https://doi.org/10.3301/ABSGI/2018.02

Catania, 12-14 settembre 2018

ABSTRACT BOOK

a cura della Società Geologica Italiana

Congresso congiunto SGI-SIMP

CATANIA·2018
12-14 SETTEMBRE

CONGRESSO
SGI · SIMP

«Geosciences for the environment, natural hazards and cultural heritage»

PRESIDENTI DEL CONGRESSO:

Carmelo Monaco (SGI) e Paolo Mazzoleni (SIMP).

COMITATO SCIENTIFICO:

Valerio Agnesi, Domenico Calcaterra, Angelo Camerlenghi, Piergiulio Cappelletti, Stefano Catalano, Massimo Coltorti, Claudio Faccenna, Sandro Conticelli, Agata Di Stefano, Elisabetta Erba, Stefano Gresta, Alessio Langella, Alessandro Pavese, Mauro Prencipe, Marco Viccaro.

COMITATO ORGANIZZATORE

Rosolino Cirrincione (coordinatore), Germana Barone, Stefano Branca, Giovanni Barreca, Bernardo Carmina, Salvatore Caffo, Carlo Cassaniti, Domenico Cosentino, Giorgio De Guidi, Lorenza Fascio, Eugenio Fazio, Carmelo Ferlito, Patrizia Fiannacca, Nadia Malaspina, Rosanna Maniscalco, Gaetano Ortolano, Giovanna Pappalardo, Fabio Massimo Petti, Rosalda Punturo, Rossana Sanfilippo, Giuseppe Tortorici, Alessandro Zuccari.

CURATORI DEL VOLUME

Fabio Massimo Petti, Bernardo Carmina, Rosolino Cirrincione, Carmelo Monaco.

Multiple origins of methane in fluids circulating in the Othrys ophiolite, central Greece

Daskalopoulou K.[1-2], Calabrese S.[1], Grassa F.[3] & D'Alessandro W.*[3]

[1] Università degli Studi di Palermo, Dipartimento Scienze della Terra e del Mare, Palermo
[2] National and Kapodistrian University of Athens, Department of Geology and Geoenvironment, Athens, Greece
[3] Istituto Nazionale di Geofisica e Vulcanologia - Sezione di Palermo

* *Corresponding email:* walter.dalessandro@ingv.it

Keywords: continental serpentinization, hyperalkaline springs, bubbling and dissolved gases.

The complex geology of Greece includes two important parallel running ophiolitic belts. The Othrys Massif in central Greece belongs to westernmost of them. In and around this wide ophiolite outcrop, some cold hyperalkaline and some hypothermal (T < 40°C) alkaline springs are present. Thirty water samples were collected at 17 different sites and both bubbling and dissolved gases were analysed for their chemical (He, Ne, H_2, O_2, N_2, CH_4, C_2H_6, CO_2 and H_2S) and isotope (He, $\delta^{13}C$-CO_2, $\delta^{13}C$-CH_4, $\delta^{2}H$-CH_4) composition. All samples except one have H_2S contents below detection limit (10 µmol/mol), whilst H_2 (from <2 to 2500 µmol/mol), CO_2 (up to 26,000 but generally below 1000 µmol/mol) and O_2 (up to 16,000 but generally below 3000 µmol/mol) present low concentrations. Gases in alkaline waters (pH <10) are generally dominated by CH_4 (from 128,000 to 915,000 µmol/mol), while hyperalkaline (pH > 11) waters are N_2 dominated (from 727,000 to 977,000 µmol/mol). Generally, He isotope composition excludes contributions from a mantle source, showing a mostly pure crustal contribution for the alkaline waters and a prevailing atmospheric contribution for the hyperalkaline ones.

Methane may have different origins, which can be subdivided in biogenic (either directly produced by microbial activity or deriving by decay of organic matter at T > 150°C) and abiogenic (from pure inorganic reactions). Among the latter, one of the most debated origins comes from serpentinization processes of ultramafic rocks in ophiolitic sequences at low temperatures (T < 80 °C). Furthermore, secondary processes (diffusion, inorganic or microbial oxidation, etc.) may mask the original chemical and/or isotope composition. Primary and secondary processes acting on CH_4 can be recognised mainly through its isotope ($\delta^{13}C$ and $\delta^{2}H$) composition and the ratio between CH_4 and C_2+C_3 hydrocarbons (Bernard ratio).

Samples collected in the Othrys Massif display a wide range of both isotope compositions of CH_4 ($\delta^{13}C$-CH_4 from -74.5 to -14.5 ‰ and $\delta^{2}H$-CH_4 from -343 to -62 ‰) and Bernard ratio (from 220 to 15,800). The relatively high values of the ratio seem to exclude great contributions from thermogenic CH_4. Alkaline waters present the most negative isotope values for CH_4, evidencing a biogenic (microbial) origin, whereas many of the hyperalkaline waters have CH_4 isotope values compatible with an abiogenic origin through serpentinization processes but also at points, very negative values are present, indicating sometimes a clear biogenic contribution. Finally, few samples both from alkaline and hyperalkaline waters show some evidence of secondary oxidation processes.

UNIVERSITÀ
degli STUDI
di CATANIA

ON THE ROCKS
GEOLOGICAL
VIDEO
CONTEST

UN'INIZIATIVA DI
SOCIETÀ GEOLOGICA ITALIANA
MENTE ET MALLEO

ON THE ROCKS è il primo **video contest** tutto **dedicato al mondo della Geologia**, per raccontare in modo creativo e informale storie, ricerche, passioni e nuove idee sulla Terra, il tutto in 180 secondi.

www.sgi-ontherocks.it/

9 788894 269642