# GEOPHYSICAL INTEGRATION: APPROACHES OF FOCUSED SOURCE ELECTROMAGNETIC APPLIED TO GROUNDWATER

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Evaluation of the results of a commercial project using a conventional geophysics technique, the horizontal electric dipole (HED), and first approach of the Focused Source Electromagnetic (FSEM) technique applied to fracture zones in basalts of Serra Geral Formation in the State of Paraná are discussed here. The data is of excellent quality. In addition to the HED, measurements of chargeability, parameter of the Induced Polarization (IP) method used here mainly for the mapping of non-weathered rocks, seeing that the effect IP is present in clays, in the presence of pyrite and others rocks with electronic conductivity. The array HED used was dipole-dipole AB of 50 m length, and the distance from the transmitting dipole to the nearest receiving electrode was 50 m and 100 m, the changeover step of the arrangement was 50 m. Each AB position measured up to 16 levels with spacing of 50 m. While the spacing of 100 m measured two sequences of 8 levels each, one starting 50 m ahead, another 100 m, with considerable coverage of the spacing measurements of 50 m. The current generated established in the transmitting dipoles was around 3 A. The section obtained reached about 240 m depth. For transmission of the current a TxII Canadian transmitter (Instrumentation GDD) was used, powered by a motor-generator with a maximum power of 6.5 kVA. The transmitter generated a sequence of square wave alternating-sign of low frequency pulses with pauses between them. The durations of the pulses and the pauses were 2 s. The square pulses of alternating polarity allowed removing static, industrial, and magnetotelluric noise. The natural electrical potential (SP) was automatically compensated (zeroed) by the receiver. The final precision of the potential and current measurements is estimated to be within one tenth of a millivolt and one to three milliamperes respectively. In the first approach obtained for FSEM, a particular combination of these two measurements at the receiver provided vertical focusing of the electric current and eliminated the influence of the x-directed axial current at the receiver. Unlike the traditional dipole-dipole used in the HED, strongly affected by shallow heterogeneities, the ratio of the dipole-quadripole measurements of FSEM provides smoothed responses along the profile. We observed a significant reduction of the sensitivity for lateral variations in the resistivity of layers near the surface and increase of the sensitivity of less superficial structures located below the receivers. The qualitative analysis of the FSEM allowed a visual interpretation based on the body of the responses even in the presence of multiple unwanted effects, and it was evident that the FSEM does not require long offsets to investigate large depths, since great depths are investigated in late time after the current turn-off during the pulses.

KEYWORDS: FOCUSED-SOURCE ELECTROMAGNETIC, GROUNDWATER