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Geochemical characterization of fluids along the Dead Sea Rift: implications for fluids sources and regional geodynamic setting

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The Dead Sea Fault where a lateral displacement between the African and Arabian plates occurs is characterized by anomalous heat flux in the northern Israel area close to the border with Syria and Jordan (Shalev et al., 2012). The concentrations of He and CO_2, and isotopic composition of He and total dissolved inorganic carbon were studied in cold and thermal waters collected along the Dead Sea Fault, in order to investigate the source of volatiles and their relationship with the tectonic framework of the Dead Sea Fault.

The waters with higher temperature (up to 57.2 ˚C) are characterized by higher amounts of $CO_2$and helium (up to 55.72 and 1.91*10^{-2} cc l^{-1}, respectively). Helium isotopic data (R/Ra from 0.11 to 2.14) and $^{4}He/^{20}Ne$ ratios (0.41 - 106.86) show the presence of deep-deriving fluids consisting of a variable mixture of mantle and crust end-members, with the former reaching up to 35%. Carbon isotope signature of total dissolved carbon from hot waters falls within the range of magmatic values, suggesting the delivery of deep-seated CO_2. The geographical distribution of helium isotopic data and isotopic carbon (CO_2) values coupled with ($CO_2/^{3}He$ ratios) indicate a larger contribution of mantle-derived fluids affecting the northern part of the investigated area, where the waters reach the highest temperature and anomalous heat flux was recognized by Shalev et al. (2012). Such occurrence is probably favoured by the peculiar tectonic framework recognized in the northern part of Israel (Segev et al., 2006), including a Moho discontinuity up-rise and/or the presence of a deep fault system coupled with the recent magmatic activity.

References:

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