with this work, any outcrops of iron ore should be sampled. If this work indicates bodies of a size and grade to justify mining, trenching and diamond drilling then should be done to further sample the ore and to determine the depth extent. It is probable, on the basis of the present magnetic and geologic data, that high grade ore bodies are present that can be mined by open pit methods.

E. L. Stephenson

E. L. Stephenson
Consulting Geophysicist

Reno, Nevada
July 1951

E.L.S. Copy

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August 14, 1951

Mr. Robert L. Bodor
Manager, Mining Properties
Ford Motor Company
3000 Schaefer Road
Dearborn, Michigan

Dear Mr. Bodor:

As Mr. E. L. Stephenson sent you his magnetic and geologic report the end of last week you will probably have it when you receive this communication.

In further summarizing Mr. Stephenson's report, the magnetic work found five areas having definite indications of iron ore. These are all in T. 25 N., R. 34 E. and may be listed as follows:

Section 21; extreme northeast corner. This is the edge of an ore body off this section and is of no value without the other ground.

Section 22; southwest 1/4. This is not on land controlled by you, however, should it ever be, this and other parts of the section may warrant further consideration.

Section 25; northwest part of the southwest 1/4. This is not on land controlled by you and furthermore appears to be too small.

Section 27; central part of the northwest 1/4 and southeast part of the southwest 1/4. These two parts of this section are of principal interest and may warrant further exploration.

We therefore have the west 1/2 of section 27 with which to be concerned at the present time. Although no roads go into this area, the nearest being about one half mile south of the southwest 1/4, the building of a road to each of these spots would not be a difficult task. Therefore, if the ore is here, it may be considered accessible.

As with any exploratory program, the exploration merely consists of narrowing the target; this problem is no exception. The 4 1/4 sections of Southern Pacific land in which you were interested has now been reduced to the west 1/2 of section 27. If you wish to continue this program with the final objective of having rather definite ore reserves, it will now be necessary to do some detailed magnetic work in the two anomalous parts of section 27. Roughly speaking the two areas in question are each about 1000 feet square. When this is completed, and if the results indicate ore bodies of large magnitude, it will be necessary to do a little diamond drilling to properly delineate the ore.

I assume that you are interested in developing reserves for the future and it is my belief that such ore as may be found in section 27 would be of greater advantage to you for future use. I believe its value is entirely predicated on whether you want this iron ore for present or for

future reserves. For present use the cost of developing a body of iron ore that is not well exposed would be as great if not greater than the profit you would pay a mining company to mine the ore off their own property. It may be argued that the same relationship of cost would exist in the future, however, we cannot safely predict what the future will bring. A company such as yours had best take the conservative outlook of only being sure of what they actually have in possession.

The present practice of exporting iron ore to Japan , although a poor national move, is to your advantage as some of this ore can just as well be diverted to you. The best example of this is the iron ore mining that will soon be done by the Mineral Materials Company a few miles from your ground. In their process of miningiron ore for export they could take a little additional care and mine some of the higher grade material for you at a small additional cost.

My recommendations may therefore be summarized as follows; if you are only interested in iron ore for today, it will be cheaper for you to buy it because large scale mining will soon be started by people who undoubtedly will be willing to supply you. However, if you wish to plan on future ore reserves, you should continue the exploration on section 27 by first having detailed magnetic work done and then by diamond drilling a few exploratory holes, if the magnetic results are encouraging.

If you plan to carry the exploration through in this manner, it will be to your advantage to get the magnetic program underway as soon as Mr. Stephenson is available, which will be in a month or two. In this way you may be in a position to save some cost on the drilling. I believe that Mineral Materials Company will have diamond drilling done, if so, you should have yours done by the same contractor to avoid a heavy "moving in and out" cost. This would be high in your case as the footage would probably be small.

I hope that I have summarized this project and the conclusions reached thus far so that you can better formulate a clear picture of what your next steps should be.

Sincerely submitted,

Victor E. Kral