With a rapidly increasing population density, particularly in coastal areas, the quantity and quality of water becomes a rate limiting parameter in land management. Prolonged periods of drought, uncontrolled over-exploitation of the groundwater resources for drinking water and irrigation purposes, fish breeding works and decrease of the natural recharge of the coastal aquifers as a result of the upstream damming, cause progressive insalination compromising seriously important strategic water resources. Proper water resource management is dependent on the development of accurate predictive groundwater low models. The accuracy of the models, however, is largely dependent upon the ability to adequately determine the geometry of hydrologic systems.

A geophysical survey using seismic reflection and time domain electromagnetics (TDEM) was carried out in the south-eastern part of the Sardinia island (Italy) to study a very complex coastal aquifer situated where, in the past, a very important salt water intrusion phenomena occurred, and where important interventions (hotels, various buildings for tourism and agriculture and a dam, just closed to the delta of the river Flumendosa) are planned. While seismic reflection profiling can potentially provide an accurate spatial representation of hydrogeologic structural boundaries (Birkelo et al., 1987; Geissler, 1989; Liberty, 1998; Miller et al. 1989; Miller and Steeples, 1990; Whiteley et al., 1998), TDEM is more capable in recognition of hydrogeologic units (Fitterman and Stewart, 1986; Poulsen and Christensen, 1999; ), identifying if necessary fresh and salt waters (Goldman, 1991; Mills et al., 1988). Therefore, a joint analysis of seismic reflection and TDEM data has been carried out to have a more complete knowledge of the aquifer. To date the authors are aware of only one example in refereed literature (Shtivelman and Goldman, 2000) reporting a similar integrated interpretation of seismic and electromagnetic results.

The seismic section shows several reflectors which reach a maximum depth of about 700 meters in the central part. Two strong reflectors dominate the deepest part of the section. The continuity of these events is interrupted in many location along the entire section. These discontinuities were interpreted as deep faults with vertical displacements up to 100 m. Whereas the upper part of the section is dominated by smooth, horizontal reflectors, which are almost undisturbed down to 400 m, even if local amplitude changes of reflectors are present. All reflectors, above about 400 m, were interpreted as boundaries in quaternary alluvium deposits. In spite of the high quality of the section, seismic data do not allow stratigraphic distinction in the quaternary deposits.

The TEM and the TEM FAST pseudo 2D sections, obtained using in the inversion geometrical constrains derived from seismics, show very conductive layers (0.5-10 Ohm x m) in the shallower part of the section, obviously due to the presence...
of salt, brackish or fresh water in alluvium or eolian sand deposits. In the central part
of the section, lateral resistivity changes can easily visible. High resistivity layers
dominate the section below 250 meters. In this resistive layer, lateral variations of
resistivity can also be seen, probably in correspondence of either faults or changes
of the Palaeozoic rocks. The TEM FAST soundings clearly show the connection
between the channels and the encroachment areas and distinguish different aquifers.

The geophysical survey carried out in the Muravera plain provided very useful
information on the aquifers present in the area. In fact, superimposing the final TEM
sections and the seismic section, obtained with separate data processing and
interpretation, or with joint inversion, it can transform the geological information,
mainly deriving from seismic results in hydrogeological information. The attribution of
low resistivity values to seismic "strata" allows the definition of the geometry and the
quality of the aquifers.

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