LAYER-DISCONTINUITY INDICATIONS IN THE INDUCTION RESPONSE OF EM TRANSILLUMINATION MEASUREMENT

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To identify areas of disturbed geology between boreholes or mine-galleries generally radio wave (RT) or quasistationary resisitivity tomography (REST) surveys are employed. At large separations moderate formation-resistivities may limit the range of the RT and in the case of REST the large volume of the current flow may make the interpretation difficult. Numerical simulations and in-mine test measurements prove that induction-phenomena at the relatively low frequency range – 0.1-100 KHz – could have a role in the transillumination exploration. A resistive layer sandwiched between two conductive shoulder formations enhances considerably the electric field intensity of the vertical electric, or horizontal magnetic dipole source placed in it. By increasing the frequency the electromagnetic field will be concentrated more and more towards the resistive layer. Disturbances as short-circuits modify the intensity and spatial distribution of the real and imaginary current systems, consequently the amplitude and phase response measured inside the layer compared to those in an intact layer. Geologic information can be made clearer by transforming the measured field response to apparent resistivity spectrum based on a „normalized electric field versus induction number" curve valid for a uniform half-space. Vertical electric field amplitude response was used in our surveys. The maximum of induction origin in the audio-frequency range and the decreasing part of the response towards the higher frequencies contain the information about the volume in the vicinity of the equatorial plane of the transmitter and receiver dipoles. The apparent resistivity spectrum at the largest frequencies approximates the effective resistivity of the rock between the source and receiver, which hints at the consistency of the layer. However, our studies show that for determination of the effective resistivity the knowledge of some field strength values at the response maximum is sufficient.

EM induction, transillumination, inhomogeneity

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