P9-4 THE ASSISTANCE OF ELECTROMAGNETIC OPERATIONS IN SEARCHING FOR MINERALIZATION OF QUARTZ-SULFIDE IN GABRO ROCKS

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IP method has been very effective in last decades in our country, contributing in exploration of sulphide mineralization deposits. However, because of some well known limitations, in a lot of areas, we have been unable to discriminate between economic massive mineralization and non-economic disseminated one.

The some difficulty we have found in searching for Nickel-sulphide mineralization associated with pyrrhotite within ultrabasic rocks; sulphides and magnetite within host rocks cause both high IP effects measured using conventional IP techniques.

It is actually clear that the shape of the decay curve might give more information to qualitatively estimate the texture of the sulphide mineralization. It depends, however, on the technology of the instrumentation and the data processing technology. The results obtained recently have been very encouraging.

We have also used the potential possibilities that are offered by using modern IP instruments such as IPR10-A, IPR11 (Scintrex) and Diapir 18/A in investigating decay curves, contributing in a better selection of IP anomalies.

Without pretending to have the some quality as when using IPR11,we have tired to study the dynamic diagrams of polarizability (din-pol) using the domain IP instrument Diapir 18/A. such diagrams give information on a qualitative evaluation of sulphide mineralization with following textures: a) massive with stringers (veinlets); b) with stringers; c) disseminated.

The shape of these diagrams responds to actual textures.

Let us first show what is a polarizability dynamic diagram. Such a diagram is a representation of the time domain IP data, which can qualitatively give a fast estimation of the mineralization texture. It represents the dependence of the apparent dynamic polarizability $P_{kni}^{\sim}$ on the logarithm of the reference period (time):

$$P_{kni}^{\sim} = f(\log tr)$$

Two parameters are needed to plot the din-pol diagram:

1)Apparent dynamic polarizability $P_{kni}^{\sim}$ through the following expression:

$$P_{kni}^{\sim} = \frac{P_{kni}}{DE}$$

$P_{kni}^{\sim}$ is the measured value of the apparent polarizability for a given pulse (k) duration T_k, given window (n) t_{ni} and given integration period (I) dt_i.

2)Normalizing coefficient DE through the following expression:

$$DE=(-1)^{N-1} \log \frac{(2N-1)T_k + tni}{2(N-1)T_k + t_{ni}}$$

N is the pulse number of the inducing current considered being of infinite length corresponding to the state of established equilibrium, condition which in practise is satisfied for a small pulse number. In cases when the ratio τ/T_k (τ being the decay constant of the model and T_k being the pulse length) is more than 1 ($\tau/T_k > 1$), this pulse number should be more than 2.

So, the measure polarizability values for different periods and windows can be processed during the decay period using a normalizer (DE), enabling all the observations be interpreted as a single observation.

We have computed the coefficients DE for all combinations k, n, i. Varians values of $P_{kni}^{\sim}$ correspond to various measuring times on the decay curve, called reference period and calculated using the following formula:

$$t_r = t_{ni}\sqrt{\frac{Tk + tni}{tni}}$$

After having the value of tr. we get its logarithm.

After having calculated the values of P_{kni} ,tr and log tr, we plot the Dinpol diagram on a mono-logarithmic paper, P_{kni}~ serving as the ordinate axis and tr. as the abscissa axis.

First we calculated theoretically Din-pol diagrams for various cases of parameters (k, n, I) and various parameters of the cole-cole relaxation model. We calculated the decay curves using a program similar to the program used to compute the master curves for the receiver IPR-11.

Our conclusion is that the descending or ascending trends of the dinpol diagram is totally related to the time constant (τ), which is an indicator of the mineralization texture. As it is already known, higher τ values show more concentrated mineralization; the value of c is related to the uniformity of metallic grains in rocks, higher values (up to 0.5) indicating grains uniformity.

Therefore the dinpol diagrams express theoretically a qualitative relation to the mineralization texture. Their shape depends mostly on the decay constant (τ).

Using Diapir 18/A, the measurements can be accomplished in two cases (a) when T_k/t_{ni}=cons.; (b) when $T_k/t_{ni} \neq$ cons.

The best rehability of this qualitative interpretation of the Din-pol diagram is obtained when T_k/t_{ni}=cons., because the secondary voltage is higher and the relative error is lower.

The receiver allows to change three parameters: T_k,t_{ni} and dt;

-T_k is the period length of charging current pulse.
$T_k=(T_0 + dT_0)\ 2^k$;K=0,1,……7;T_0=600 ms; dT_0=1000 ms;T_0^{2k} is delay time.

-t_{ni} is the point (window) where is measured the secondary IP voltage.
t_{ni}=(2n-1)dt; n=1,2,……9,0 (n=10)

-dti is the period (integration time of the secondary voltage)
dti=$dt_0\ 2^I$,dt_0=100ms; i=0,1,…..9.

These theoretical conclusions we tried to confirm interpreting din-pol diagrams obtained from laboratory rock simple and 1-D, 2-D and 3-D measurements. The measurements were accomplished for T_k/t_{ni}=cons. and DE =cons.

We analyzed over 90 samples taken in different areas of various mineralization textures (massive with stringers and disseminated), texture being previously described in detail by a mineralogist. For 1-D,2-D and 3-D model measurements we changed depth to the top of the mineralization.

It is to be stressed out that the shape of the din-pol diagram fits quite well with the mineralization texture. Samples of massive texture show an ascending trend of the dinpol diagram, those of texture with stringers show a parallel trend, and samples of disseminated mineralization show a descending trend.

We also carried out measurement on well-know geological sectors with outcropping mineralizations. We obtained the same trends. Theoretical considerations and the results we obtained from laboratory and field measurements allow us to draw conclusion that the dinpol diagrams give the possibility to estimate the texture of mineralization causing IP anomalies, when the ore bodies are close to the surface. Increasing the depth to the ore bodies lowers this possibility because of the dilution factor of the signal and limitation of the sensibility of the receiver.