

## Urban Geo-ecology, a New Branch of the Geo-sciences, Support of Durable Territorial Planning

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### Abstract

*For a durable socio-economic development under the context of durable territorial planning, the support offered by the sciences having as subject the earth, water and air with the evaluation of the pollution degree, as well as with proposals regarding the conservation, reconstruction and consolidation of the environment is necessary to be used.*

*For knowing the particularities of the evolutionist trends of the environmental factors submitted to different and constant anthropic pressures, a new concept was developed under the context of using the results offered by the sciences applied in the earth study domain and this concept is "the urban geo-ecology". Therefore, the urban geo-ecology represents a multi-disciplinary research of the different braches of the earth and water sciences (such as: hydrology, engineering geology, geo-chemistry, stratigraphy and geo-morphology), with the purpose of obtaining information regarding the way in which the geo-ecological factors answered to the socio-economic development of an urban area.*

*By the results of the research in the geo-sciences domain, very important data are obtained for the local and central administrations, for the engineers working in different fields which have as subject the environmental protection, the implementation of social, economic and industrial objectives, etc., and for developers or managers of companies whose investments have an impact on the environment.*

**Key words:** *urban geo-ecology, geo-ecological factors, environmental protection, impact on the environment.*

### Introduction

The fast rate of socio-economic development, the population increase, the construction extension and development of the activities implying ecological factors, generate an enormous pressure on the environment. The integrated management of the environmental factors implies a detailed knowledge of them, of the characteristics of the carried out anthropic pressure and the impact they have on these factors, but also a scientific evaluation of the potential risks.

In many urban areas, the development of the anthropic activities has generated transformations of the environment with obvious damages both on it and on the local population. The lack of evaluation on the environmental factors' capacity to tolerate this pressure can bring unwanted consequences.

In the areas with a high population density, the state of the natural environment is characterized by its sensitivity to the pollutant agents. The susceptibility degree increases in the same time with the retention capacity of the deposits and if the aquifer formations are closer to the surface.

## **Theoretical and Experimental Details**

This new branch of the geo-sciences was necessary because in many urban areas in which dwellings were developed on different types of land, but especially on the macroporous land or on soils with a low drainage capacity, or in areas in which the phreatic levels had or have rising evolutionist trends, the urban constructions were affected by phenomena which endanger their stability, and implicitly the physical and material integrity of the inhabitants. Moreover, evaluation of the pollution of the underground water resources is a primordial request in what regards the environmental protection.

Obtaining the necessary data regarding the geomorphologic, geological, hydrogeological and hydrochemical conditions from an area with a high population density is realized by processing the information obtained both through direct investigation methods (boreholes, open wells, CPT, bearing capacity determinations) and indirect investigation methods (geophysical methods like: VES, georadar, seismic measurements), laboratory tests etc. This data is completed with observations on the underground water level and chemistry, and data regarding the soil content. All this information represent a geo-scientific data base which processed into a GIS system can be used for designing maps and graphic models in order to know the geological infrastructure, as well as its answer to the human activity.

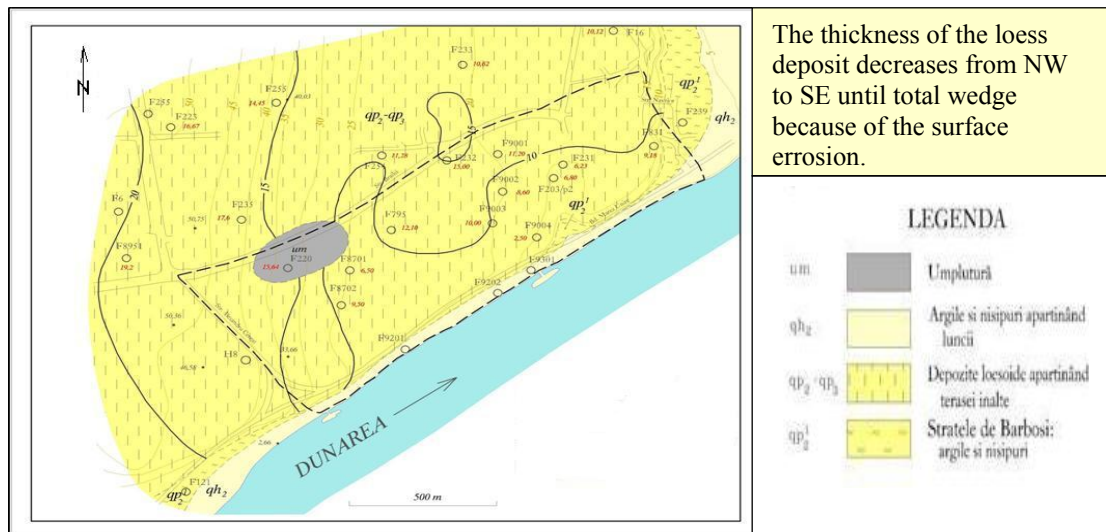
## **Results**

The information obtained represents the basis of the evaluation of the environmental factors' behavior under the pressure of development in an urban area, as well as of the pollution degree of the underground waters and identification of the contamination sources.

This new concept was first applied in Romania within a pilot project performed in Galati, following the increasing importance given to the durable territorial planning policies and to ensuring an active support for a coherent socio-economic growth, in accordance with the legislation on environmental protection. This application was realized by INCDIF - „ISPIF” together with specialists from the Hungarian Geological Institute.

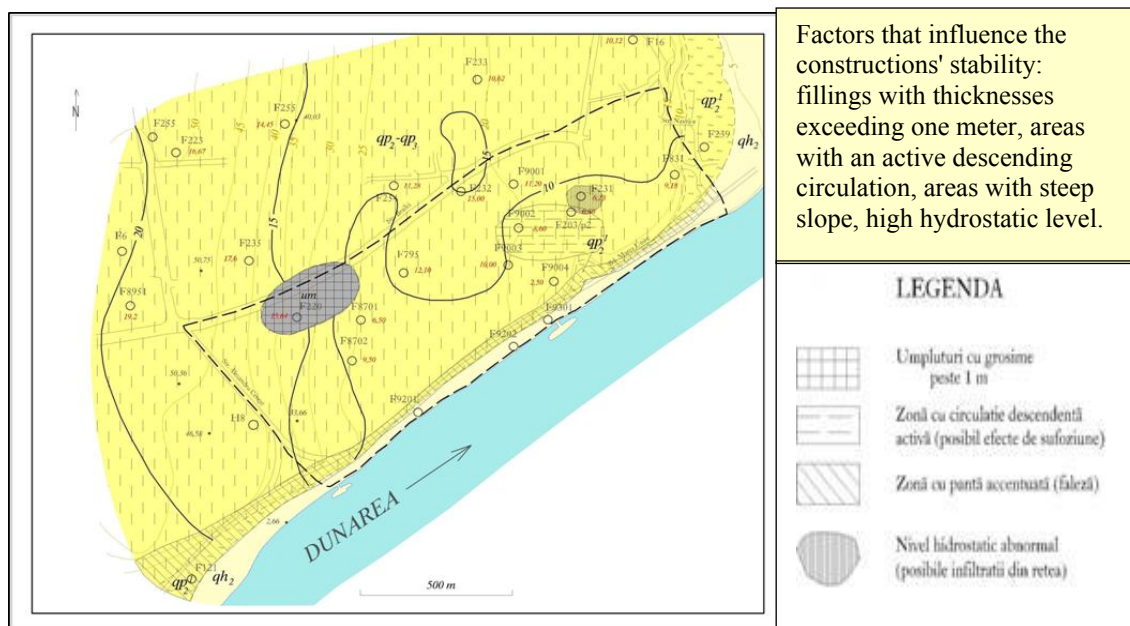
The archive and field data were processed and they represented the base in drafting certain thematic maps of urban geo-ecology which gave us an image representative for the moment and the evolution in time of the investigated environmental factors..

The thematic maps of urban geo-ecology have pointed out: superficial geological deposits by marking the anthropic deposits and the isobath of the first layer foot, the isophreatic and hydroisohypses of the underground waters pointing out the trend of modification in time of their levels. Processing the results of the laboratory analyses represented the base for certain isoline maps of the main physical-chemical elements relevant from the point of view of the identified quantities.



**Fig. 1.** Map of the superficial geological deposits marking the anthropic deposits and the isobath of the first layer foot

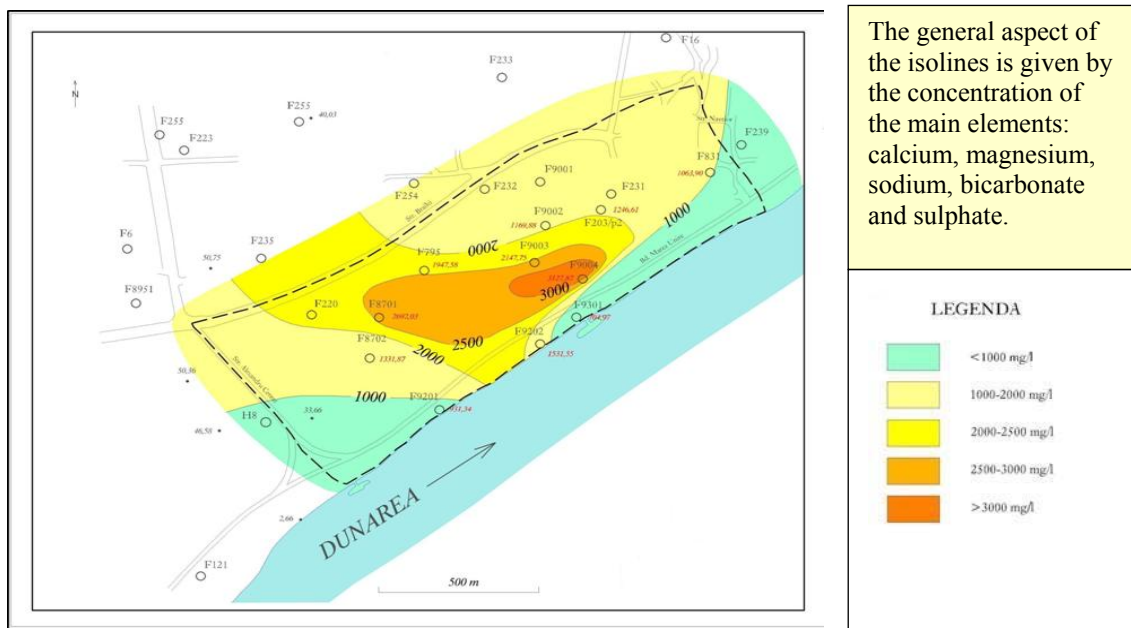
For locating the critical areas regarding the stability of the constructions, it was drafted a map by zoning the investigated area depending on the factors which influence the constructions' stability: fillings with thicknesses exceeding one meter, areas with an active descending circulation, areas with steep slope, high hydrostatic level.



**Fig. 2.** Map by zoning the investigated area depending on the factors which influence the constructions' stability

The modification suffered by the distribution of the phreatic levels was highlighted in maps with hydroisohypses of the phreatic levels between 1973 and 2007.

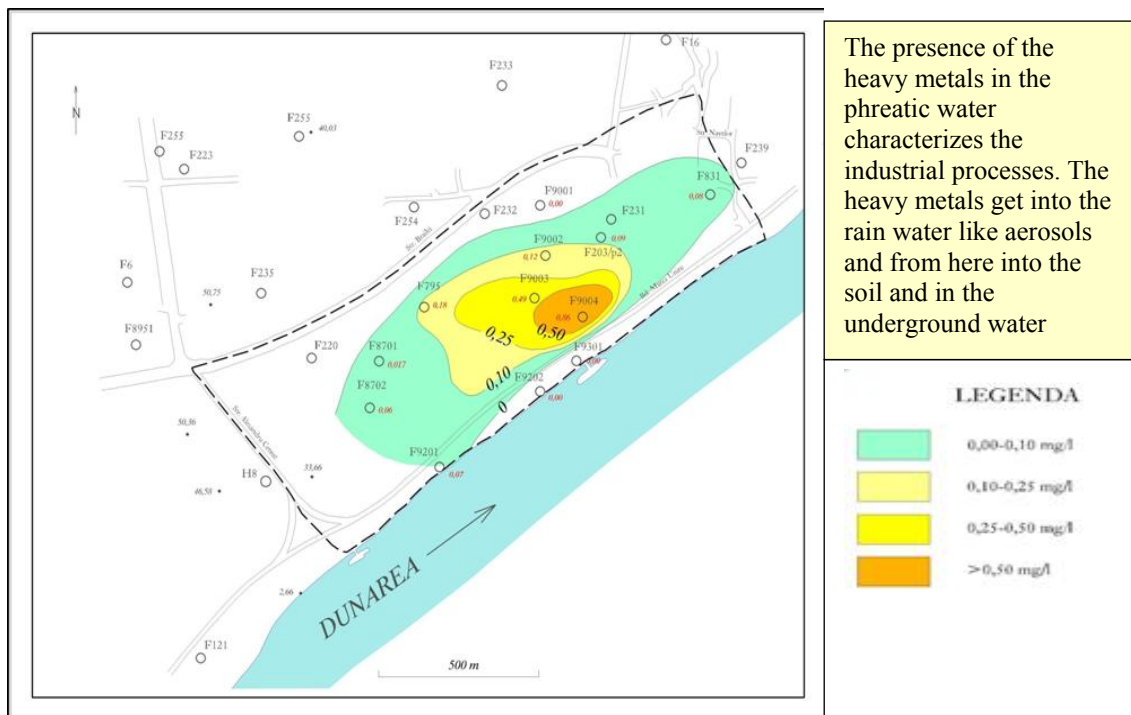
Maps with isolines of the main soluble chemical elements were also drafted:



**Fig. 3** Concentrations of the soluble ions in the phreatic water mg/l in 2007

From values under 1000 mg/l present at the periphery of the perimeter, we have concentration exceeding 3000 mg/l in the central area of the perimeter, maximum depth point of the hydrostatic level. The flux of anthropic ions also converges in this point.

The presence over the admitted limits of certain heavy metals in the phreatic water was also verified:



**Fig. 4** The copper content in the phreatic water mg/l in 2007.

The values determined for heavy metals in the water samples taken exceed with one size order the limits admitted for natural waters, being as indicators of their pollution degree.

No representations were executed in the project for components like  $\text{NH}_4^+$ ,  $\text{NO}_2^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{PO}_4^{3-}$ , nor for heavy toxic metals like Pb, Cd and B, as the number of the analytical results different from 0 (or over the detection limit) was too low for a graphical representation by isolines.

Diagrams of the mineralogical composition were realized.

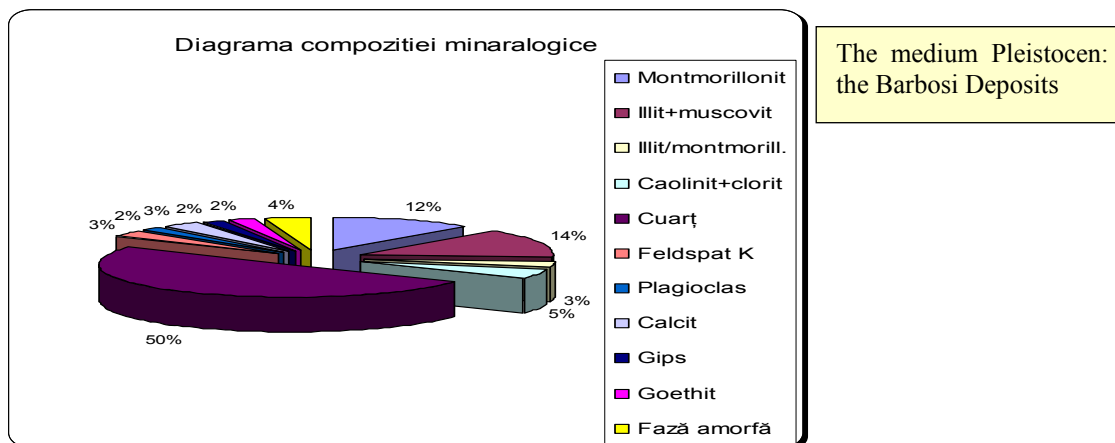


Fig. 5 Diagrams of the mineralogical composition

Within the studied perimeter, where the built surface is composed almost entirely from loessoid deposits with a medium degree of water and pollutant retention and also considering a depth of the phreatic level under 5 m, there is a medium susceptibility degree towards the pollutant agents for the entire perimeter.

## Conclusions

The pilot project realized in Galați proves the necessity of performing certain research for extended urban areas by applying modern and feasible study methods, creating the possibility of solving the problems which appeared as a result of certain increasing anthropic pressures on the environmental factors from an urban area. The thematic maps try to develop the knowledge of the geo-ecological factors' evolution under the pressure of the socio-economic growth of an urban area, leading to actions to be taken for the conservation and amelioration of the environment.

This type of project facilitates some decision making and the adoption of certain scientific solutions in the policy and strategy of the territorial and urban planning, in accordance with the evolutionist trends of the natural conditions.

## References

1. \*\*\*The INCDIF – Geological study regarding the area Brăilei Street – Navelor Street – Marii Uniri Blvd., ISPIF” Archive (2007).

## Geo-ecologia urbana, o noua ramură a geostiintelor, suport al amenajărilor teritoriale durabile

### Rezumat

*In contextul dezvoltării amenajărilor teritoriale pentru o dezvoltare socio-economică durabilă, este necesar să fie utilizat suportul oferit de științele care au ca obiect de studiu apa, aerul și pământul, cu aplicație asupra evaluării gradului de poluare, dar și cu propuneri privind conservarea, reconstrucția și consolidarea mediului.*

*Pentru cunoașterea particularităților tendințelor evolutive a factorilor de mediu supuși unor presiuni antropice diverse și constante s-a dezvoltat un nou concept în contextul aplicării rezultatelor oferite de științele aplicate în domeniul studiului pământului și anume geo-ecologia urbană. Acesta are la bază o cercetare pluridisciplinară a diverselor ramuri ale științei pământurilor și a apelor (cum ar fi hidrologia, geologia inginerască, geochimia, stratigrafia și geomorfologia), în scopul obținerii informațiilor referitoare la modul în care au răspuns factorii geo-ecologici la dezvoltarea socio-economică a unei zone urbane.*

*Prin rezultatele cercetării în domeniul geostiintelor se obțin date foarte importante pentru administrațiile locale și centrale, pentru inginerii ce desfășoară activități în domenii diverse având ca obiect de studiu protecția mediului, proiectarea de obiective sociale, economice, industriale, etc., pentru dezvoltatori sau factori de decizie din cadrul unor firme ce realizează investiții cu impact asupra mediului.*