



# 11.º SEMINÁRIO SOBRE ÁGUAS SUBTERRÂNEAS

Porto, 2 e 3 de março de 2017

Instituto Superior de Engenharia do Porto



# 11.º Seminário sobre Águas Subterrâneas

Porto, 2 e 3 de março de 2017 | ISEP

## THE CONTRIBUTION OF GEOPHYSICS AND HYDROGEOLOGY IN THE KNOWLEDGE OF THE EASTERN HAOUZ AQUIFER (MOROCCO).

Samia ROCHDANE<sup>1,3</sup>, Abdennabi ELMANDOUR<sup>3</sup>, José TEIXEIRA<sup>2</sup>, Alberto GOMES<sup>2</sup>

1: Geography Dpt., Faculty of Arts, University of Porto, Porto, Portugal, samia.rochdane@gmail.com.

2: Centre of Studies on Geography and Spatial Planning (CEGOT). Geography Dpt., Faculty of Arts, University of Porto, Porto, Portugal, jateixeira@letras.up.pt; atgomes@up.pt.

3: CadiAyyad University, Marrakech, Morocco, a.elmandour@uca.ac.ma

### ABSTRACT

Eastern Haouz is an intra-mountain basin characterized by a semi-arid climate. This area experiments an increasing demand for drinking water and agricultural productivity water. To satisfy this demand, local villages of the area solicit the surface water (rivers and springs) and groundwater reserves. Piezometric map (Fig.1) shows that groundwater recharge is driven by anastomosis in contact with limestone outcropping in the High Atlas Mountains and shales exposed in the Jebilet mountains, as well as infiltration of irrigation water (S. Rochdane 2013). Maps of hydrographic network and piezometry show the overlap between the groundwater divided line and surface water divided line.

**Key words:** Eastern Haouz plain, geology, hydrogeology, tomography, gravimetry.

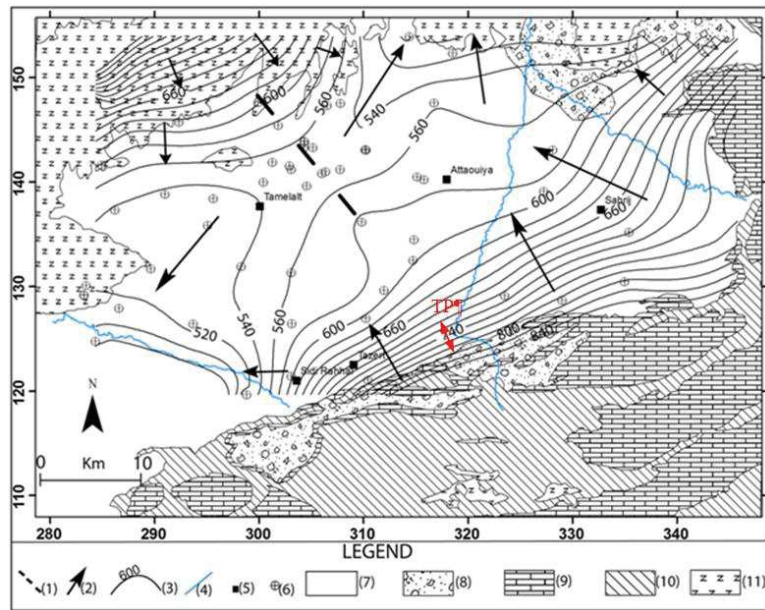


Fig. 1 Geology of the study area (according to the 1:50 000 geological map of Morocco) and piezometric map. 1 Groundwater division line, 2 groundwater flow direction, 3 piezometric contour (m), 4 river, 5 villages, 6 Boreholes, 7 quaternary deposits (alluvium), 8 Mio-Pliocene: conglomerates, limestones and marls, 9 Jurassic and Cretaceous: limestones, marls and sandstones, 10 Triassic: dolerites, clays and conglomerates with deposition of evaporites, and 11 Paleozoic: schist, sandstones and quartzite. TP - Tomography profile.

## 11.º Seminário sobre Águas Subterrâneas

Porto, 2 e 3 de março de 2017 | ISEP



The compilation of geological, geophysical and hydrogeological data shows that the region is formed by a subsurface structural basin as a graben, surrounded by two horsts corresponding to the massifs of the High Atlas and the Jebilet hills. In the south of the basin, the large thickness of the cover gives a higher accumulation of water, which ensures the sustainability of the supply of the free water table housed in the alluvial deposits of Mio-Plio-Quaternary age and the captive deep aquifer located in the limestones of the Jurassic positioned on the South of the plain. The gravimetric study showed that the base uplift, east of the village of Tamelelt, in the north of the plain, imposes a dividing line of the surface water and groundwater, which gives two directions of flow; one, to southwest, that feeds the Tensift basin and other, to northeast, feeding the Oum Er Rbiaa basin (Fig.2). The electric tomography confirmed the results of the gravimetry and showed that the change of direction of Tassaout River is due to a thick conglomeratic layer, very resistant to river flows erosion (Fig.3). The obtained results improve the understanding of the geometry and hydrogeology of the eastern Haouz aquifer. Electric tomography comes to show, justify and validate our hypotheses about the surface and groundwater divided line and the cause of the direction change of the Tassaout River. The knowledge of eastern Haouz aquifer contributes for a better management of the groundwater reserves and helps to prevent threats for this vital natural resource of the area.

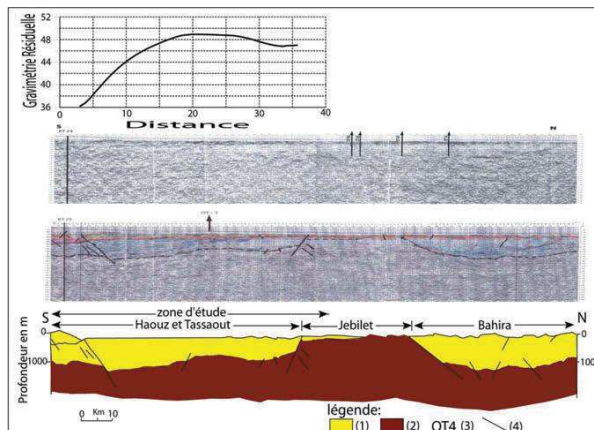


Fig. 2 Gravimetric profile, seismic profiles and seismic section. 1. Cover, 2. Basement, 3. Borehole, 4. Fault.

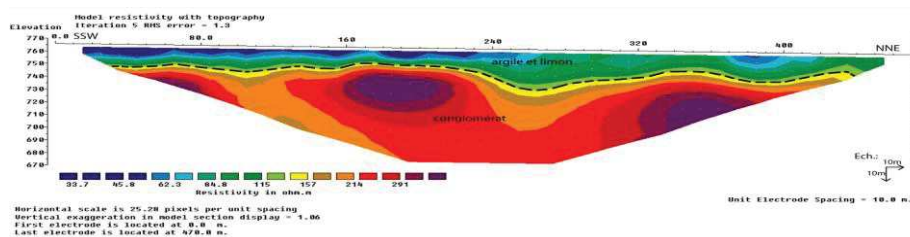


Fig.3: Inverse ERT section of the eastern Haouz profile.

### REFERENCE:

SAMIA ROCHDANE, Abdennabi EL MANDOUR, Mohammed JAFFAL, Mahjoub HIMI et Albert CASAS:  
« The quality of surface and ground water in the eastern Haouz and Tassaout area, Morocco » Hydrological Sciences Journal: red book for the Symposia H04: "Understanding fresh-water quality problems in a changing world", (IAHS Publ. 361, 2013) ISBN Number: 978-1-907161-39-1. Pp 220-226.