

STUDY INTERACTION BETWEEN SEISMICITY AND GAS EMISSION ON THE TERRITORY OF GEORGIA

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Abstract:

Natural gases emission are a very sensitive indicative for geological, especially for geotectonic state. As it was expected in distributing of gas associations the properties of the geological structure of Georgia has been obviously revealed. In order to study the gas distribution (CO₂, Rn, He, CH₄ etc.) and define its quantitative characteristics the field work was organized in 2013 on the territory of Georgia.

In order to study of regional seismicity influence on gas emission has been organized the real time monitoring of free gas discharge CO₂, and Rn emission, also air temperature and atmosphere pressure on the Borehole # 37 in Borjomi.

1. Field study

In order to study the CO₂ distribution the field work were carried out on the territory Georgia with foreigner colleagues – project coordinator German colleagues as well as Bulgarian and Slovenian ones. For field studies the mobile group was the same way equipped with special devices and moved by car along the pre-defined routes and carried out the sampling of natural and artificial springs. For field measurements they used WTW340i (for pH, conductivity, temperature, free oxygen) as well as SISE INGEM-1 for Radon and Helium measurements. Also, special equipment for gas content measuring had been purchased, namely PGD3-IR (Methan, Oxigen, CO₂ and HS). Selected points were sampled for typical chemical analysis ((Na, Ca, K, Mg, HCO₃, SO₄ და Cl) and the samples were shipped to the laboratory (Tbilisi) for further analyzing.



Fig #1 Water's physical parameters measurement process



Fig #2 Sampling process for hydro- chemical analyze



Fig #3 Geological sampling and gas composition measurement process

The sampled points were mapped by GPS and on the next step the data was processed by ArcMap. By the same software the results of water and gas hydrochemical analysis, as well as geological,

hydrogeological and hydrochemical data of the region have been processed. This gave us the possibility of complex studies.

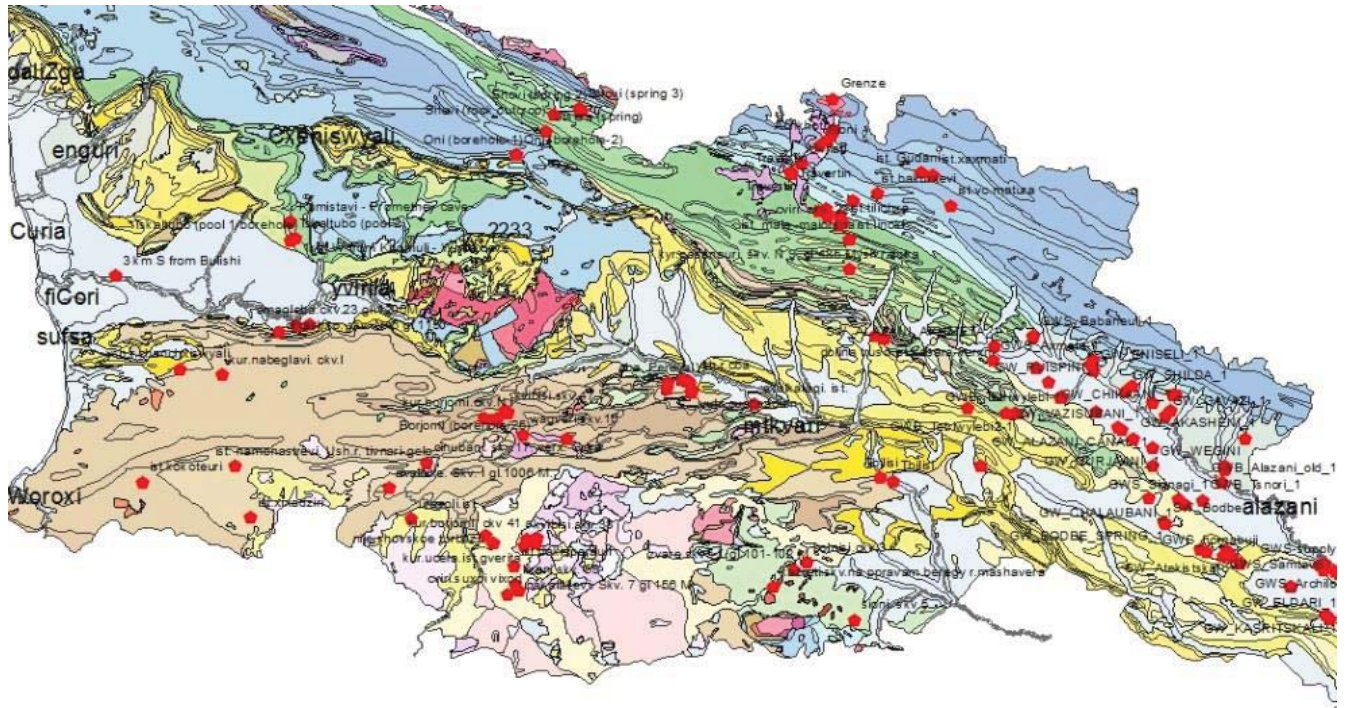


Fig.# 4 Distribution of sampled points in different Geological regions

During field work hydrochemical parameters (Na, Ca, K, Mg, HCO₃, SO₄ and Cl) in underground waters had been observed as well as gas content and general peculiarities of it distribution. For all observed parameters were determined the background values.

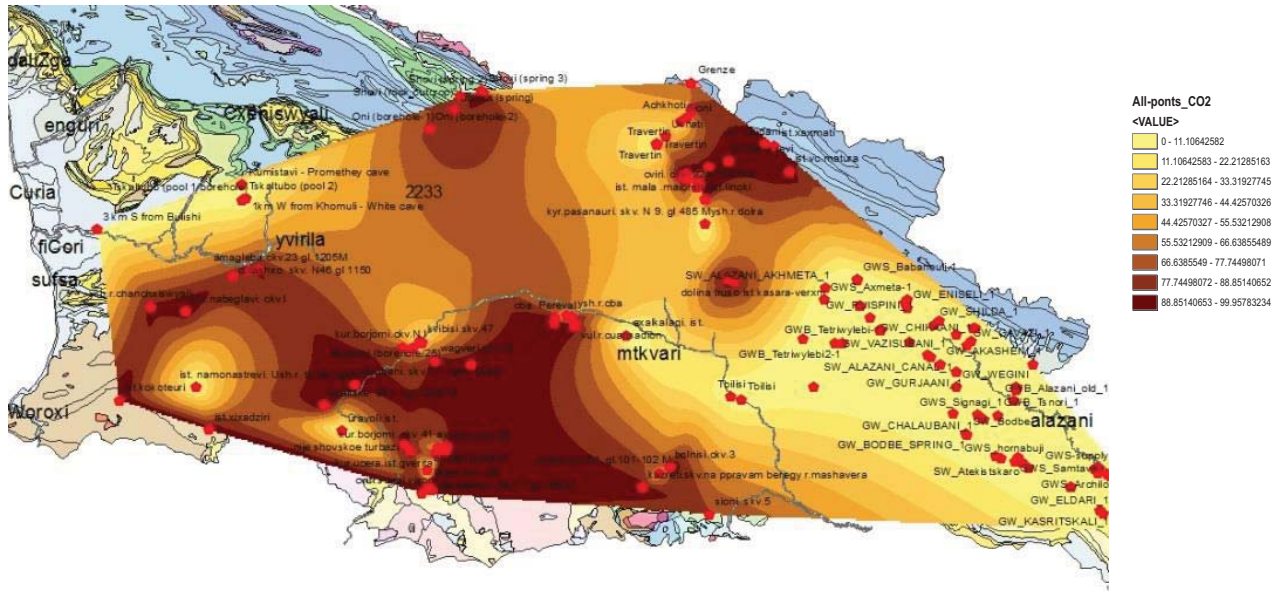


Fig.# 5 Distribution of CO₂ of groundwater in different Geological regions

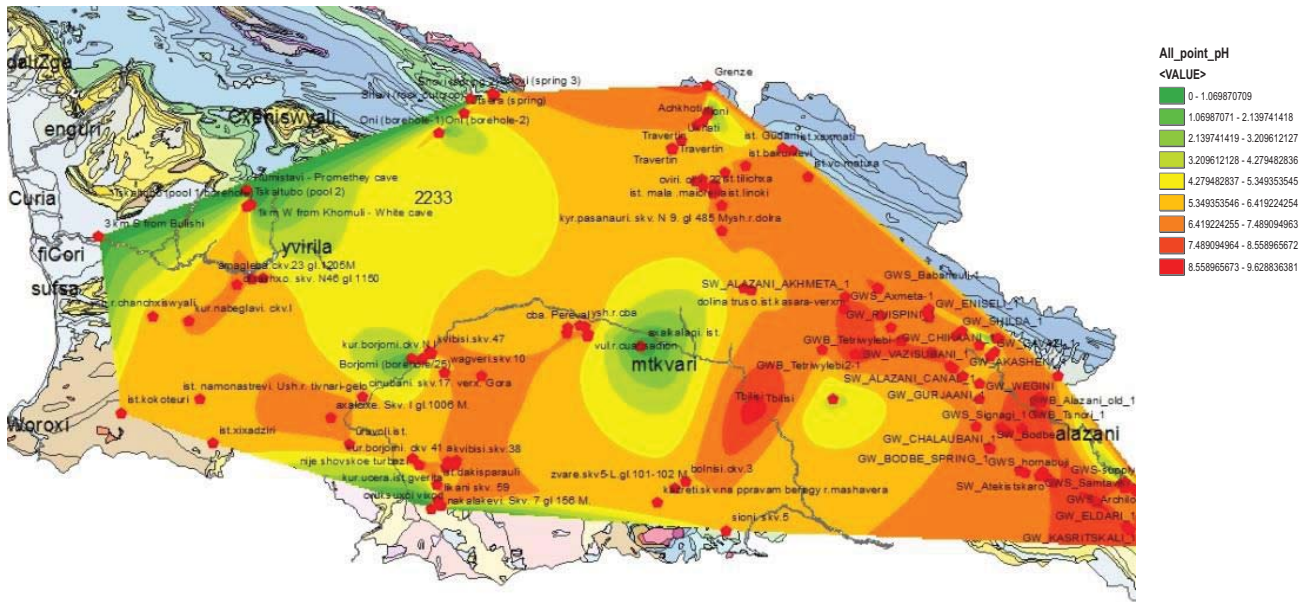


Fig.# 6 Distribution of pH value of groundwater in different Geological regions

2. Discovering of links between rocks, faults and geological structure of Georgia

Natural gases are a very sensitive indicative for geological, especially for geotectonic state. As it was expected in distributing of gas associations the properties of the geological structure of Georgia has been obviously revealed. Researches were done in two zones:

1. the northern zone – containing much carbonic acid gases;
2. The southern zone– with the content of nitrogen and carbonic acid gases.

The northern zone contains two geotectonic elements – the main Caucasian anticline block and the great Caucasian folded ridge without the extreme segments in the east and west [1].

In gas associations of these zones that are connected especially with mineral waters, Carbon dioxide obviously dominates. Investigations do not reveal a clear chemical link between underground waters and carbon dioxide, but the bulk of its exposure is connected with Narzan, the main type of mineral waters on the given territory.

The total content of free CO₂ in the waters of North zone, as it was mentioned above, is 1-2 g/l. So high concentration is related with special groups of underground waters and shows the genetic connections of CO₂ concentration with magmatic-metamorphic processes. So, the It is evident the volcanic origin of CO₂

Carbon dioxide gas exposures in the southern zone are very numerous. Gas factor of Borjomi group as well as Vardzia, Nakalakevi and others often reach 7-10 g/l. Besides, the horizon pressure is quite high (25 atmospheres in a bore hole). Seldom, but dry outlets of carbon dioxide gas are observed anyway. Exposed carbon dioxide amounts to 2 g/l.

All the above mentioned refers to the existence of strong carbon dioxide escalations. Genetic links of carbon dioxide and the young post-magmatic processes cannot be doubtful; besides, the Quaternary lava discovered here refers to the recent volcanic activity.

3. Relation between regional seismicity and gas emission

In order to study of regional seismicity influence on CO₂ emission has been organized the monitoring of free CO₂ emission on the Borehole # 37 in Borjomi. The gas flow meter has been connected to the data logger which is connected data transmitting device. The data (gas discharge, temperature and atmosphere pressure) are logged continuously and can be transferred or checked online at office in Tbilisi. CO₂ emission variation data together with seismic data are analyzed in order to find out their interaction.

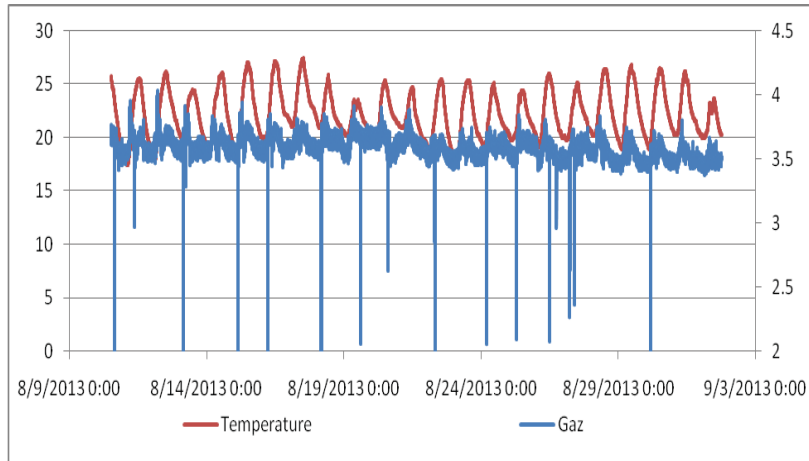


Fig. #7 CO₂ emission and atmosphere temperature variations on the borehole # 37

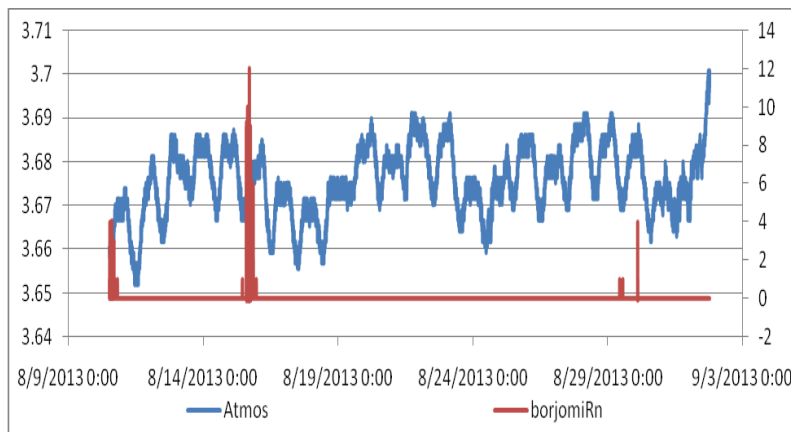


Fig. #8 Radon emission and atmosphere pressure variations on the borehole # 37

As example, we are presenting period of observation August of 2013. During this period was not fixed strong earthquakes and variation was only depending from meteorological factors, such as temperature and atmosphere pressure. Gas discharge is changing between 3.2-3.7 m³/day, but same Rn extraction picks was fixed, which are related with small local earthquakes occurred in this period.

Conclusions

Was study the natural CO₂ distribution on the territory of Georgia and investigated the properties of water samples and of rocks which contain and absorb CO₂ during its emission. Has been organized the monitoring of free CO₂ emission on the Borehole # 37 in Borjomi.

References

[1] Buachidze I. M at all, "Hydrogeology of USSR" Book X, Georgia, "Hedra", Moscow, 1970.