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The fluids' geochemistry along the "Sperchios Basin - Northern Evoikos Gulf" Graben, a geodynamically complex area of Central Greece

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The study area is a 130 km long fast spreading graben in Central Greece. Its complex geodynamical setting includes both the presence at depth of a subduction slab responsible for the recent (Quaternary) volcanic activity in the area and the western termination of a tectonic lineament of regional importance (the North-Anatolian fault). Its high geothermal gradient 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 about 50 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 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 (0.05 R/Ra) up to 0.87 R/Ra (corrected for air contamination), showing in the easternmost sites a small but significant mantle input. Isotopic composition of CH₄-C indicates a thermogenic origin for the CH₄-rich samples and hydrothermal origin for the remaining samples. Positive δ¹⁵N values indicate a contribution of crustal derived nitrogen for the N₂-rich samples. The δ¹³C values of most the CO₂-enriched samples show a mixed origin (mantle and marine carbonates).

Also the chemical composition of the waters shows differences along the graben and two main groups can be separated. The first, represented by dilute waters (E.C. < 600 μS/cm), is found in the westernmost sites characterised by the presence of CH₄-rich and mixed N₂-CH₄ gases. The remaining waters display higher salinities (E.C. from 12 to 56 mS/cm) due to the mixing with a modified marine component. Only the water composition of easternmost sites in the Giggenbach's cation triangular graph plots in the field of the partially equilibrated waters giving estimated temperatures at depth of 150-160°C.