

Groundwater prospecting, drilling and well construction in hard rocks in semi-arid regions: an overview

António Chambel

International Association of Hydrogeologists (IAH), Geophysics Centre of Évora (CGE), Geosciences Department, University of Évora, R. Romão Ramalho, 59, 7000-671 Évora, Portugal, achambel@uevora.pt

Abstract

In semi-arid and arid areas rock weathering is normally much less deep than in rainy areas. So, rocks tend to be more near the topographic surface. These climatic conditions also generate much less vegetation, which in all the cases clearly favours a direct observation of rock condition, fracturing or weathering.

By other side, aquifers in hard rocks present specificities in relation to water presence and movement that implies a different approach when dealing with groundwater prospecting. Hard rocks are considered to have basically 3 layers of interest for hydrogeology: the weathered zone on the top, the fractured zone under the first one, and the non-fractured zone under the last one, where the possibility to get water is very low. Water is stored in both fractures and rock matrix, but moves mainly through the fractures. The capacity to transmit water is much more related with the interconnection between fractures than with the storage capacity. Even if the storage capacity is high, if interconnection is not strong, a well will not be fully successful.

As most part of the wells is vertical, attention must be concentrated on the tilt of fractures: vertical fractures are much more difficult to intersect with a vertical drilling than inclined ones, and horizontal fractures will be the most easy to cut. If vertical, horizontal and inclined fractures are present in the same area, if they interconnect and go deep enough, if their distribution in space is regular and if the space inside fractures is not filled with clay or other impermeable minerals, we are in presence of the best conditions to have a successful drilling.

Attention must also be given to the total vertical length of the weathered layer or layers and to the estimated vertical extension of the fractured zone. Indirect indications may come from geophysics. The most used method seems to be the geoelectrics, followed by electromagnetic methods.

Drilling methods are most part of the time rotoperussion. During drillings it is essential to register the lithologies, the fracturing levels and the water strikes. Registration of drilling velocities can be important to perceive the nature of rock (fracturing, weathering, etc.).

A good planning, the right construction skills and a sustainable exploration plan are essential to have a durable working well, and to maintain the water quality on the well and in the

aquifer. Isolation, protection, casing, filters, caps are some of the figures needing attention during construction which will help to maintain a sustainable water supply system.

Key-words: Groundwater prospecting, drilling, well construction, hard rocks, semi-arid areas