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The 2014 Effusive eruption of Stromboli Volcano: The observed geochemical variations of soil CO_2 fluxes and PCO_2 in the thermal waters.

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The Stromboli volcano, the more active of the Aeolian Archipelago, is characterized by an open conduct degassing system with a continuous explosive activity every 20-30'.

In the recent years, effusive activities occurred in 1985, 2002-2003, 2007 and in 2014 while paroxysmal events have taken place only on 5^{th} April 2003 and 15^{th} March 2007.

The geochemical monitoring program has been carried out through routine thermal well sampling (COA well) and continuous soil CO_2 flux measurements on the summit of the volcano (STR02). The long time series of CO_2 fluxes acquired in 1999-2008 period led to the identification of three classes of degassing Low ($<$ 4000 g m^{-2} d^{-1}), Normal (4000-10,000 g m^{-2} d^{-1}) and High ($>$ 10,000 g m^{-2} d^{-1}).

The data of soil CO_2 fluxes in the 2010-2012 period showed a sustained degassing with daily average values almost always higher than the 10,000 g m^{-2} d^{-1}. During the end 2012-begin 2013 a new trend in increase of soil CO_2 flux was recorded with fluxes up to 20,000 g m^{-2} d^{-1}. It is very interesting to note that the COA well showed an increase of the dissolved CO_2 concentration from 60 to 200 cc/l STP recorded from the end of the eruption 2007 to mid-2010. Then, after a slight decrease in dissolved CO_2 concentration of around 90 cc/l STP (December 2010), there was a new trend in growth, up to values of about 160 cc/l STP (April 2013). This continuous growth trend of the partial pressure of CO_2 in the thermal aquifer, corroborates abnormal soil CO_2 fluxes recorded at the summit of the volcano, supporting the hypothesis of a continuous process of pressurization of the volcanic system. On 7 August a new fracture opened at 650 m a.s.l., and lava moved down along the Sciara del Fuoco, reaching the sea; concurrently, persistent explosive activity ceased. On 28 October the lava flow abruptly decreased, until 13–17 November, when the effusion ceased.

Six soil CO_2 campaign to estimate the total output discharged from the summit area of Stromboli was carried out in the period 2007-2015. About 50 point of soil CO_2 fluxes measurements was performed for each survey. These measurements were made on the summit area, and include the zone of STR02 soil CO_2 equipment, covering a surface of about 67500 m^2.

In the same period of observation, seven campaigns for the measurement of soil CO_2 were also carried out to estimate the total output discharged in a peripheral area of Stromboli (Scari). The comparison of the data of total diffuse degassing issued in the summit area with continuous CO_2 monitoring carried out at a single point (STR02) showed a good correlation supporting the hypothesis that the monitored single point is representative of the overall outgassing volcanic system. The contemporaneous monitoring of summit soil degassing areas and dissolved CO_2 in the aquifers located in the flanks of the studied volcano give a complete and clear picture of the volcanic activity.