

TDIP imaging of watershed over crystalline basement

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Aquifers located in Brittany (Western France) are set over crystalline geology. Water is generally flowing through highly permeable fractures. We show the TDIP potentiality in picturing hydro-geophysical contexts. Those preliminary results need now to be confirmed by both sample measurement and in-situ characterizations.

Saint-Brice-en-Cogles (Northern Brittany, N48.422°, W1.377°)

The geological context comprises fractured schists with granite inclusions, located on a granite basement. Normal faults from Caledonian to Hercinian era define a horst/graben situation (Fig. 1). A borehole drilled thanks to the CASPAR program produced $43 \text{ m}^3 \text{ h}^{-1}$ during a preliminary pumping test, showing the high potentiality for consumable water production.

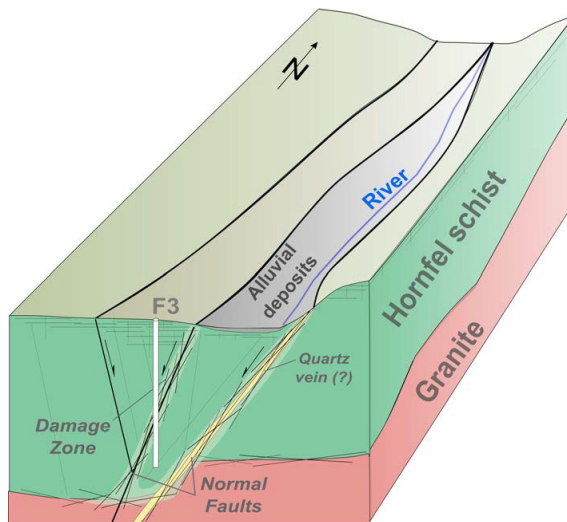


Fig. 1: Block diagram showing the aquifer situation.

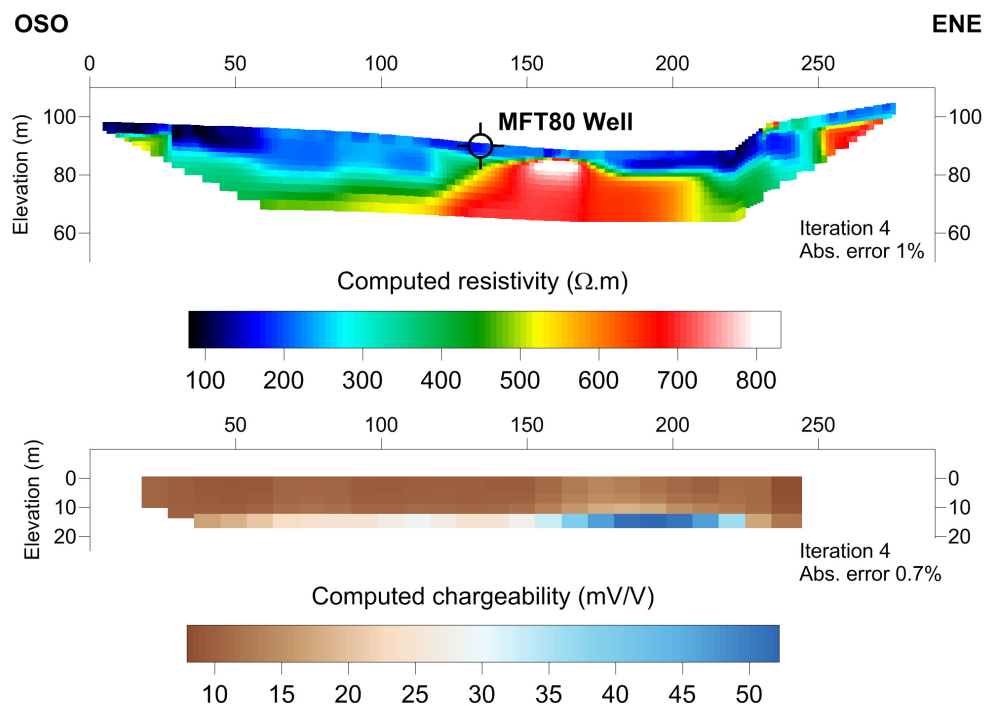


Fig. 2: Saint-Brice. a) Computed resistivity (Wenner-Schlumberger array, inter-electrode spacing = 3m).
b) Computed chargeability (dipole-dipole array, inter-electrode spacing = 3 m).

Several electrical resistivity tomographies were performed in the west-east direction (Fig. 2). While the resistivity tomography shows a striking picture of the recharge zone associated with a conductive anomaly, the TDIP results make not coincide the highest chargeability with the MFT80 borehole location (close to productive F3 borehole) in which pyrite have been seen associated with fracturing in drilled sample. The association of fractures (so hydraulic transmissivity) with high chargeability response linked to pyrite is therefore to be discussed, with probable oxidation phenomena clearly visible on core drilling samples (Fig. 3).



Fig. 3: MFT80 core drilling. Oxidized (top, from 25 m depth) and unaltered (bottom) schist samples.

Guidel (Southern Brittany, N47.755°, W3.481°)

An unexploited aquifer could be considered in a pristine state, at the opposite of the more well-known Ploemeur aquifer located some kilometres to the east and pumped for the last 30 years. At least one borehole shows some artesian condition. A wet zone is probably supplied from below, with surface water properties very similar to those of deep water. Electrical resistivity tomography shows a discrepancy between resistivity and chargeability, both in measurements and inverted values (Fig. 4). We think that higher permeability and water circulations can be associated with a decreasing of induced polarization properties, probably through oxidation of polarisable materials.

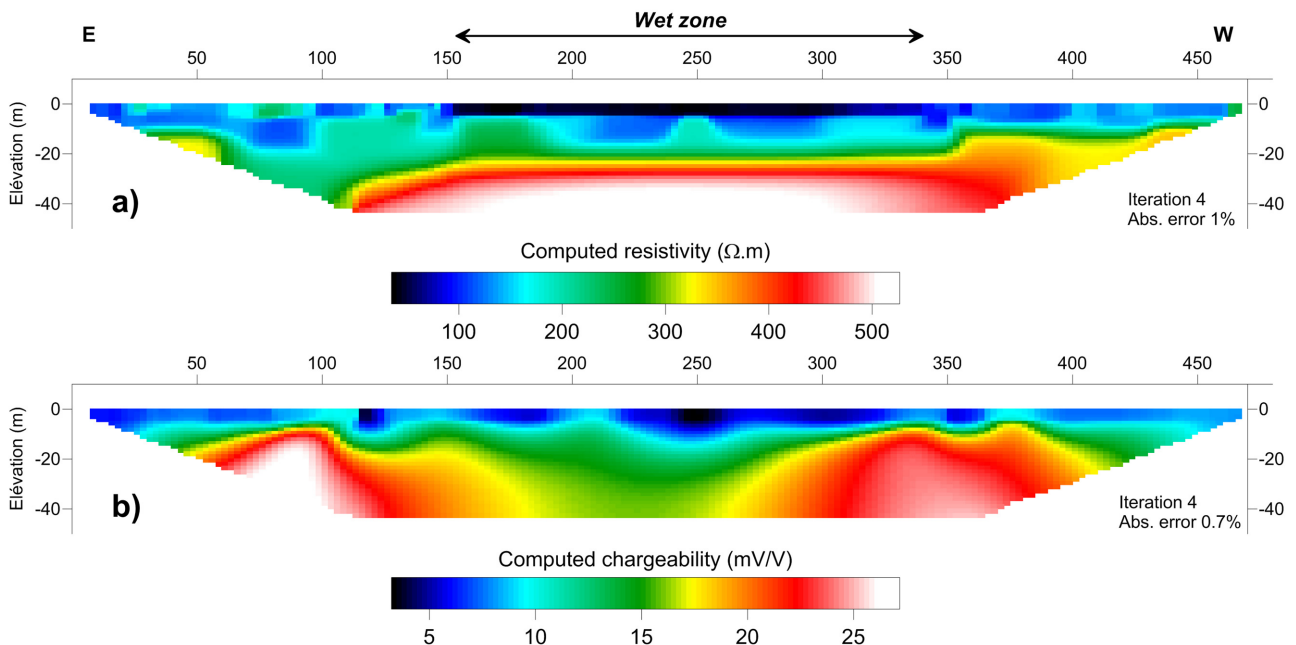


Fig. 4: Guidel (Wenner-Schlumberger array, inter-electrode spacing = 5m).
a) Computed resistivity. b) Computed chargeability.