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BOOK OF ABSTRACTS



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Origin and evolution of the fluids emitted along the “Sperchios Basin – Evoikos Gulf” Graben (Central Greece)

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Abstract

The study area is a 130 km long fast spreading graben in Central Greece bordered by active faults. Its complex geodynamical setting includes the presence at depth of a subduction slab responsible for the recent (Quaternary) volcanic activity in the area which possibly represents the northward continuation of the South Aegean active volcanic arc. To the area belongs also the western termination of the North-Anatolian fault a tectonic lineament of regional importance. The high geothermal gradient of the area is evidenced by the presence of many thermal springs with temperatures from 19 to 82 °C, issuing along the normal faults bordering the graben. In the period 2004-2012 more than 60 gas and water samples have been collected and their chemical and isotopic analysis revealed a wide range of compositions. Going from west to east the gas composition changes (Fig.

1) from CH₄- to CO₂-dominated passing through mixed N₂-CH₄ and N₂-CO₂ compositions, while at the same time the He isotopic composition goes from typical crustal values (0.02 R/Ra) up to 0.87 R/Ra (corrected for air contamination), showing in the easternmost sites a small but significant mantle input (up to ~ 10%). Isotopic composition of CH₄-C indicates a thermogenic origin for the CH₄-rich samples ($\delta^{13}\text{C}$ from -50 to -37 ‰) and hydrothermal origin for the remaining samples (> -25‰). Positive $\delta^{15}\text{N}$ values (around +2 ‰) indicate a contribution of crustal derived nitrogen for the N₂-rich samples. The most pristine values of $\delta^{13}\text{C}(\text{CO}_2)$ refer to the most CO₂-rich samples. These values (~ -3 ‰) point to a mixed mantle-marine carbonate source. Lower $\delta^{13}\text{C}$ values (-10 ÷ -5 ‰) of the other sites can be explained by loss of CO₂ due to dissolution processes.

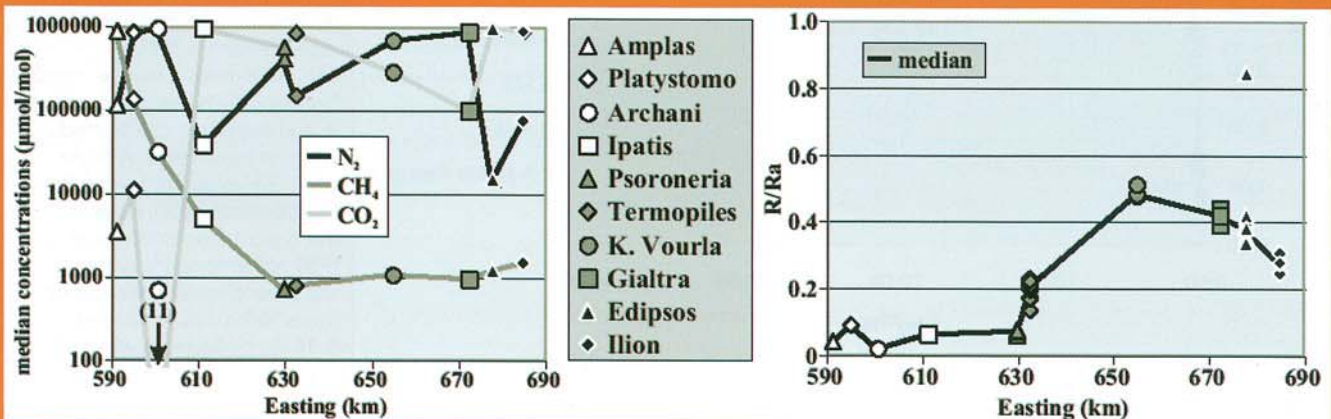


Fig. 1: West-east variations of the major chemical components and of the He isotopic composition of the gases collected along the “Sperchios Basin – Evoikos gulf” graben. CO₂ concentration at Archani is 11 µmol/mol.

Also temperature and salinity of the waters shows differences along the graben increasing from west to east (Fig. 2). Two main groups can be separated on the basis of the total dissolved salts (TDS). The first, represented by dilute waters (TDS < 500 mg/l), is found in the westernmost sites characterised by the presence of CH₄-rich and mixed N₂-CH₄ gases. The remaining waters display higher salinities (TDS from 9 to 35 g/l) due to the mixing with high salinity waters.

The water composition can be explained by mixing of two end-members, one with low salinity of meteoric

origin and the other with high salinity of marine origin. The mixing can be evidenced in Fig. 2. Low salinity waters show low chloride contents and their light water isotope composition overlaps the field of the cold groundwaters of the area confirming their meteoric origin. High salinity waters are aligned along the mixing line between the cold groundwaters and the seawater confirming the contribution of marine component.

Most of the water compositions in the triangular graph of Giggenbach fall in the field of the non equilibrated waters being therefore unsuitable for geothermometric

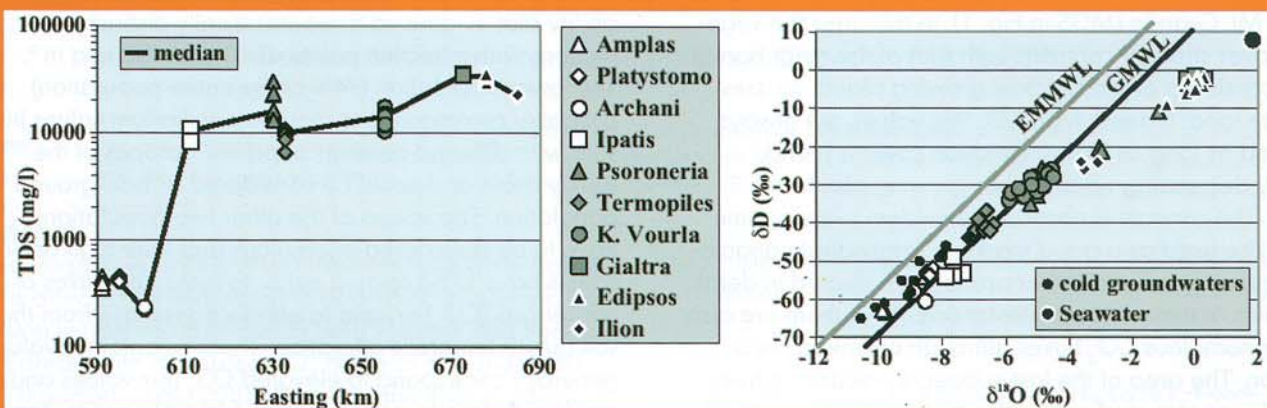


Fig. 2: West-east variations of the TDS of the thermal waters collected along the "Sperchios Basin – Evoikos gulf" graben (left) and isotopic composition of the waters (right). GMWL = global meteoric water line; EMMWL = Eastern Mediterranean meteoric water line.

estimations. Only the easternmost sites (Gialtra, Ilion and Edipsos) falling the field of the partially equilibrated waters yield estimated temperatures in the range 150-170 °C. Silica geothermometers confirm these estimations. This study revealed that the complex geodynamic setting of the area is clearly reflected in the wide compositional range of the gases collected in the area that evidence

contributions from different end-members (atmosphere, crust, mantle and hydrothermal systems). Water chemistry can be explained mainly from the mixing of a meteoric low-salinity end-member with a high-salinity marine end-member partially modified by hydrothermal water-rock interactions. The highest estimated temperatures in the hydrothermal reservoirs are in the range 150-170 °C.

Carbon dioxide and radon measurements in the soils of Pantelleria island (southern Italy)

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Abstract

Pantelleria is an active volcanic complex, at present in quiescent status, hosting a high enthalpy geothermal system. Explorative geothermal wells tapped exploitable water-dominated reservoirs at 600-800 m depth with maximum measured temperatures of 250°C.

Five field campaigns for soil gas measurements were made in the period from July 2005 to October 2006. CO₂ flux was measured with the accumulation chamber method at 807 sites, CO₂ concentration and Rn activity in soil atmosphere were measured at 50 cm depth at 728 and 358 sites, respectively.

The first campaign covered the whole island (about 83 km²) with an approximately sample density of 3.5 points per km² for CO₂ (flux and concentration) measurements and of 1.6 points per km² for Rn measurements. The distribution of the sampling points was as far as possible evenly distributed. Only few limited areas resulted uncovered due to accessibility problems

(inhabited areas, airport, steep or rough topography). In the following four surveys nine areas were studied with greater detail with sample densities of up to 100 points per km².

Flux measurements for the whole surveys gave values in the range < 0.1 - 4700 gCO₂ m⁻² day⁻¹ (Fig. 1). Organic contribution could not be distinguished with statistical methods and in the present study was considered negligible above 30 g m⁻² day⁻¹. The sites displaying flux values above this threshold, representing about 32% of the total population, are almost all located within the 50 ka old caldera. The highest values correspond to the areas of Favara Grande and of the lake Specchio di Venere (Fig. 1), which have long been recognized as sites of anomalous degassing with the presence of active fumarolic vents with temperatures of about 100 °C in the former and thermal springs with abundant bubbling gases and a mofette in the latter. A new anomalous degassing area with very high output values has been identified on the southern