

## 6 | General hydrogeological problems

### 6.1 | Hard rocks as specific media — methods and results





abstract id: **303**

topic: **6**  
**General hydrogeological problems**

**6.1**  
**Hard rocks as specific media — methods and results**

title: **Study and correlation of hydrogeological, tectonic and hydrochemical conditions of fractured rocks in Tinos Island (Aegean Sea, Hellas)**

author(s): **Costantine Botsialas**  
National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Department of Dynamic Tectonic and Applied Geology, Greece,  
[botsialas@geol.uoa.gr](mailto:botsialas@geol.uoa.gr)

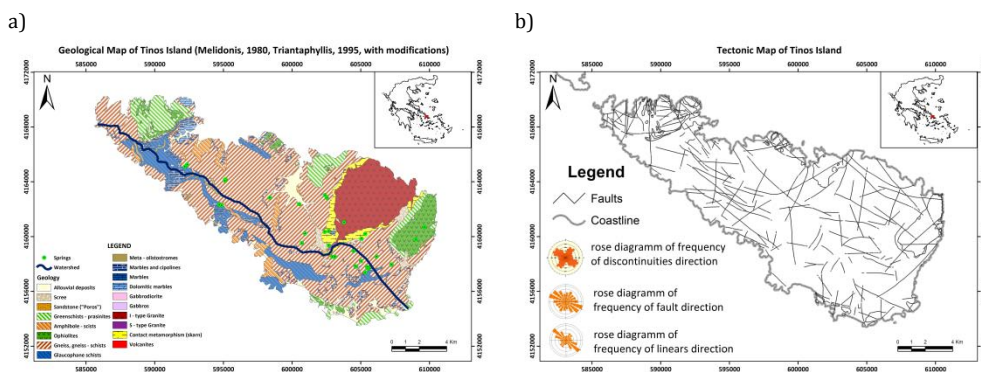
**Gerasimos Yoxas**  
National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Department of Dynamic Tectonic and Applied Geology, Greece,  
[yoxas@geol.uoa.gr](mailto:yoxas@geol.uoa.gr)

**Emmanuel Vassilakis**  
National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Department of Dynamic Tectonic and Applied Geology, Greece,  
[evasilak@geol.uoa.gr](mailto:evasilak@geol.uoa.gr)

**George Stournaras**  
National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Department of Dynamic Tectonic and Applied Geology, Greece,  
[stournaras@geol.uoa.gr](mailto:stournaras@geol.uoa.gr)

keywords: fractured rocks, hydrogeology, hydrochemistry, Tinos Island, Aegean Sea, Hellas

The present paper is dealing with the analysis and characteristics of the discontinuous media, represented by the schist-gneiss sequences of the Tinos Island (Aegean Sea, Hellas). The encountered geologic formations belong to the Atticocycladic complex. According to Melidonis (1980), three groups or sequences of rocks participate in the geological structure of Tinos, the sequence of metamorphic rocks, the sequence of igneous rocks and the Quaternary sediments (Fig. 1a).



**Figure 1.** Geological (a) and Tectonic (b) map of Tinos Island (Melidonis, 1980; Triantafyllis, 1995; with modifications).

The existence of three main categories of folds (Stolz et al., 1997), with axes of NW-SE, NE-SW and N-S directions respectively and two groups of faults with SE-NW and NNE-SSW directions respectively, complete the geotectonic structure of the island (Fig. 1b). The basic factors which affect and form the hydrological and hydrogeological character of the island are the discontinuous media character (secondary porosity), due to the tectonic and microtectonic activity and the degree of weathering of the given formations (Stournaras et al., 2007; Leonidopoulou et al., 2005). The discontinuities of the rock mass are divided into different categories according to their form and genetic cause and conditions. Special interest has been given in ruptures and diastases, since they play the most important role for the groundwater circulation and accumulation. These discontinuities are classified by planning, geometry, and genetic point of view into shear, tension and hybridic discontinuities. In this frame, a correlation between the ruptures and the faults and plies has been attended. In the frame of the hydrogeological behavior, the hydraulic characters of the simple porosity, double porosity, and multiple porosity fractured media are examined and evaluated. In the field of the remote sensing, used in the tectonic approach, atmospheric and geometric correction, mosaic synthesis, and data integration led to the photo lineation-ruptures map of different groups, to the faults map and finally to the statistical analysis of the discontinuities (Botsialas, 2007).

The apparition of the main groups of springs of a schist aquifer in Tinos Island is described, related to the tectonic regime of the island and of the spring's environment (Stournaras et al., 2003). The springs mechanism and the lithologic behavior of the water bearing strata are connected and correlated to the above tectonic study, hence, a systematic regime. In order to estimate the groundwater flow due to the discontinuities, the Drogue equation has been applied. According to the discharge rate of main springs, the values are of the order of  $10^{-3}$  (1/t). Due to the fact that factor  $n$  represents the difference between the initial and the final flow, the Drogue's equation was applied for  $n = Q_0/Q_t$ . That rate, established for schist Tinos springs, approaches

the value of 6/5. Regarding the role of the discontinuities, in the case of Tsiknias group (Lazaros and Glyko Nero springs), there is a coincidence of the springs orientations and the extended discontinuities, representing the main discharge flow paths.

In order to estimate the correlation of hydrochemical and hydraulic conditions, a sample collection (springs) was made. According to the chemical analyses, 5 main chemical types of ground water were identified. For the main springs, the beginning of springs' depletion is combined with an increase of the TDS concentration (Bourdakou, 2009).

## REFERENCES

- Botsialas K., 2007: *Analysis, Interpretation and Estimation of the hydrogeological and geotechnical environment of discontinuous media. Application in schistolithic system of Tinos Island*. PhD Thesis, Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens. In Hellenic (Unpublished).
- Bourdakou R., 2009: *Study of hydrogeological conditions of Tinos Island with the use of the hydrogeological and hydrochemical time series*. PhD Thesis, Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens. In Hellenic (Unpublished).
- Leonidopoulou D., Stournaras G., Maroukian H., 2005: *Morphometric analysis, weathering and groundwater regime in Falatados-Livada drainage basin, Tinos Island, Hellas*. 7<sup>th</sup> Hellenic Hydrogeological Conference, Volume II, pp. 133–140.
- Melidonis N.G., 1980: *The geological structure and mineral deposits of Tinos Island (Cyclades – Greece). A preliminary report*. Institute of Geological and Mineral Exploration, Athens, 13. (In Hellenic).
- Melidonis N.G., 1968 and Triantaphyllis M., 1995: *Geological map, Tinos–Yaros sheet*. Institute of Geological and Mineral Exploration (I.G.M.E.)
- Stolz J., Eggen M., Rickli M., 1997: *Tectonometamorphic evolution of SE Tinos, Cyclades, Greece*. Schweiz. Mineral. Petrogr. Mitt. 77, pp. 209–231.
- Stournaras G., Leonidopoulou D., Yoxas G., 2007: *Geoenvironmental approach of Tinos's wetlands (Aegean Sea, Hellas)*. 35<sup>th</sup> International Congress of IAH, Groundwater and Ecosystems Proc., Portugal, pp. 593.
- Stournaras G., Alexiadou M.Ch., Koutsi R., Athitaki Th., 2003: *Main characters of the schist aquifers in Tinos Island (Aegean Sea, Hellas)*. 1<sup>st</sup> Workshop On Fissured Rocks Hydrogeology Proceedings, Hellas, pp. 73–81.