ILLINOIS
Illinois State Geological Survey
PRAIRIE RESEARCH INSTITUTE

Two-Dimensional Electrical Resistivity Methods Information Sheet

Illinois State Geological Survey
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Background

The purpose of the Illinois State Geological Survey's (ISGS) Geophysics Web App is to make available to the public the geophysical data acquired by the ISGS over the past several decades. An important component of the geophysical program since the inception of the geophysics section has been the collection and use of electrical resistivity methods. There are three main types of electrical resistivity geophysical methods: Electrical Resistivity Tomography (ERT), Vertical Electrical Sounding (VES), and downhole resistivity.

Both VES and downhole resistivity measurements are 1-dimensional (1D): they measure the resistivity directly below a single ground point. ERT can be either 2-dimensional (2D) or 3-dimensional (3D), or several 2-dimensional profiles can be combined to create a pseudo-3D resistivity model (also called 2.5-dimensional). All three methods take advantage of the contrast in electrical properties of natural and man-made materials. For example, limestone has a relatively high resistance to the passage of an electrical current, while clay and shale tend to conduct electricity relatively well.

For the 1D VES and downhole, the data are displayed on the map as points, corresponding to the surface location where the data was collected. This VES data may extend up to 300 feet, but the downhole EER data can extend for as deep as an uncased well may extend.

For the 2D ERT profiles, the data are displayed as lines corresponding to the surface locations where the data was collected. The data from the 2D profiles may extend to as much as approximately 90 meters (300 feet, or 100 yards) below the surface. Nearly all of the ERT data was collected using an ABEM Terrameter SAS 1000, ABEM Terrameter SAS 4000, or ABEM Terrameter LS. Similarly, nearly all of these data were processed using Geotomo Software's Res2DInv. More information on 2D and 3D imaging techniques is available here.

The outputs from all electrical resistivity data are downloadable in the app where available by following the appropriate link in each profile's dialog box, as well as intermediate files with processing. The profiles are imaged individually, but each line may be part of a larger project. All profiles or points within a project are grouped by color.

The data in this application can be viewed online or downloaded in several formats. See the readme file here for more information about the available data for each profile, and continue

reading on the next page for more information on the theory and application of electrical resistivity methods.

Resistivity of Earth Materials

Electric Resistivity geophysical methods are used to map the resistivity in the subsurface. Different rock and soil types have different electrical resistance characteristics, and this variability can be used to determine the type of rock or soil underfoot. The table to the right gives examples of the range of resistivity one can expect from different materials. There are large ranges possible for a given rock because the resistivity of a medium can be dependent on a variety of conditions (e.g., water saturation, weathering, faulting, etc.).

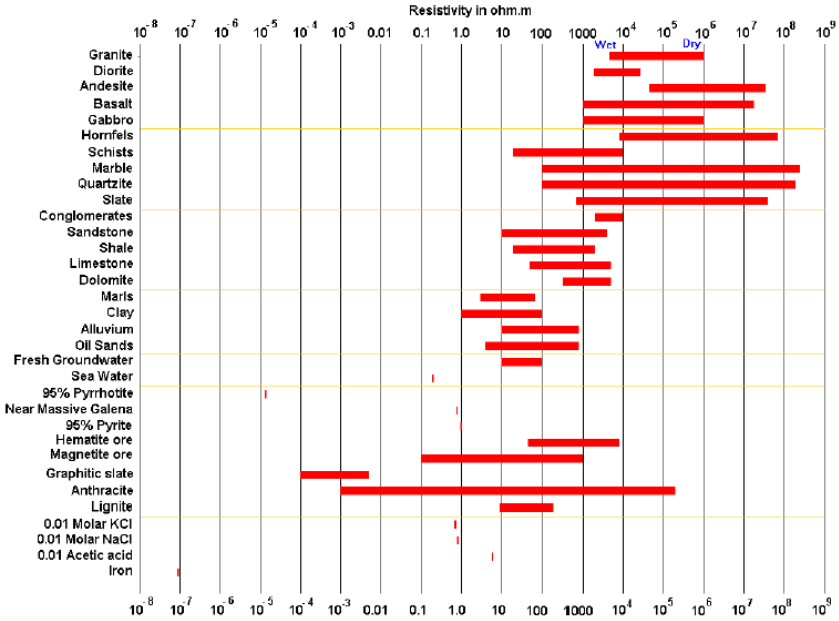

Figure 1. The resistivity of rocks, soils, and minerals (Loke, 2016)

Reference:

Loke, M. H. (2016). Tutorial: 2-D and 3-D electrical imaging surveys. Geotomo Software, Inc.