RESEARCHES REGARDING POSTVOLCANIC EMANATIONS FROM SOUTH-WEST OF ROMANIA. MUD VOLCANOES FROM FIBIS VALLEY

Stela Uruioc[1], Smaranda Mâsu[2], A. Sinitean[1]

[1]West University of Timisoara, Chemistry, Biology & Geography Faculty, Department of Biology, e-mail: stela.uruioc@email.ro; [2] INCD-ECOIND Timisoara, e-mail: andatee@yahoo.com;

ABSTRACT

Mud volcanoes (MVs) area from south-west of Romania are situated from 40 km north-east of Timişoara, from Fibis Valley. The main crater of gryphon type is characterized by gas, mud and water eruptions. The water expelled from mud volcanoes represents a complex mixtures of deep and shallow meteoric waters. The soil from upper terrace of Forocici gryphon (FG) is enriched in metals (Fe, Mn, Zn, Cu). The substratum of gryphon is populated of diatoms from which 6 species were identified.

Key words: Romania, Banat, mud volcanoes, gryphon, heavy metals, diatoms

INTRODUCTION

Mud volcanoes are a natural phenomena that reflect regional geological processes. Geologists describe MVs as capricious, and are still argiung about exactly how they are formed. There are many global studies of mud volcanoes that reveal aspects of their origin, mechanism of formation and paleo-activity (Guliyev and Feizullayev, 1995, Jakubov et al., 1971, Kopf, 2002). MVs are important source of information about subsurface sediments and conditions. The aim of this paper is the study of heavy metals content from FG water crater as well as the biodiversity of diatoms flora found here. Even though in such particular micro-stations, under the aspect of present abiotical conditions, this group of algae manage to adapt and populate them, until now a number of 6 species were identified. All of this data represent an important contribution in knowing in detail the mud volcanoes.

MATERIALS AND METHODS

In this work, we continued our investigations regarding heavy metal content from FG water. Water level decrease from FG allows taking soil samples from upper terrace of FG. Samples of soil were collected at 3 points (sample S1at north, S2 at west, S3 at south). From C1 crater, situated at south from FG, we gathered S4 sample at depth of 45 cm. All samples were gathered in may 2007. Water and soil samples were analysed in INCD-ECOIND Timisoara laboratory with the help of an spectrophotometer of atomic absorbtion of AAS Varian type. The samples of diatom were collected from three stations. The material gathered was chopped away from the substratum and preserved in 4% formalin. The samples have been processed through both methods of oxidation and incineration of the organic material in order to obtain only siliceous frustules; the mounting of samples was carried out in colophon. Besides the proper identification of the species, a brief description of general spreading was done, of their ecology, according to their bibliographical source.

RESULTS AND DISCUSSION

The analysed soil at upper terrace of FG are enriched in metals (Fe, Mn, Zn, Cu) compared to water of FG (Table 1 and 2). The Fe is the most abundant metal in FG as well as in C1. Content in Fe is included between 6548 mg/kg d.s. and 15936 mg/kg d.s. (Table 1). The Fe presence under the hematite form was also pointed out at the ground surface in springs by emanations of CO_2 and on outcrops (Uruioc, 2002).

Table 1. Heavy metals content from the soil in upper terrace of Forocici Gryphon (FG) and crater C1. (mg/kg d.s.*)

Site	Sample	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
FG	S1	udl**	9.05	29.46	15936	107.48	13.53	16.60	99.60
	S2	udl	7.80	33.78	6548	441.97	20.75	19.34	747.00
	S3	udl	9.96	17.59	14848	503.64	23.41	16.60	290.50
C1	S4	udl	11.62	20.58	15521	472.10	24.57	5.81	207.50

*dried substance **under detection limit

The Fe origin can be biogen as a product of ferobacteria (Bizera, 1965), or paleoclimatic, Fe resulting from paleo-alteration, of some silts deposited in Pleistocen (Florea, 1964; Rogobete, Țărău, 1997). Red siltic clay rich in Fe, recrossed by mud and fluids, can derive from other warmer and cooler bioclimatic areas (Ianoş et al., 1997). The high value for Fe remains a problem to discuss. The concentrations of metals like Mn (107.48-505.64 mg/kg d.s.) and Zn (99.60-747.00 mg/kg d.s.) are very high. The concentration of Zn from sample S2 is over 7 times higher as S1 and double as S3. In general, elements like Cr, Fe, Pb in sample of soil, collected from north (S1) and south (S3), presents similar values.

Table 2. Metals composition of water of Forocici Gryphon (FG) (mg/kg d.s.*)

Site	Sample	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
FG	W1	udl**	0.04	-	2.79	0.23	0.05	sld	0.80
	W2	udl	0.05	-	0.06	0.18	0.05	sld	0.74

*dried substance **under detection limit

Metals like Cu (17.59-33.78 mg/kg ds), Ni (13.53 -23.41 mg/kg d.s), Pb (16.60 -19.34 mg/kg d.s) show one concentration variation. The content in metal, sometimes very different from a sample to another, on a small surface (FG 9/11m in diameter) show a large variation in activity of gryphon. Content of Cr of soil from crater C1 is higher than the value of Cr from FG, whereas content of Pb is 3 times less (Table 1). We consider that this high concentration of heavy metals from soil has its origins in depth. It reaches in soil through depositing of heavy metals from FG water. The water of FG represents the expulsions of shallow waters whereas deep-seated fluids percolate slowly to the surface and are expelled as mud-water mixtures in gryphon and springs (Planke et al., 2003). The analysed water for FG is less poor in metals (Fe, Mn, Zn, Ni, Cr) compared to soil at upper terrace of FG (Table 2).
In order to identify the species of diatoms present in the sample collected and processed, several identifiers have been used, the most important being the one published in the series

Diatoms of Europe. For the sake of unity, the taxonomically system used by the authors was preserved:

Bacillariophyceae Haeckel

Cymbelalles D. G. Mann

Gomphonemataceae Kützing

Gomphonema minutum (Agardh) Agardh – its spread are for now is difficult to define and establish, probably is often confused. It is frequently found especially in eutrophical waters; it's tolerance to pollution is up to β-mesosaprobic.

Naviculales Bessey

Sellaphorineae D. G. Mann

Pinnulariaceae D. G. Mann

Pinnularia obscura Krasske – cosmopolitan in northen-alpine regions, particularly in moist mosses and on wet rocks (Fig. 1). This taxon found by Hustedt in the lower Weser region; according to Lange-Bertalot, it is one of the commonest soil diatom. It prefers oligotrophical biotopes but it is apparently indifferent towards content of electrolytes.

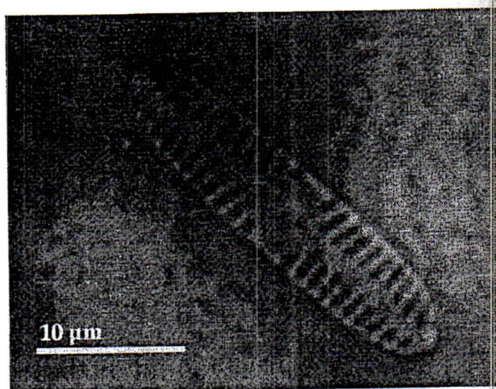

Fig. 1 - *Pinnularia obscura*

Naviculineae Hendey

Naviculaceae Kützing

Geissleria acceptata (Hustedt) Lange-Bertalot & Metzeltin - presumably cosmopolitan, but not precisely known, since is difficult to distinguish from other taxa. Recorded by Hustedt from the diluvial (fossil) and recent from lake Salem, North Germany, or other localities. Ecology: highly mesotrophic to eutrophic, but oligosaprobic waters with average electrolyte content.

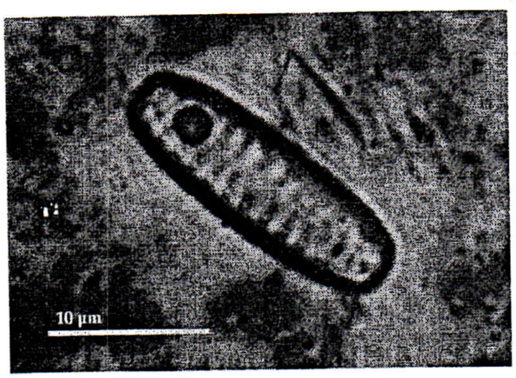

Fig. 2 - *Hippodonta linearis*

Hippodonta linearis (Østrup) Lange-Bertalot, Metzeltin & Witkowski – distribution and ecology are not precisely known due to confusions with other taxa (Fig. 2). It is found in brackish water of the Baltic Sea and also in the electrolyte rich freshwater of Lake Kinneret (Israel).

Stauroneidaceae D. G. Mann

Stauroneis anceps Ehrenberg – widespread and common in all types of waters (though rarely found in great numbers in epilithon). The taxon contains a number of varieties which may differ ecologically. The mentioned taxon is founded in mesotrophic and circumneutral fresh and fresh brackish waters and is sensitive to pollution.

Bacilariales Hendey

Bacillariaceae Ehrenberg

Nitzschia solita Hustedt – cosmopolitan, frequently found, in almost every kind of water, with high ecological amplitude; the ecological optimum is in eutrophical waters with high content of electrolytes.

CONCLUSIONS

The analysed soil at upper terrace of FG are enriched in metals (Fe, Mn, Zn, Cu) compared to water of FG.

The content in metal, sometimes very different from a sample to another, shows a large variation in activity of gryphon.

The Fe content from upper terrace soil FG, is more abundant than soil from C1 crater. Fe origin can be biogen or paleoclimatic, but remains a problem to discuss.

The water of FG represents the expulsions of shallow waters whereas deep-seated fluids percolate slowly to the surface and are expelled as mud-water mixtures in gryphon and springs.

From the substratum of gryphon, we identified 6 species of diatoms.

REFERENCES

Bizerea, M., (1965) *Zona vulcanului noroios din Campia Inalta a Vingai*. Lucrarile stiintifice ale cadrelor didactice. Universitatea Timisoara. Institutul Pedagogic. p.154-168

Florea N. (1964). *Gruparea rocilor din punct de vedere pedogenetic*. Inst. Geol., Dări de seamă ale şed. Com. Geol., vol. I/I, Bucureşti, p 283-288

Guliyev I.., S., Feizullayev A.A., (1995). *All about mud volcanoes*, Institute of Geology of the Azerbaijan Academy of Sciences, Baku p. 52

Ianoş GH., Puşcă I., Goian M. (1997). *Solurile Banatului. Condiţii naturale şi fertilitate*. Ed. Mirton,Timişoara, p 392.

Jakubov A., A., Ali-Zade, Zeynalov M., M., (1971) *Mud volcanoes of the Azerbaijan* SSR, Academy of Science of the Azerbaijan SSR, Baku p. 257

Kopf A., J., (2002) *Significance of mud volcanism*, Reviews of Geophysics 40 (2), p. 2.1-2.52.

Planke, S., Svensen, H., Hovland, M., Banks, D., A., (2003) *Mud and fluid migration in active mud volcanoes in Azerbaijan*, Geo-Mar Lett, 23: p 258-268

Krammer, K., Lange-Bertalot, H., (1986) - Bacillariophyceae: Naviculaceae, În Ettl, H., Gerloff, J., Heyning, H., Mollenhauer, D. (Red), *Susswasserflora von Mitteleuropa,* Vol. 2/1, G. Fischer, Stuttgart.

Krammer, K., Lange-Bertalot, H., (1988) - Bacillariophyceae: Bacillariaceae, Epithemiaceae, Surirellaceae, in Ettl, H., Gerloff, J., Heyning, H., Mollenhauer, D. (Red), *Susswasserflora von Mitteleuropa,* Vol. 2/2, G.Fischer, Stuttgart.

Krammer, K., (2000) – The Genus Pinnularia, În Lange-Bertalot, H., *Diatoms of Europe,* Vol. 1, Gantner Verlag, Ruggel;

Lange-Bertalot, H., (2001) – Navicula Sensu Stricto 10 Genera Separated From Navicula Sensu Lato Frustulia, În Lange-Bertalot, H., *Diatoms of Europe,* Vol. 2, Gantner Verlag, Ruggel.

Rogobete Gh., Ţărău, D. (1997). *Solurile şi ameliorarea lor. Harta solurilor Banatului*. Ed. Marineasa, Timişoara. p. 194

Uruioc S. (2002). *Mineralogia şi petrologia solurilor din zona central-nordică a Banatului*. Editura Presa Universitară Română, Timişoara. p. 367