

ELECTRICAL RESISTIVITY TOMOGRAPHY

The electrical resistivity tomography (ERT) is used to map the subsurface distribution of electrical resistivity by means of injection of DC current in the ground and by measuring the voltage on the ground surface or inside boreholes. The characteristics of electric resistivity are tightly correlated to the chemical-physic characteristics of the ground materials and, for this reason, ERT provide a very precise vision of the subsurface

Electrical resistivity values are digitally recorded on a multi-electrodes georesistivimeter and processed using inversion software (RES2DINV) to create 2D sections or a three-dimensional model of the underground.

The ERT sections can reach a depth of about 300 m with a line length of about 1000 m in a pole-dipole electrode array (with a remote pole)

Electrical resistivity survey are applied to evaluate:

1. Presence of groundwater
2. Depth of bedrock
3. Mapping of contaminant plumes
4. Location of faults and rock fractures
5. Detection of buried landfill cells
6. Location of clayey zones that may form aquitards below proposed landfill locations
7. Zones of buried constructions debris
8. Void spaces, such as large culverts, pipelines, caves, or abandoned mine adits



Survey on a industrial pavement

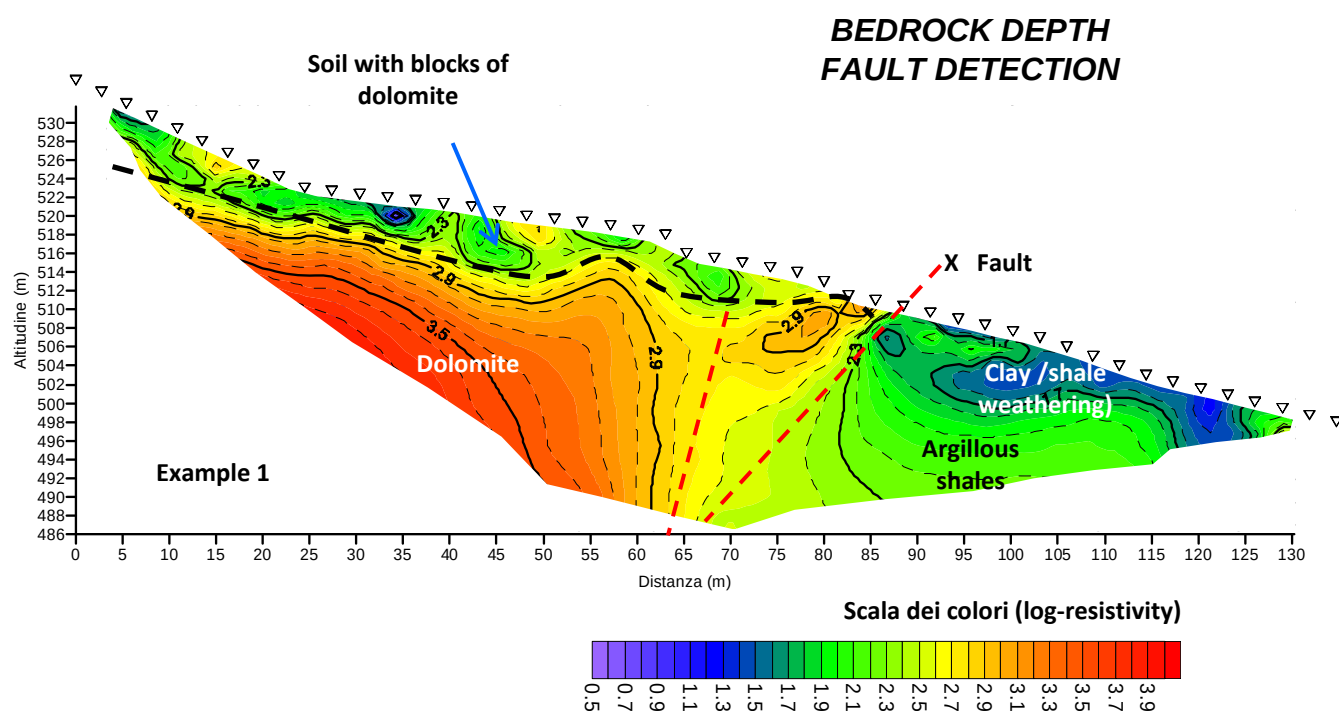


Survey on a landfill



Survey in difficult terrain

GEOLOGICAL MODELLING

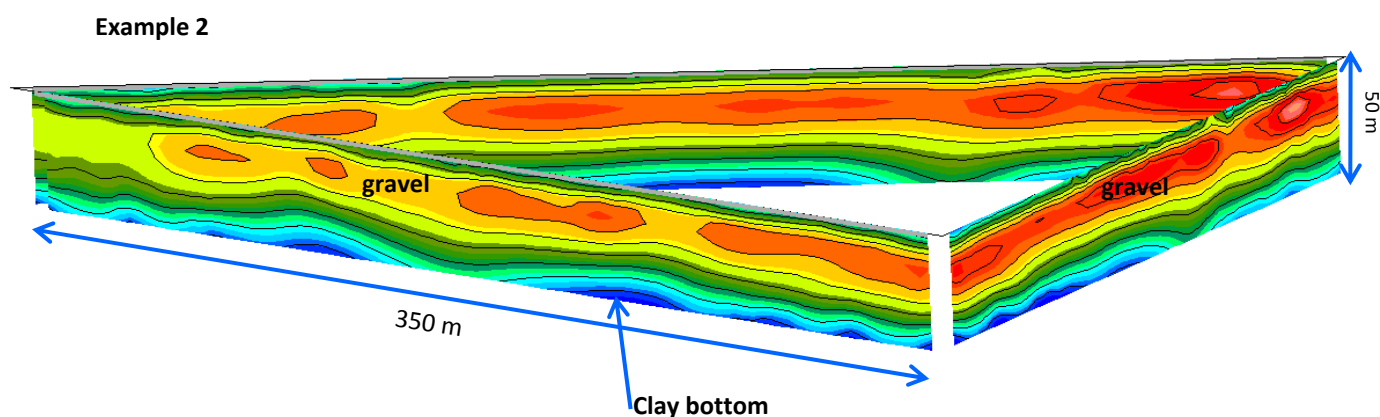


The electrical resistivity method is applied to detect the main geological structures. The different resistivity values may be related to geological setting (stratigraphy) or tectonics (fault and fractures).

The section of example 1 shows a reverse fault at the contact between dolomite (high resistivity) and shale (low resistivity).

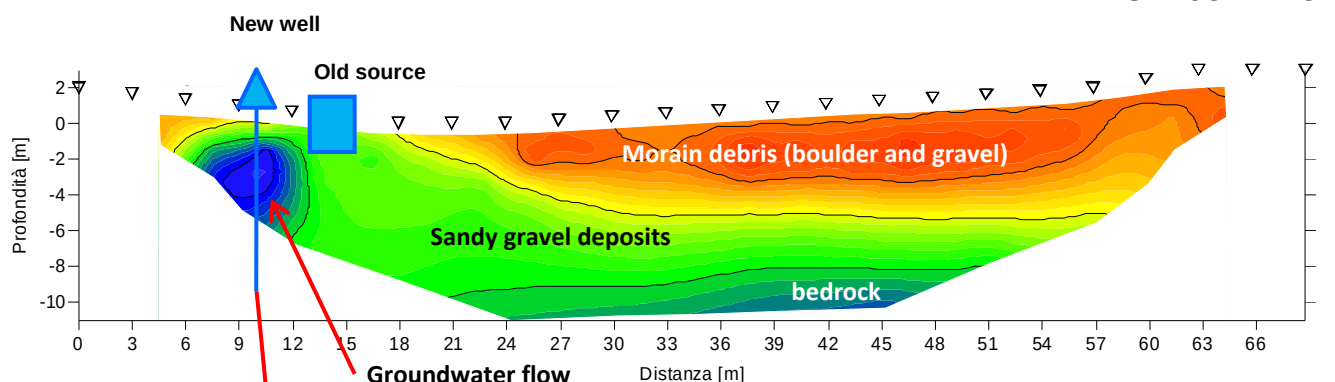
Example 2 is related to a 3D model of a site for gravel quarry, to evaluate the potential volume of a gravel level (design of the gravel pit). The gravel has a high electrical resistivity, while the clay at the base (located about 35 m from ground level) is conductive.

3D MODEL FOR A GRAVEL PIT DESIGN



GROUNDWATER EXPLORATION

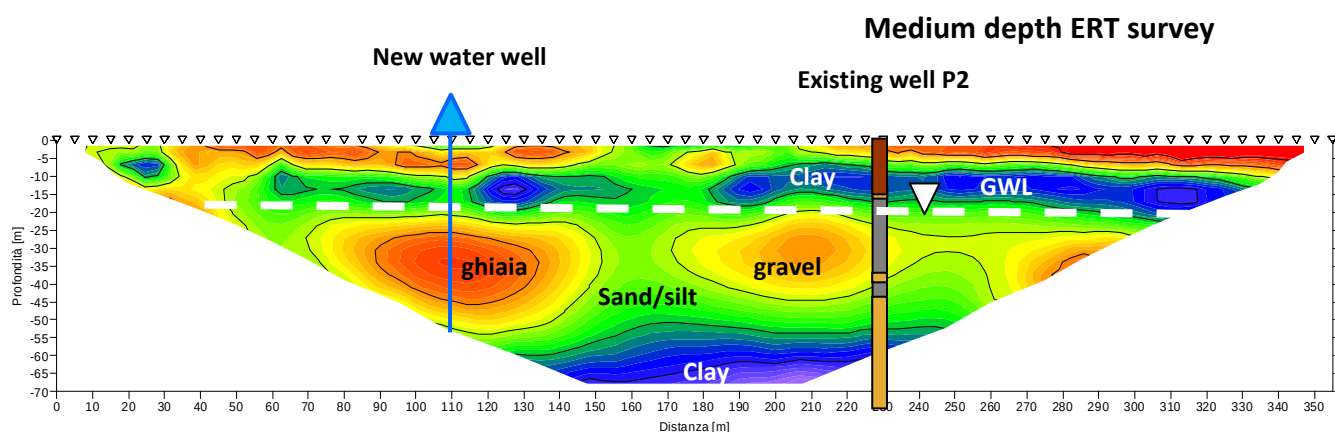
INDAGINI SUPERFICIALI



This example is related to a hydrogeological study to replace an old spring catchment with a water well.

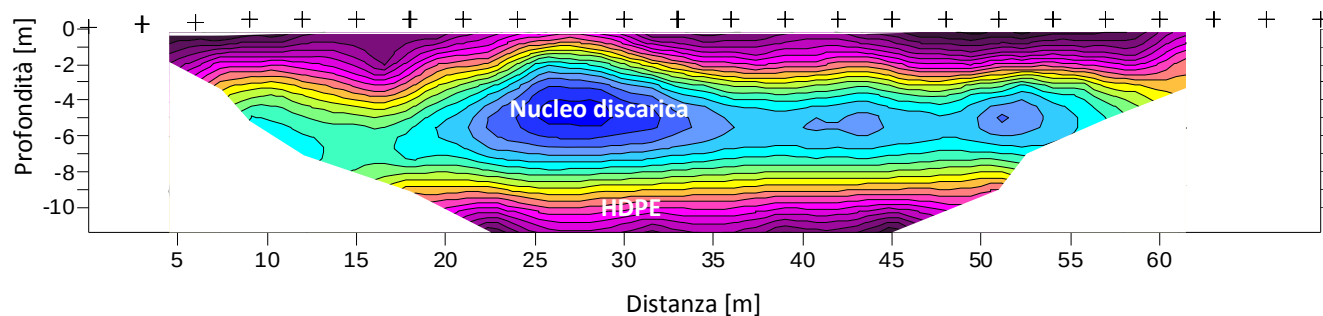
(Valgrosina, Sondrio, Western Alps - Italy).

The 2D ERT section pointed out a quite simple geological model, with a shallow level of high resistivity sediments (moraine with prevailing boulders) lying on fluvial-glacial deposits. Groundwater flows in a channel, and the spring get a little part of the water. For this reason, a new water well has been drilled in the low-resistivity zone

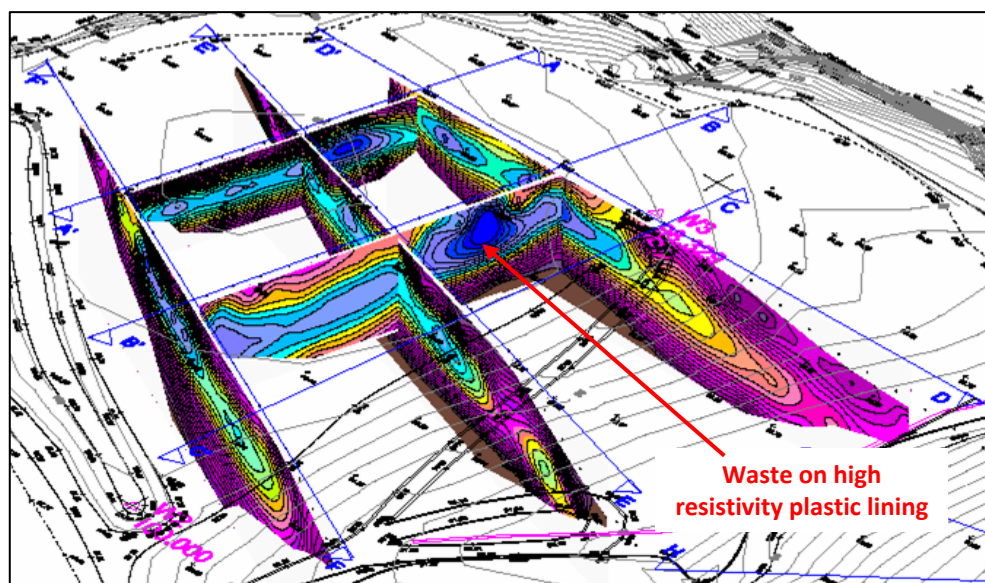


The depth of investigation is related to the length of the ERT line, in the ratio (usually) of 6 :1 (line length = 6, depth = 1). This ratio can be reduced using a remote pole (3:1). The example shown in the picture above refers to a 72 electrode line with a maximum depth of 70 m, which purpose was the best location for a new water well. According to the ERT section, the new water well was located and drilled in a gravel lens (high permeability

LANDFILL SURVEY



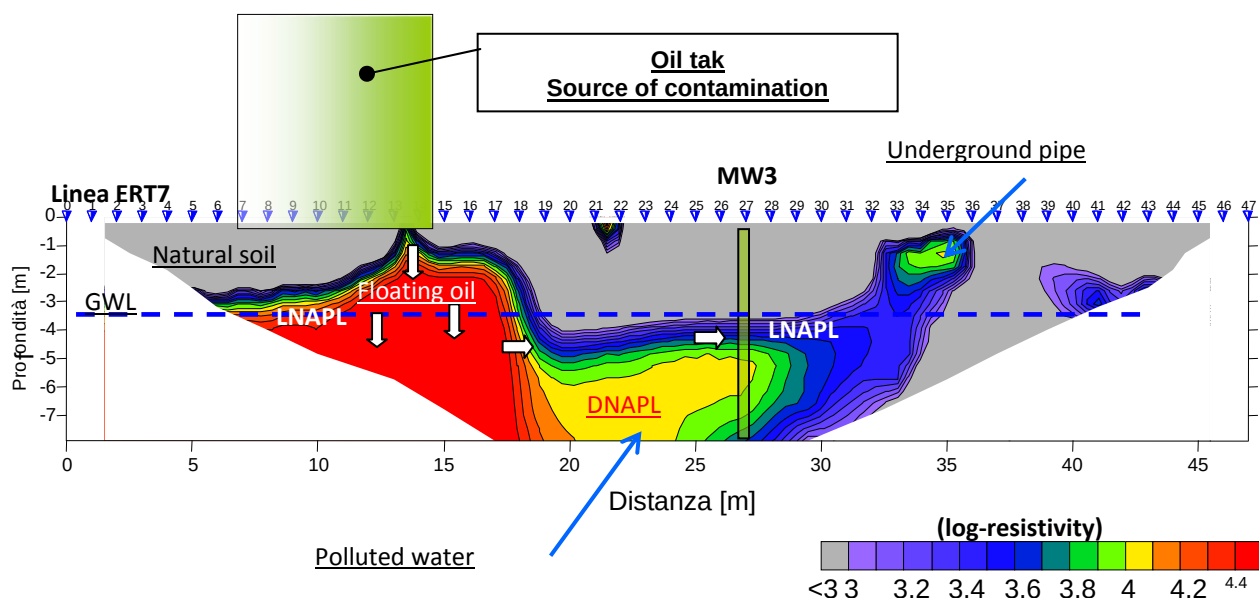
3D MODEL FOR THE RECONSTRUCTION OF THE THICKNESS OF THE WASTE AND RECOGNITION OF THE LANDFILL BOTTOM (PLASTIC LINING)



The application of electrical methods for the detection of buried landfills (thickness of the waste, location of the bottom, etc.) is helped by the strong contrast between the waste and bottom plastic lining (if any) or the natural soil. Urban waste typically have a low resistivity, while the plastic lining is impermeable to current flow and appears as a strong resistivity layer. The case shown on this page is related to a landfill site in Swansea (UK).



CONTAMINANT PLUME DETECTION



The plume of contamination usually show a strong contrast with the natural soil or groundwater. The oil (and all hydrocarbons) have a high electrical resistivity, and can be easily recognized with the geoelectrical survey