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Groundwater Coastal Discharge at the Kalogrias Bay in Mani and its Relationship with the Geological and Tectonic Structure of Taygetos (Mani, Southern Peloponnese- Greece)

George Migiros (1) and Ioannis Papanikolaou (1,2)

(1) Laboratory of Mineralogy & Geology, Department of Geological Sciences and Atmospheric Environment, Agricultural University of Athens, 75 Iera Odos Str., 118 55 Athens - GR (bagm@aua.gr), (2) AON Benfield Hazard Research Centre, Department of Earth Sciences Birkbeck College and University College London, WC 1E 6BT, London UK (i.papanikolaou@ucl.ac.uk)

A massive groundwater coastal gushing spring with an annual freshwater discharge rate that exceeds $7*10^6 m^3$ has been mapped within the Messiniakos Gulf in the Kalogrias bay and Kardamili-Mani (southern Peloponnese), approximately 100m from the coastline. The mechanism that supports this high discharge rate is not only of exceptional scientific interest due also to its complexity, but its potential exploration would be crucial for the future survival, economic development and prosperity of a large part of the Mani peninsula. The sea bottom morphology has an ovoid shape with the deepest part at 29m towards the gushing spring, it is characterized by important linear morphologic features in a rather unstable geologic environment of carbonate bedrock which is covered by a thin layer of semi-cohesive sediments. The study area belongs to the Geotectonic Unit of Mani that covers a large part of the Taygetos mountain and forms the predominant water supply source for all karstic springs of Mani. It consists of thick carbonates of Triassic that end up with the flysch sedimentation in Oligocene times. These alpine rocks are covered uncomfortably by Pliocene and Pleistocene sediments of variable clastic materials.

Detailed geological and tectonic analysis of the region, supported by the mapping of springs and the relevant karstic features of the area shows that:

a) Springs towards the mountain areas are either contact springs or karstic springs of low discharge rate that are strictly related to the folds and thrusts that were developed during the Alpine deformation phase.

b) Springs towards lower slopes and the lowland areas are linked to the Pliocene and Pleistocene sediments that outcrop in local topographic lows and are aligned along strike the normal faults formed by the subsequent extensional phases. They are of low discharge rate and their water supply comes both from the overlying strata of the same Plio-Pleistocene deposits and sideways from the bedrock carbonate rocks.

c) All springs that are developed towards the lowland areas, the shoreline and predominantly offshore, where the major gushing spring of Kalogrias bay emerge, are directly related to the karstic hydrological pattern of the Taygetos Mountain.

This karstic path is highly related to the tectonic structures and in particular:

a) towards the mountain area it follows the anticline megastructures with a N-S trending fold axis that is plunging towards south;

b) towards the hilly area and the lower slopes it strikes west following the transverse fault structures that form oblique normal faults that are E-W trending;

c) towards the lowland, shoreline and offshore area the karstic water produces gushing springs along strike the NNW-SSE trending normal faults that were formed during the recent extensional field and predominantly towards their intersection points with the transverse E-W trending oblique normal faults.

In conclusion, these pathways that are tectonically controlled, are used by the karstic systems that have been mapped and discharge the karstic water flow westwards towards the Messiniakos Gulf.