



## **Carbon isotopic composition of soil CO<sub>2</sub> efflux at Solfatara (Plaeagraean fields, Nales, Italy)**

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With a flux of deeply derived fluids of about 5000 t/d and an energetic release of ~100 MW Solfatara of Pozzuoli (South Italy) appears to be one of the largest studied volcanic-hydrothermal manifestations of the world. Since 1998 eleven surveys of CO<sub>2</sub> flux measurements over a large area, including the volcanic apparatus and its surroundings, were performed at the Solfatara, highlighting the expansion of the area interested by anomalous soil CO<sub>2</sub> degassing (DDS), interesting the Solfatara cone and eastern sector of the surroundings. In particular, since July 2000 the DDS expanded from about 450000 m<sup>2</sup> up to about 1000000 m<sup>2</sup> of April 2004, with an evident increase in the area external to the Solfatara cone in correspondence of a main fault system NE-SW oriented. Concurrently, the estimated hydrothermal CO<sub>2</sub> output was quite constant after an appreciable reduction between 2000 and 2003. The statistical distribution of the flux values evidenced the coexistence of two statistical populations of fluxes. One population, characterized by high mean flux values, hence reasonably associable to the hydrothermal source, remained quite constant, while the mean flux values the other population experienced a continuous increase after the 2000-2003 starting from values typical of the biologic CO<sub>2</sub> background. In particular, parallel to the increase of DDS, the average CO<sub>2</sub> flux value of the low flux population passed from 20 g/m<sup>2</sup>d in the 1998 to about 80 g/m<sup>2</sup>d in the 2005-2006, with no correlation to the season variation of CO<sub>2</sub> biological fluxes.

In order to define the “real” source of the lower flux population, to interpret the DDS expansion and to characterize the “true” biological CO<sub>2</sub> background flux, a new

method for the measurement of the carbon isotopic composition of soil CO<sub>2</sub> efflux was applied at Solfatara in March 2007. The collected data clearly show a mixing between a high flux component with a isotopic composition ( $\delta^{13}\text{C} \sim -2$  permill) and a low flux component depleted in <sup>13</sup>C ( $\delta^{13}\text{C} \sim -20 \pm 5$  permill), that can be related to the hydrothermal and biologic sources respectively. An averaged flux value of about 20 g/m<sup>2</sup>d has been estimated for the biologic background, by solving an isotopic mass-balance. This value is in line with the observed values at Solfatara in the 1998-2000 period, and in other hydrothermal and volcanic systems, supporting that the observed changes are not related to a change in the biologic activity of the soil while must be imputed to some variation of the hydrothermal system activity and/or in the pathways of the deeply produced CO<sub>2</sub> degassing.