SCHLUMBERGER

ELECTRICAL PROSPECTING

METHODS

009212

Report on the Electrical Survey
carried out for
BRITISH COLUMBIA NICKEL MINES LTD.
near Hope B.C.

1. Introduction

The object of this report is the discussion of the results of an electrical survey undertaken by the Schlumberger Electrical Prospecting Methods, during the months of August and September, on the properties of the British Columbia Nickel Mines Ltd., near Hope, B.C.

The first aim of the survey was to ascertain, whether or not, the type of mineralization occuring on the property was amenable to electrical prospecting. If such was the case, it was the intention of the company to apply the method for the study of a known orebody and for the exploration of a virgin territory.

The test was carried out by our Mr. J.Brunschig, from August 15th to August 18th. This test being satisfactory, it was followed by a regular survey, which was commenced on August 28th and lasted to September 4th.

A description of the property is given in the Annual Report of the Minister of Mines of British Columbia for the year 1929, pp.239,240 and 241, to which the reader will kindly refer.

In the following pages, we shall first endeavour to give a summary description of the electrical techniques of exploration employed. This will be followed by a discussion of the results obtained. We shall close with our conclusions and recommendations.

11. Summary description of the methods of exploration employed

(1) Reconnaissance by the Spontaneous Polarization Method

The most convenient and rapid method of undertaking a preliminary examination for metallic minerals consists of studying the phenomena of spontaneous polarization.

A mass of metallically conductive material (the metallic sulphides, except sphalerite and cinnabar, the arsenides, native metals etc.) enclosed in country rock, acts as a natural battery, the moisture in the encasing rock being the electrolyte, and the metallically conductive minerals acting as the metallic elemnets of the cell.

Near the surface, where the weak ground water solutions are oxidizing, the mineralization acts as the negative pole, whereas at depth the solutions are neutral or reducing, and the mineral mass is therefore positively charged. The electric current consequently generated by this natural battery, flows down the apex through the conductive mass, out into the wall rocks, and back to the surface, where it completes the circuit by returning into the apex of the body (Fig.1). Hence, an observer studying the ground overlying such a concealed generator of electricity will discover lines of current convdrging on one or more "negative centers" located about the conductive mass.

This ensemble of effects constitutes the phenomena of "spontaneous polarization" which we abbreviate S.P.

The method is not of absolutely general application, since two conditions must be fulfilled to permit spontaneous current generation to take place:

a) Metallic electrical conductivity of the ore minerals.

b) Continuity of the mineralization of the deposit, so that an unbroken metallic path is offered to the current.

These conditions are, for example, generally well fulfilled by masses of veins of pyrite, chalcopyrite etc.

The study of the spontaneously generated currents is very expeditiously carried out by measuring the differences of potentials which occur at the surface of the ground, along straight and parallel lines. Using the distances along these lines as abscissae, the corresponding potential values are plotted as ordinates, thus producing a profile of potentials. When this profile is flat or only slightly wavy, no electrical activity is noted. Areas of current generation are indicated by pronounced peaks of negative potentials in the S.P. profiles where they cross such areas.

The S.P. method is a very simple process of exploration since it necessitates only the location of the negative zones of potential at the surface of the ground, by means of a very light apparatus.

(2) Potential Method.

This technique is more general in its application, since it can be used for studying stratigraphical and structural problems as well as in the search for ore .

The operation consists of creating an electrical field in the ground by means of passing an electrical current between two widely spearated ground contacts. The form of the resultant field can then be studied by means of a short, movable line used to shunt off a portion of the current in the ground through a measuring instrument. (see Fig.2)

The principle can be applied through a variety of techniques of which one of the most rapid is the determination of the resistivities of the sub-soil from observations of the drops of potential. A series of such observations frequently reveals valuable data concerning concealed geological occurences.

In the case of the B.C.Nickel Mines property, it was, however, another technique of the potential process, known as the "map of the potentials", which was applied. It consists of sending the current into the soil (at the surface or underground) as described above, and studying the distribution of the current at the surface, by tracing and mapping the equipotential curves, noting their form, and drawing therefrom conclusions regarding the electrical conductivity of the underlying material.

111. Discussion of the Results.

Two distinct investigations were carried out on the properties of the company, which are discussed below:

a) Study by current of the major outcrop.

Map No.1 shows the results obtained. An orebody underlies the area under consideration. It outcrops, as shown on the map, and is partially known through drilling exploration.

An insulated cable was lowered into drill hole No.4 and the electrical current was sent into the orebody itself, at a depth of 27 feet. Since the ore possesses a conductivity which is practically infinite in comparison with that of the surrounding rocks, the entire mass of the orebody is practically thrown at the same potential and its exterior is an equipotential surface. Other equipotential surfaces are somewhat parallel to the first one. By tracing equipotential curves at the surface it is possible to get an idea of the form of the mineralized mass and of its position.

Curves C_1, C_2 and C_3 were traced. Curve C_1 gives, we believe quite accurately, the form of the orebody near the surface. Curves C_2 and C_3 show that the current progresses with more ease towards the north east than in any other direction. From this we infer, that at depth, the orebody dips steeply towards the north-west.

A point to be considered is the two refractions which occur on equipotential curves C_2 and C_3 along lines L_1 and L_2. With the limited amount of work performed, we cannot very definitely establish the cause of these refractions, but believe that they are probably due to contacts between rocks of different electrical conductivity. It will be interesting to see if further exploration will confirm this point.

b) Reconnaissance by spontaneous polarization at the B.C. Cut

This reconnaissance was carried out on virgin territory of the property where no mineral occurences were known to exist. The results are shown on Map No.2. This is not, strictly speaking, a map since the scale which is 1" for 150 feet along the profiles, is 1" for 50 feet perpendicular thereto. It is therefore, merely an ideal representation of the reconnaissance work, the purpose of which is to outline broadly the area of electrical activity discovered.

Five profiles of spontaneous polarization number P_1 to P_5 were traced. They show a large belt of intense negative electrical activity running all through the property in an east-west direction from profile P_1 to profile P_5. The axis of this zone of activity may be approximately located along line M'M.

As soon as the electrical results were obtained, our observer advised that a shallow pit be dug in the neighbourhood of profile P_2, where the electrical reaction is particularly strong. This first mining research led to the discovery of a massive orebody under a very shallow overburden. We are of the opinion that this orebody extends across the property between profiles P_1 and P_5, and we advise a systematic investigation of it. In all probability the orebody dips steeply towards the north.

IV. Conclusions

1) A short electrical survey was carried out by the Schlumberger Electrical Prospecting Methods on the property of the British Columbia Nickel Mines Ltd., near Hope B.C. Its purpose was two-foid; firstly, the studying of an outcrop already known, and secondly, the exploration of some virgin ground in the neighbourhood.

2) At the major outcrop the study was carried out by artificial current which was sent into the orebody itself. The equipotential curves drawn enabled us to outline the form of mineralization near the surface. Also, from the electrical results it may be surmized that the mineralized mass dips towards the north-west.

3) In the area of the British Columbia Cut a survey by spontaneous polarization on a virgin area led to the discovery of a new orebody. This orebody, according to the electrical results, is of very large proportion, and we advise a methodic exploration by trenching and drilling.

4) This short survey demonstrated that the mineral occurrences on the properties of the British Columbia Nickel Mines Ltd., are perfectly amenable to the potential and the self potential systems of electrical exploration, and we believe that a general survey would prove useful in determining the complete value of the Company's holdings.

Respectfully submitted,

E.G.Leonardon.

New York City
6th October 1930.