Real time and in-situ analysis of the gas-emissions of the Eastern Carpathians: results and perspectives

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START

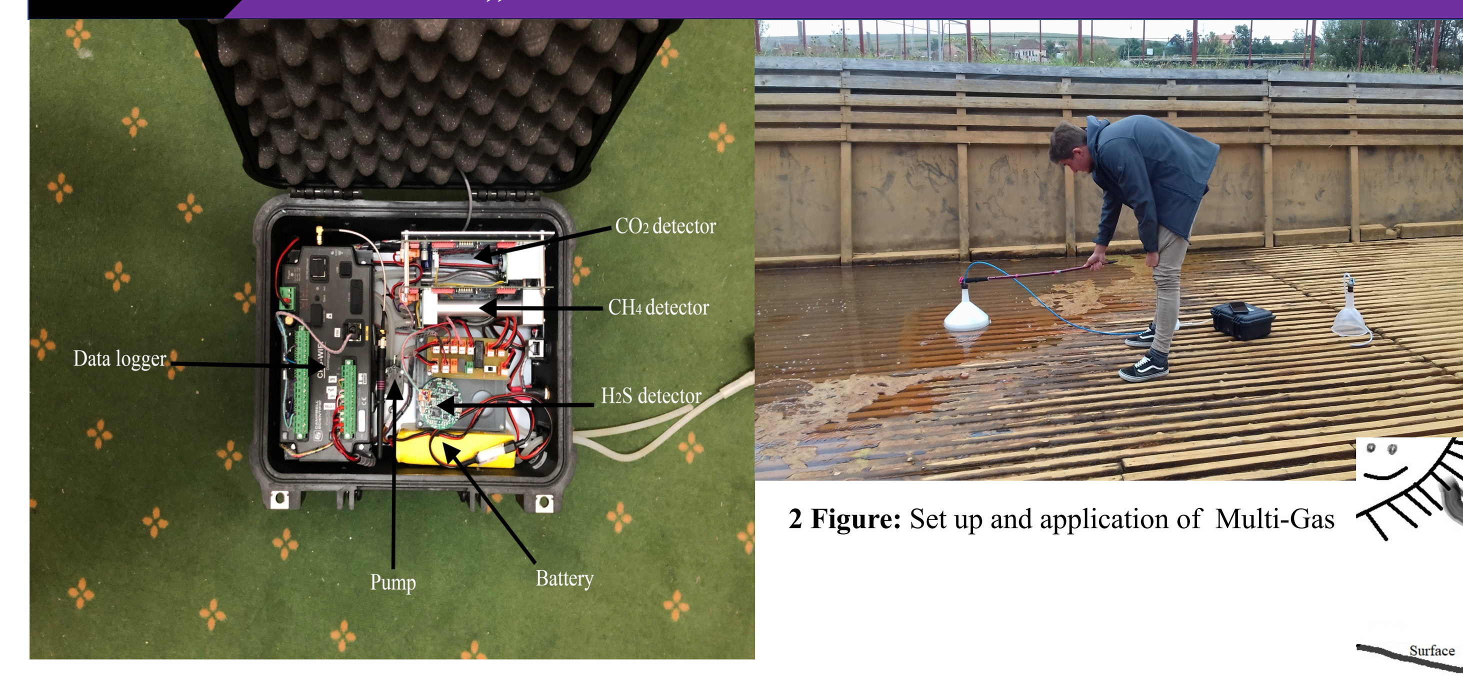
1. INTRODUCTION

Although the volcanic eruptions are very uncommon in the Carpathian-Pannonian region today, however the frequent earthquakes in the Carpathian-bend zone, the numerous appearance and intense manifestation of gas-emissions in the southeastern areas of the region and many petrochemical and geochemical, volcanologic studies as well, indicate that the area is likely not completely inactive. The gas emissions investigated by us may be directly related to these complex geodynamic processes, according to the geological context **[1,2]**.

The Eastern Carpathian Călimani-Gurghiu-Harghita Neogene-Quaternary volcanic chain and it's neighbouring zones (Transylvanian Basin, Carpathian flysch formations) contain most of the carbon dioxide rich gas-emissions in Romania, which also occur in the form of natural mofettes and bubbling pools. They can appear in frequently populated settlements more often in cellars and other public-not supervised areas, which puts the inhabitants in direct danger due the lack of information in the public knowledge.

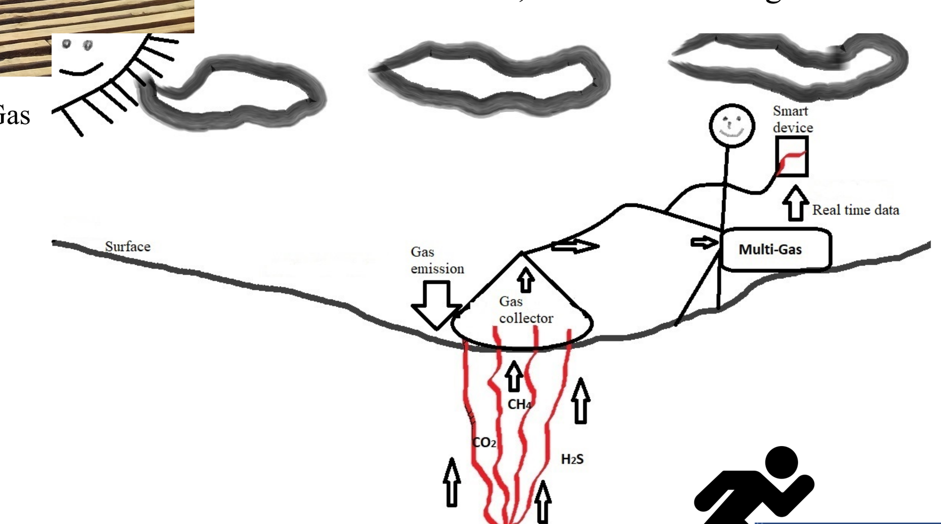
1 Figure: Location of study area in Europe (Source: Google maps)

2. THE „MULTI-COMPONENT GAS ANALYZER SYSTEM"



2 Figure: Set up and application of Multi-Gas

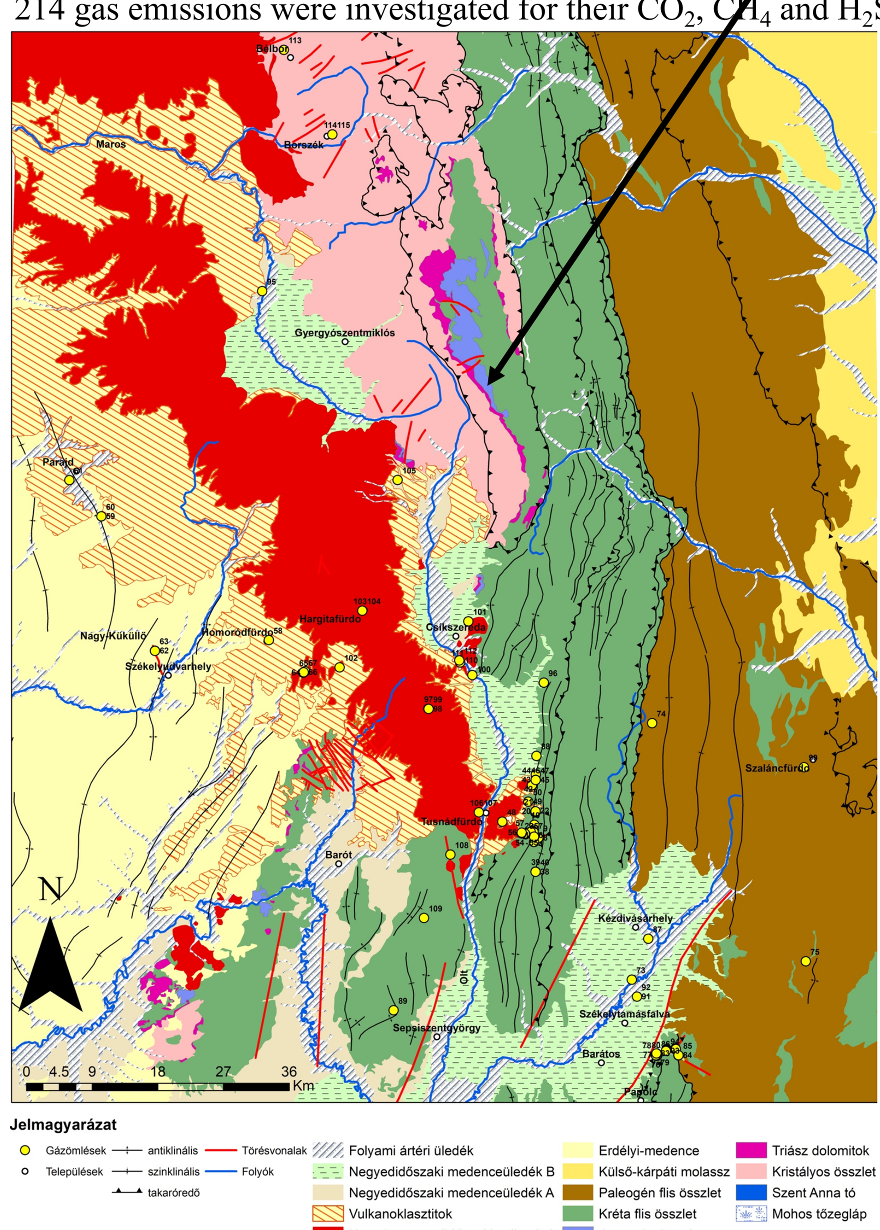
The motivation of our work is to gather quick, real time and in-situ information with the help of Multi-Gas instrument about the CO_2, H_2S and CH_4 composition of the gas-emissions across the Eastern Carpathians and to create a high resolution geological map from the measured sites in the mentioned area above. Furthermore, we would like to clarify if there is any relation between the tectonic characteristics of the study area and the manifestation, concentration of gas-emissions.



We used a specially designed portable type Multi-Gas device to gather in situ compositional information about low-temperature, CO_2-rich gases, emerging from different manifestations like dry gas emissions (mofettes), bubbling pools and springs. The instrument is equipped with two IR sensors for CO_2 (0-100%) and CH_4 (0-7%) and one electrochemical sensor for H_2S (0-200 ppm).

3. RESULTS AND PERSPECTIVES

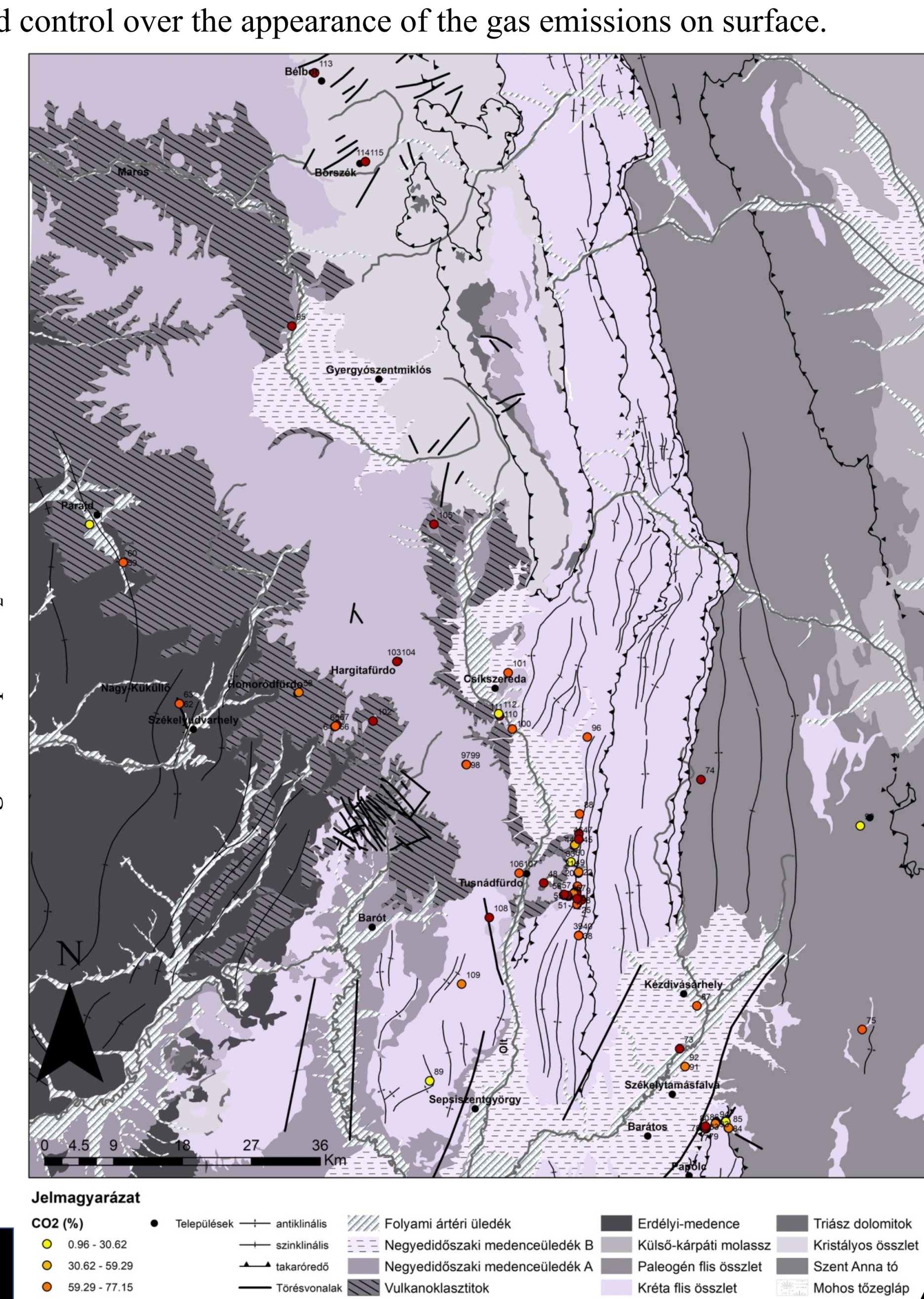
The Multi-Gas was used during several field surveys between September 2018 and December 2019 across the Eastern Carpathians area, where a total of 214 gas emissions were investigated for their CO_2, CH_4 and H_2S concentrations.



3 Figure: Map of the measured sites (edited based on: Alexandrescu et al., 1968, Joja et al., 1968, Patrulius et al., 1968, Vasilescu et al., 1968, Dumitrescu et al., 1970a, 1970b, Sândulescu et al., 1971,1973, Popescu et al., 1975, Peltz et al., 1984, Horváth et al., 2006).

3.1. THE CO_2

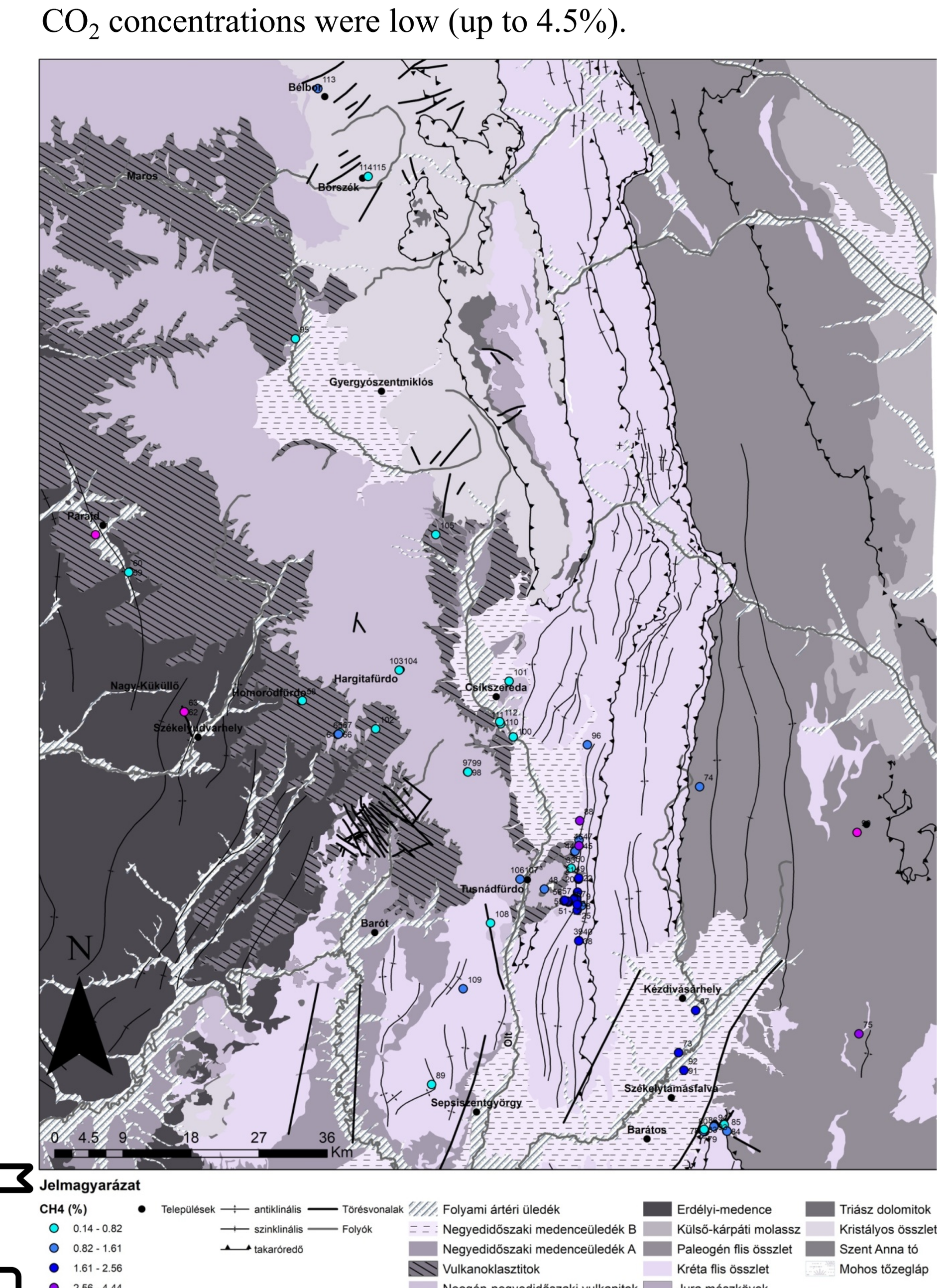
The CO_2 concentrations varied between 0.96 and 100 %. The highest values were measured in the the Quaternary dormant volcanic area of Ciomad, and also in the neighbouring thrusted and folded area of the Carpathian Flysch, which suggests a tectonic related control over the appearance of the gas emissions on surface.



4 Figure: Map of CO_2 concentrations

3.2. THE CH_4

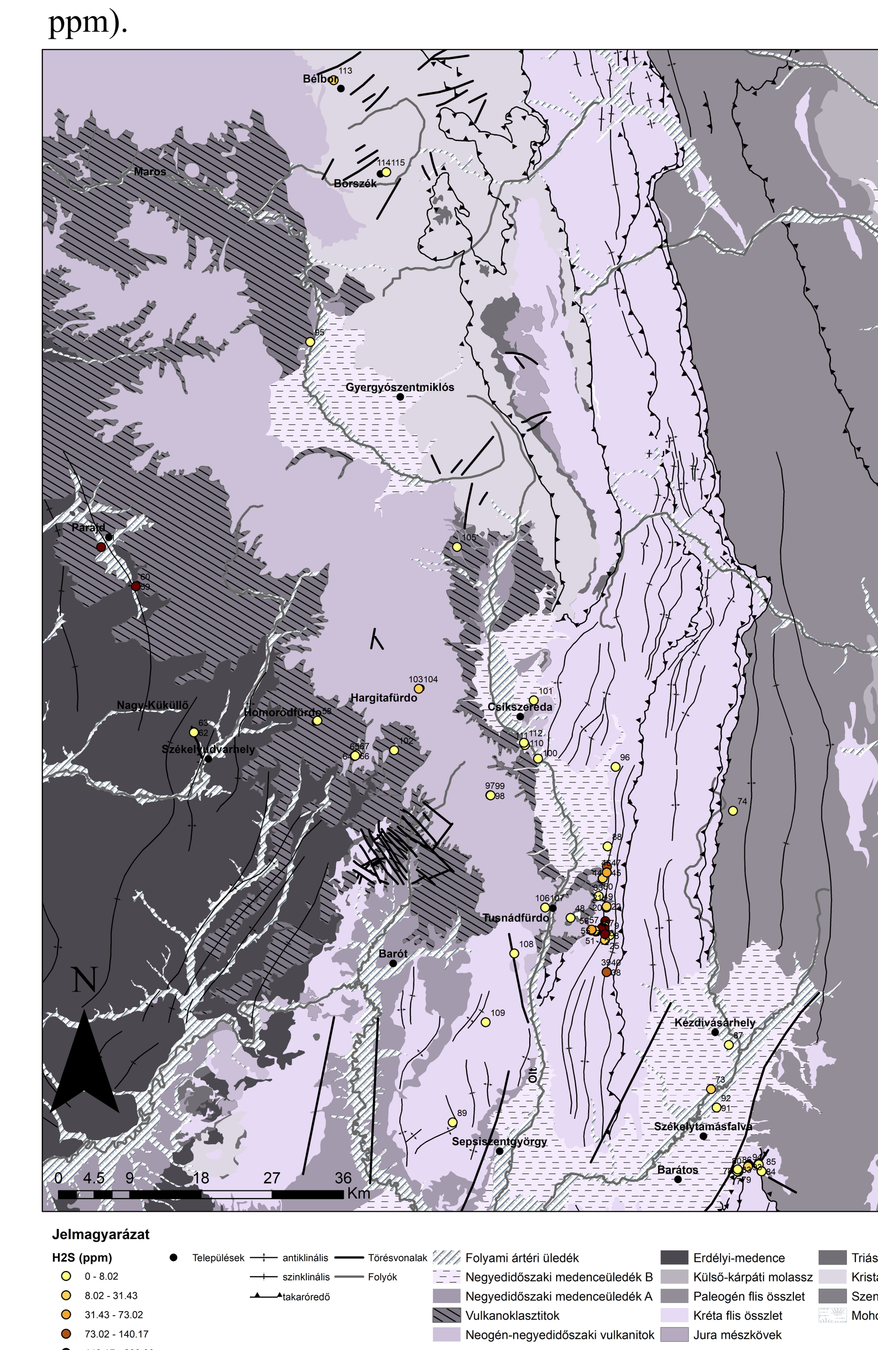
The CH_4 concentrations ranged between 0.21 and ~6.76% (above the detection limit) and were higher at hydrocarbon-prone areas, such as the sedimentary deposits of the Transylvanian Basin and Carpathian Flysch zone. In these cases the CO_2 concentrations were low (up to 4.5%).



5 Figure: Map of CH_4 concentrations

3.3. THE H_2S

The H_2S concentrations varied between ~0 (lower than the detection limit) and ~200 ppm (above the detection limit), according to our knowledge, these are the first H_2S in-situ measurements in the gas emissions of the study area. The concentrations of H_2S were higher at the volcanic area of Ciomad which can be related to volcanic degassing, the values reached above the detection limit (~200 ppm).

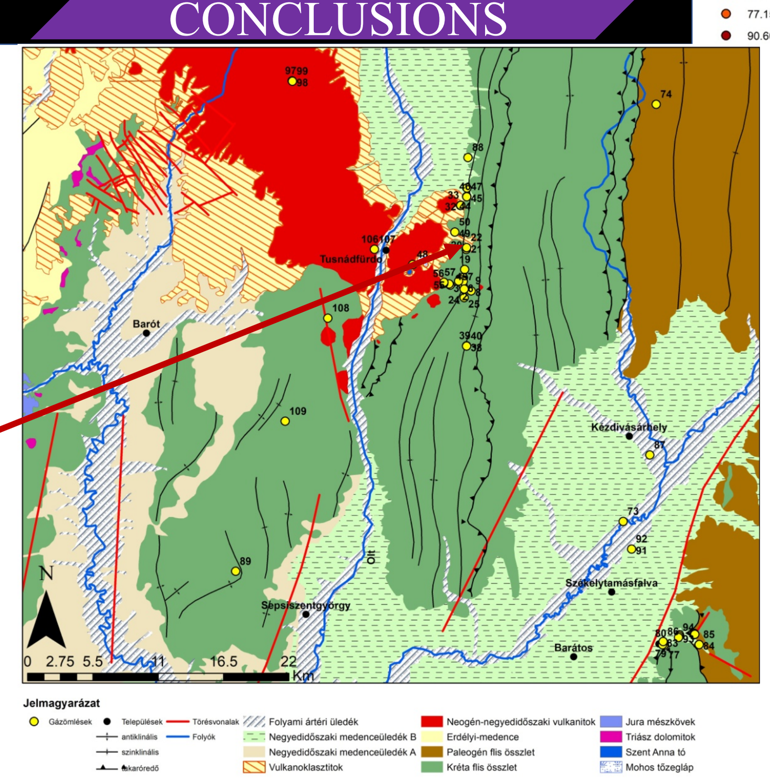


6 Figure: Map of H_2S concentrations

4. TECTONIC CONCLUSIONS

Based on the investigated sites, there is a correlation between the appearance of gas emissions on surface and the neighbouring structural geological features (folds, faults).

In the Ciomad volcanic area, and also in the neighbouring thrusted and folded area of the Carpathian Flysch is a clear north-east linear distribution of the investigated gas emissions between an anticlinic fold and the Olt-river Valley (see 7 figure).



7 Figure: Relation between gas emissions and tectonic structures

5. CONCLUSION

Composition of the different gas-species varied according to the geological context. The Multi-Gas proved to be useful tool in the in-situ investigation of cold gas emissions of the Eastern Carpathians, being efficient especially for the measurement of the H_2S concentrations that are very sensitive for oxidation processes. In the area of Eastern Carpathians is possible a relation between the structural geological features (folds, faults) of the zone and the manifestation, concentration of gas-emissions.

to be continued...

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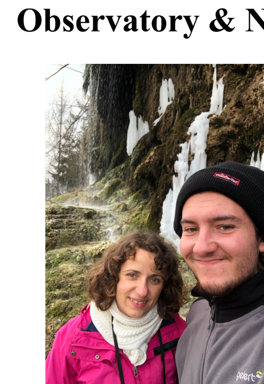

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