USING ELECTRICAL SOUNDING TO 3D IMAGING OF QUARRY MATERIALS: APPLIED TO 3 LIMESTONE ZONES.

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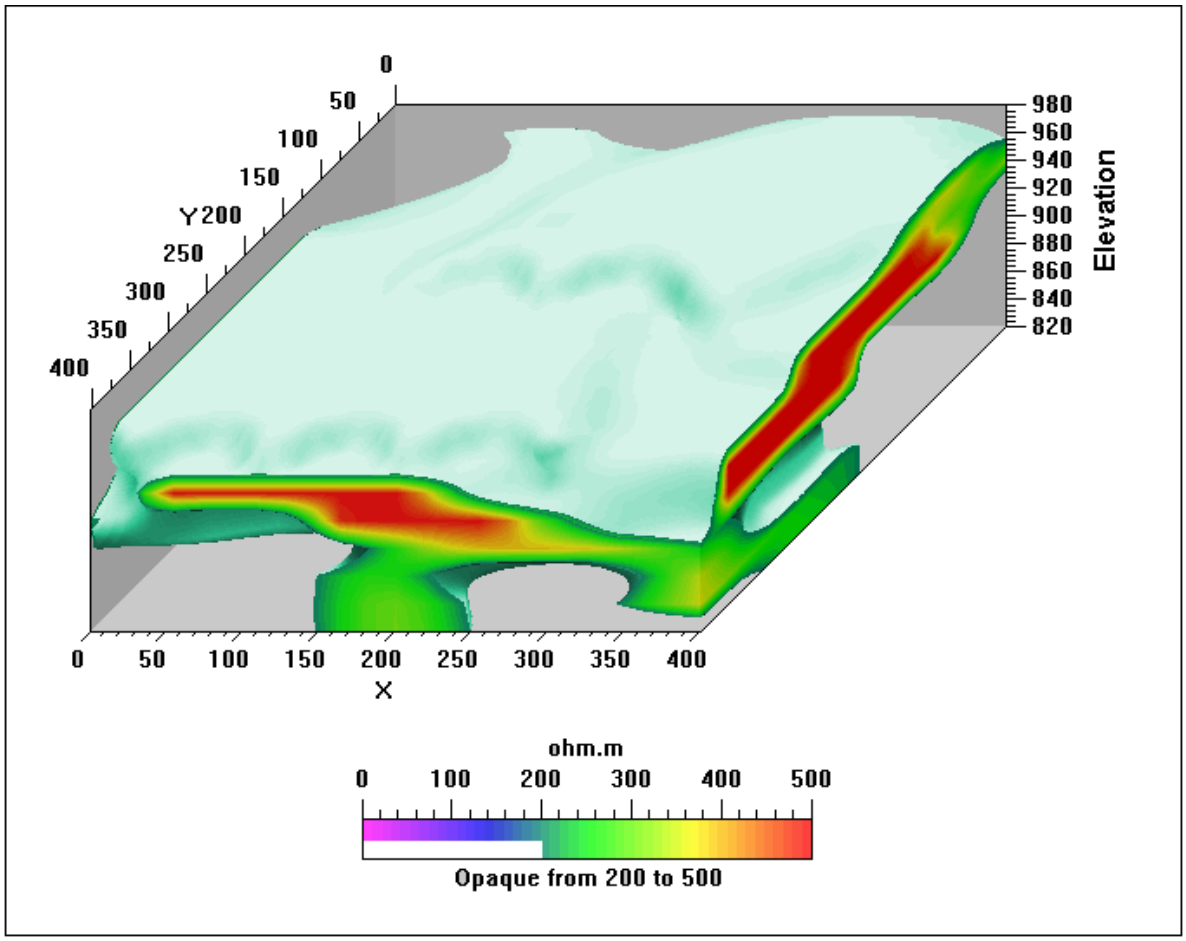
In order to build an east-west high way section (Algeria main high way), an electrical geophysical study has been conducted. The goal of the study is to estimate the limestone volume in three sectors located near the city of Constantine in eastern Algeria. In particular the study should be able is to determine the underground limestone deposit by estimating its geometric shape. The limestone volume does not have to be important since its use is going to be limited in time. The method has been chosen because it offers two benefits: first it is sensitive to the geological formations that characterize the study areas. The second benefit comes from the fact that using several sounding points, evenly spread on the study site allows to obtain by interpolation an underground 3D image. The first sector is located about 14 km south east of Constantine downtown. The first sector UTM coordinates are 291120/4033391. The second sector with UTM coordinates 290140/4032965 is around 1 km south east of the first sector. Finally, the third sector is about 200 m south west of sector 1. The investigation carried out 25 electrical vertical soundings by sector with a square mesh of 50 m by 50 m. The electrical soundings were carried out by using Schlumberger configuration. In order to reach the minimum investigation depth (around 100 meters), the AB line length was chosen to be equal to 650 meters.

The vertical electrical soundings of the first sector show three distinct materials.The first material having a resistivity smaller than 200 Ohm.m and a thickness larger than 50 meters.The second material whose average resistivity is larger than 200 Ohm.m. and thickness bigger than 40 meters
The third material with resistivity varying between100 and 200 Ohm.m. In order to obtain a more accurate image of this electrically resistant horizon, suggesting that it is made of limestone, we have built a 3 dimensional model having resistivity values that are more than 200 Ohm.m. The resulting image indicates the presence of this layer across the whole site with an almost uniform thickness. Concerning the second sector, the VES interpretation indicates that the geo-electrical section is essentially made of 3 to 4 layers that we can electrically differentiate. The inversion computation of these points shows that the substratum electrical resistivity values are less than 100 Ohm.m. As for the third sector, the recorded electrical resistivity values are rather low, which suggest that the site is made mainly of marl formations.

Several conclusions can be drawn from this investigation. The chosen method seems well suited to solve the raised problem. Indeed, the difference of electrical resistivities between limestone and the marl formations is a good sign to accurately determine their shapes as well as their depths and thicknesses. The first sector presents a thick limestone layer in its central part, but limestone is almost inexistent in its northern and southern parts. The second sector indicates the presence of a uniform layer across nearly the whole site. Its low depth (a few meters) and its relatively important thickness (50 meters on average) make this sector very interesting.The last sector is unlikely to contain limestone formations, except in its northwestern part, where an electrically resistant zone has been detected.To satisfy a temporary need (construction of a high way section), the aggregate reserves of sectors 1 and 2 seem more promising.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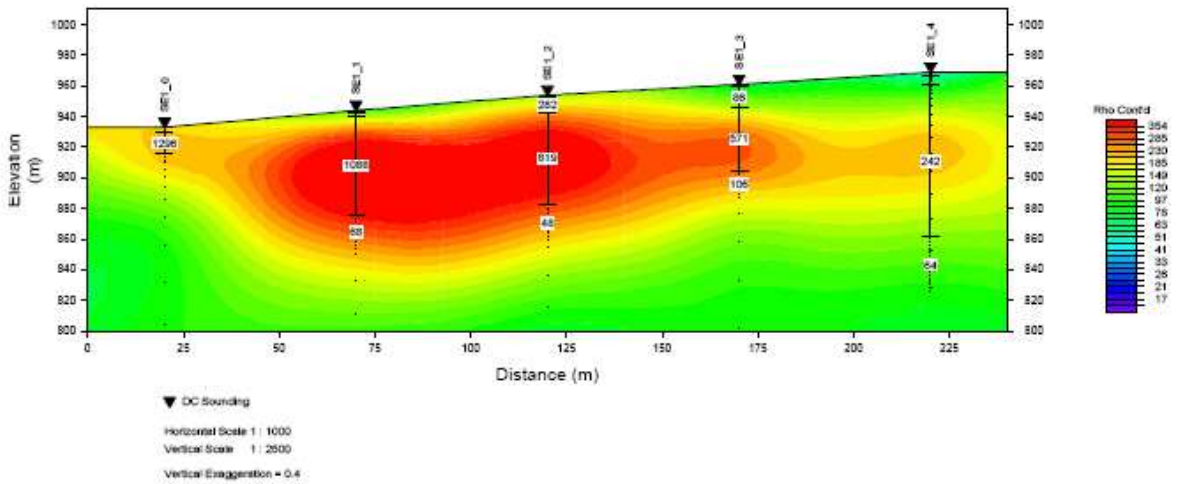
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Distance (m)
Rho Cont'd
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Vertical Scale 1 : 2500
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