A geophysical TEM-survey of the Punata Alluvial fan, Bolivia.

Background

With the realization that human exploitation of the planets resources has put us in an unsustainable sitution, with ever increasing global temperature, erratic weather patterns and droughts, geophysical investigations are more important than ever before. Instead of having to dig through the soils or bore expensive holes in the ground, geophysical methods provide an abundance of information about the subsurface at great depths.

The Punata alluvial fan is one such area where growing population and agriculture has put strain on the ground water resources. In order to achieve sustainable water mangement the hydrogeological properties of the fan needs to be evaluated. As an attempt to map the geometrical properties of the fan (aquifer), a Transient Electromagnetic Method (TEM) was used in this particular survey

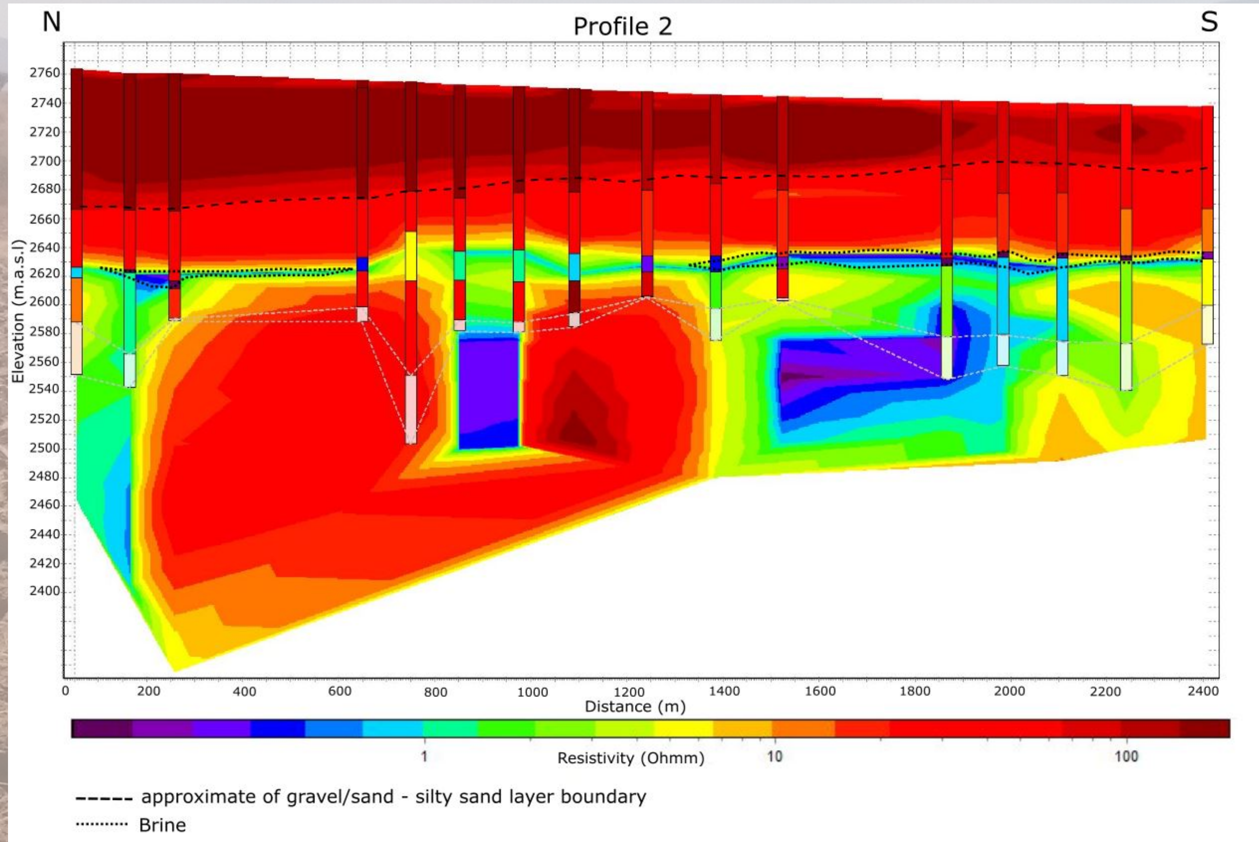

Fig 1.
This is a typical vertical 2D-profile creates from several TEM-measurement. The bars represent models with the lowest possible amount of layers and the background is based on 20-layer models. There is a distinct low resistivty layer which is brine that has accumulated on top of clay from a paleolake.

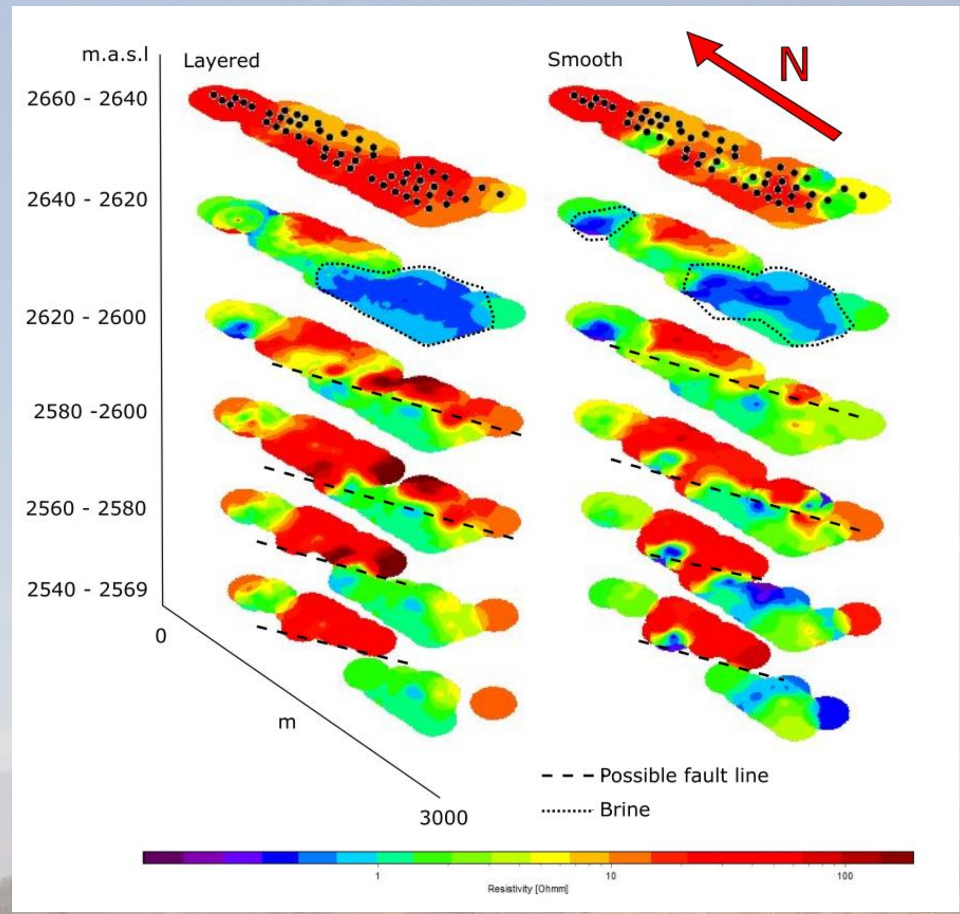

Fig 2.
These models are horizontal interpolations of the mean resistivty between adjacent soundings, at differnt depths. The brine is clearly visible in these models, but the most intresting feature is the high resitivty extending below. It has been intrepreted as a possible fault line, with the red areas representing bedrock. However this interpretation is not conclusive and require further studies.

Method

TEM utilizes the connection between electrical and magnetic fields. In short, an electrical pulse is sent through a transmitter loop and is then abrubtly turned off. This induces an electromotive force whcih propagate into the ground and in turn induces currents proportional to the resistivity. The currents yield a ssecondary magnetic field which can be measured by reciever coils, and then used to create smooth and layered resistivty models of the subsurface.

Results

The survey did not yield the depth penetration that had been hoped for, but it did reveal two other intersting features. The first is a thin brine layer with very low resistivty (Fig 1) and the second is a possible fault line underneath the alluvial fan (Fig 2).

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