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Real-time atmospheric measurements of CO_2 and δ13C in volcanic gases emitted from Mt. Etna (Italy)

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RIZZO, Andrea[1] ; JOST, Hj[2*] ; AKIYAMA, Ken-ichiro[2] ; HAMILTON, Doug[2] ; ANCELLIN, Marie-anne[3] ; CARACAUSI, Antonio[1] ; MARTELLI, Mauro[1] ; PAONITA, Antonio[1] ; LIOTTA, Marcello[4]
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[1]INGV, Palermo, Italy, [2]Thermo Fisher Scientific, [3]Ecole Nazionale Superieure de Geologie, Nancy, France, [4]Seconda Universita degli Studi di Napoli, Caserta, Italy
[1]INGV, Palermo, Italy, [2]Thermo Fisher Scientific, [3]Ecole Nazionale Superieure de Geologie, Nancy, France, [4]Seconda Universita degli Studi di Napoli, Caserta, Italy

We present new data of real-time measurements of concentration and isotope (δ^{13}C) composition of CO_2 in fumarolic-plume gases emitted from Mt. Etna volcano, performed by using a Delta Ray Isotope Ratio Infrared Spectrometer. The first two campaigns of measurements were carried out on 11 July and on 5-6 September 2013, while a third campaign was performed in mid-July 2014. With the assumption of a two components mixing, a simple linear regression was applied to the data in order to obtain the volcanogenic δ^{13}C of CO_2 emitted from the volcano.

Data acquired along the route Catania?Etna, while car was moving, showed an excess of ^{13}C-depleted CO2 when passing through inhabited centers due to atmospheric pollution produced by the cars exhaust. A similar signature was obtained when measuring car exhaust of our car. Fumaroles of Torre del Filosofo (2,900 m a.s.l.) displayed a δ^{13}C between -3.2±0.03 ‰ and -3.7±0.05 ‰, comparable to IRMS measurements of discrete samples collected in the same date and in previous investigations. Diluted plume gases were collected at more than 1 km from the craters and showed δ^{13}C=-2.2±0.2 ‰, accordingly with collected crater fumaroles.

Data collected in 2014 campaign are under processing, but preliminary results confirm a less negative signature of δ^{13}C of CO_2 emitted from Central Craters if compared to Torre del Filosofo fumaroles, with some interesting variations over time that must be compared with other parameters simultaneously acquired.

Considering the huge amount of data that may be acquired in a very short time by Delta Ray, we demonstrate that the addition to the atmospheric CO_2 content of ˜100 ppm of CO_2 from an unknown source is enough to allow a mathematical calculation of the end-member with an uncertainty generally $<$0.15 ‰. This is feasible with the assumption of a binary mixing. We thus infer that these measurements performed at Mt. Etna, if performed continuously, may contribute to a better comprehension of the magmatic processes.

キーワード: Isotope Ratio Infrared Spectrometer, volcano gas monitoring
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