DOI: http://doi.org/10.21698/simi.2019.fp18

APPROACHES CONCERNING THE CONCEPTUAL MODEL FOR THE ASSESSMENT OF THE NATURAL FUND VALUES OF THE SOIL AND WATER IN NATURAL PROTECTED ZONES

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Abstract

This article provides a detailed analysis of the fundamental elements required prior to conducting on-field research of an areas chosen as case studies for the assessment of soil and water quality in the unpolluted zones. The ultimate goal of the research to be carried out over the next two years is to obtain solid and reliable data on the quality of the two environmental components in these areas. All the data obtained will be integrated into a solid and georeference database, consisting of a sample identification module (soil and water) and a module of a varied parameters that will contain up to 42 parameters analyzed in the testing laboratories.

Finally, the article presents the conclusions regarding the transposition of the proposed objectives into field and laboratory activities, graphical and descriptive details integrated into a conceptual model, universally valid in order to evaluate protected natural areas without direct anthropogenic impact. Particular importance in assessing these areas is attributed to detailing aspects that can influence the research results in major way. Issues related to the sampling and subsampling of soil and water samples, their conservation and transport to the laboratory are considered relevant and major. Geomorphological criteria of details, geographic and geological information are considered important in assessing the areas chosen as case studies. The five areas selected in the present study have been described and a number of objectives and activities have been proposed for on-site research to be carried out in the near future.

Keywords*: assessment, conceptual model, heavy metals, on-site research, sampling*

Introduction

The starting point can be constituted by the basic concepts of geochemistry. It is considered an appropriate approach to initiation in geochemistry, the concept described by Mason in 1958, according to the geochemical cycle of the Earth (Figure 1). The geochemical cycle is presented as a sum of circulation patterns of elements in nature at geological, pedological and ecological time scales. It is a conceptual model with two parts, one geological one, and another related to environment. The geological part (the major geological cycle) occurs in depth in the internal structure of the earth. It begins when sedimentary rocks are accumulated in deep and are transformed by processes of diagenesis, that is to say, they sum up the physico-mechanical and chemical processes that affect postsedimentation to metamorphism and metasomatism, and later transformed into metamorphic consolidated rocks, respectively in crystalline rocks (Mason 1958).

The geochemical minor cycle, or the environmental part of the cycle, begins when the formed rocks are exposed to external factors, such as the surface of the earth's crust. This is where erosion and transport occur in different stages and ways and ends with the formation and storage of sedimentary rocks that end the cycle and continues from the point where it began.

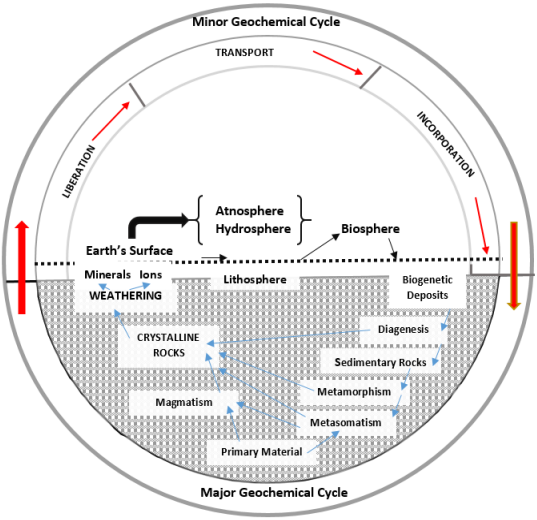

Figure 1. Diagram of the geochemical cycle (Mason 1958)

A second geochemical conceptual model is that of the pedosphere described by Mattson in 1938 (Figure 2). This concept is important because it introduces the idea of the interaction of the four geospheres and the events occurring at landscape level in geological and pedological time. Mattson mentions that when the four geospheres interact at ground level, there is a fifth geosphere - the pedosphere. More specifically, the nature of the pedosphere varies depending on the climate, geological conditions and time, when the pedosphere is formed (Mattson 1938).

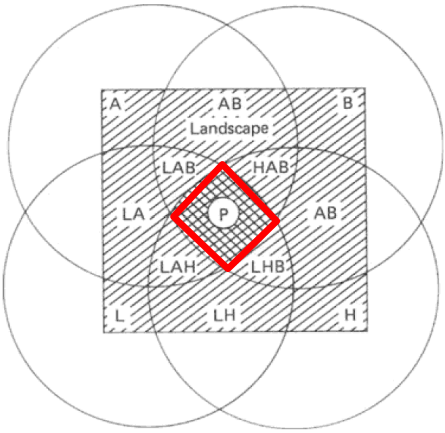

Figure 2. Diagram of the possible intractions between the Litosphere (L), the Hydrosphere (H), the Atmosphere (A) and Biosphere (B). Whenthey interact they form the Pedosphere (P). (modified after Mattson, 1938)

For each interaction of geospheres, the author has indicated a series of landscapes that can be formed in the following:
LA - Barren desert where the dispersed system consist of mineral particles and air. There is no water and life;
AB - Uppermost part of the soil consisting of plant cover;
HB - A pond with countless organisms;
LH - Waterlogged sand or clay under sterile conditions;
LAH - Extreme conditions in some saline soils;
LAB - Deposits of guano by migratory birds;
HAB - Organic soils and forest litter;
LHB - Waterlogged soils and lake bottoms.

More researchers consider that the chemical composition of the sediments depends on the type of material deposited, the weathering processes and the diagenesis and geochemistry of individual elements (Rollinson 1993), (Solecki & Chibowski 2000), (Mahjoor et al. 2009).
There are many studies to be determined was to determine the geochemical heterogeneity of the sediments in lakes situated within the protected areas to identify reference sites for monitoring programme with the aim to detect changes in the environment exposed to strong anthropopressure (Cieślewicz et al. 2018).
Returning to the current coordinates, leaving them the basic conceptual ones, there was defined the "natural environment" by the specific Romanian legislation, respectively the Emergency Ordinance no. 57 of 20 June 2007, regarding the regime of natural protected areas, preservation of natural habitats, wild flora and fauna respectively as the ensemble of natural, terrestrial and aquatic physico-geographic, biological and biochemical structures and processes, having the quality of life preserver.

It is important to mention that heavy metals are naturally occurring elements that are found throughout the earth's crust, most environmental contamination results from anthropogenic activities (Dediu et al. 2016).
The research concerns that are presented in this article are focused on finding and highlighting the background values of quality indicators for soil and water samples in protected areas in Romania, where the anthropic influences, especially pollution are minimum. In this regard, 5 areas as case studies were highlighted in Figure 3 along with a description of the activities proposed for 2019.

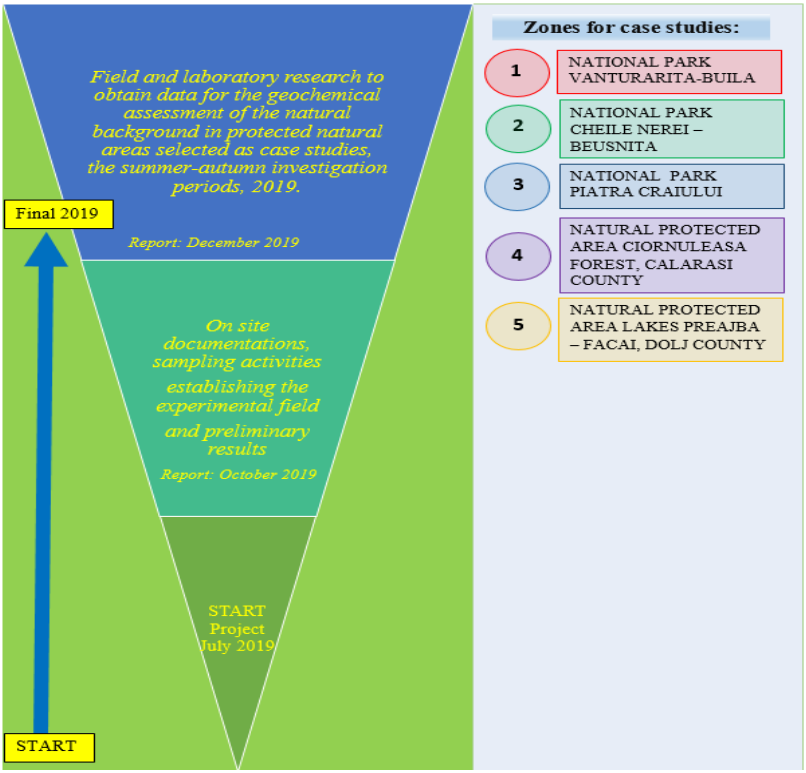

Figure 3. Diagram of activities and case studies chosen

Experimental part
The location of study areas on the maps are presented in Figure 4.
Activity planning targets wil be conducted in two main directions:
A. Field activities:
- dimensioning the number of samples to soil and water to be sampled;
- establishing of appropriate equipment for sampling;
- appropriate techniques sampling soil and water samples;
- obtaining relevant information and details (relief, geology, hydrographic network, vegetation, climatic influences, manifestation of geomorphological phenomena etc)

B. Laboratory activities:

- establishing quality indicators that will be determined by analytical techniques;
- preparing the appropriate test method;
- adequate test equipments;
- ensuring an efficient project management with increased attention to the human resources involved in meeting the deadlines for finalizing the research reports.

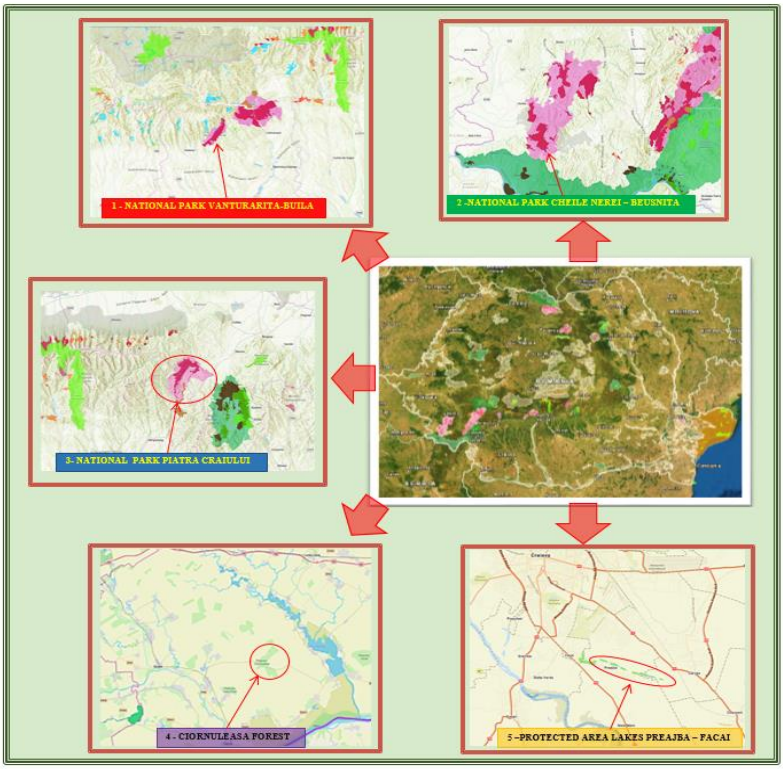

Figure 4. Maps to indicate zones for case studies

Figure 5 shows the activities to be carried out in 2019 and the quality indicators chosen to be investigated in the selected areas (case studies).

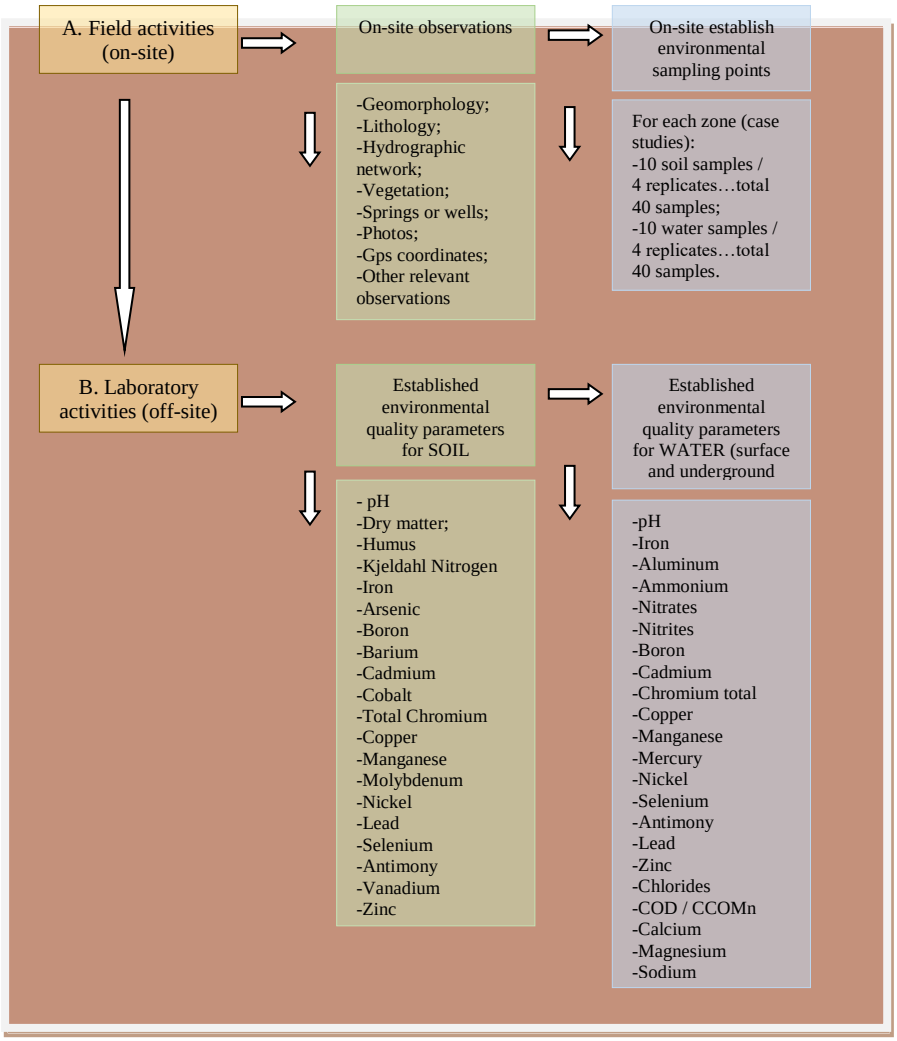

Figure 5. Schematic presentations of activities and parameters for laboratory tests

Results and Discussion

The judicious preparation and planning of the activities in order to achieve the proposed objectives is essential to ensure the success of a project, especially as the activities will take place between August and December 2019.

For a better understanding of the proposed activities, the logical schemes of the proposed laboratory activities for soil investigation (Figure 6) and water investigation (Figure 7) were drawn up.

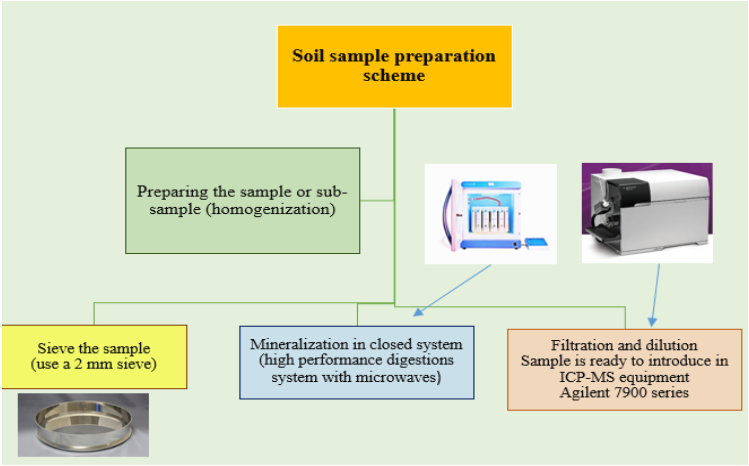

Figure 6. Schematic presentation of the soil samples laboratory tests

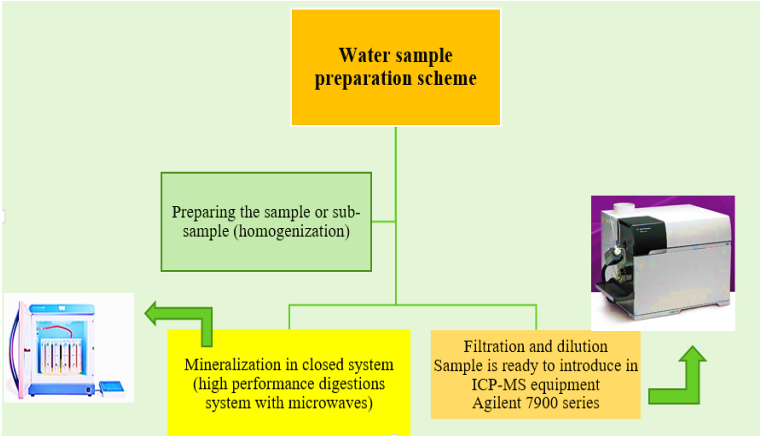

Figure 7. Schematic presentation of the water samples laboratory tests

The proposed activities will constitute an experimental field that will provide solid analytical data that will be the main results obtained within the project. These data will constitute a database which at this point is presented as a conceptual model (a project) in Figure 8.

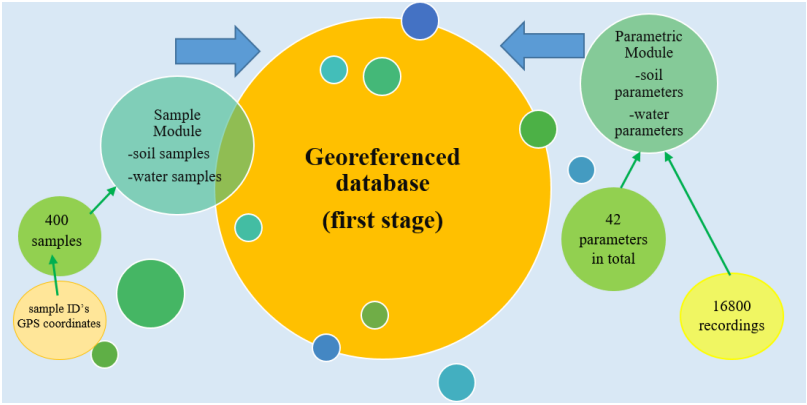

Figure 8. Schematic presentation of project of the database architecture

Conclusions

Planning of in-terrain (on-site activities) and in laboratory (off-site activities) activities is essential in achieving major investigative objectives in extented areas located at appreciable distances one from another. It is especially important that activities carried out before those in-terrain to be solidly documented and clearly understood to facilitate on-site research. Criteria for establishing sampling points on-site are particularly important and should not be neglected. Any aspect of detail that can be considered relevant must be recorded and notified. The experience and expertise of the key project team is particularly important in such situations, because any sample taken from the field must provide a representative of the chosen area, of course, related to the research objectives.

The introduction of the replicated samples in the analysis is able to lead to statistical interpretations and to a high degree of confidence in the results obtained.

The initiation of a solid database with geo-referenced is able to lead to objective observations regarding the quality of environmental factions in protected areas, respectively where the impact of anthropic activities is minimally invasive.

In the future, this database, as new and new information will be added, will be useful for an in-depth understanding of the environmental aspects of pollution and climate changes, the evolution of pollution over time, and the adaptability of ecosystems to induced by climate changes.

References

******* Emergency Ordinance no. 57 of 20 June 2007, regarding the regime of natural protected areas, preservation of natural habitats, wild flora and fauna, published in: Official Monitor, no. 442 of 29 june 2007

Cieślewicz, J, Kobierski, M & Cichosz, M 2018, *Geochemical assessment of lake sediments in protected areas in Poland - a search for reference conditions*, Journal of Limnology, vol. 77 no. 1, pp. 35-45

Dediu V, Kim L, Cosma C & Guta D 2016, *The determination of lead, chromium, arsenic and selenium in sedimentsand soil samples by electrothermal atomic*

absorption spectrometry using chemical modifiers, International Symposium – SIMI 2016*"The environment and industry"*, Proceedings Book, pp. 416-421

Mason BH 1958, *Principles of Geochemistry* (second edition). John Wiley, New York

Mattson S 1938, *The constitution of the Pedosphere*, Annals of the Agricultural College of Sweden no. 5, pp. 261-76

Mahjoor AS, Karimi M & Rastegarlari A 2009, *Mineralogical and geochemical characteristics of clay deposits from South Abarkouh District of clay deposit (Central Iran) and their applications.* Journal of Applied. Science, no.9, pp. 601-614.

Rollinson, HR 1993, *Using geochemical data: Evaluation, presentation, interpretation*, Longman, New York, pp. 352

Solecki, J & Chibowski S 2000, *Examination of trace amounts of some heavy metals in bottom sediments of selected lakes of south-eastern Poland*, Polish Journal of Environmental Studies, no.9, pp. 203-208.