

## Useful Balkan collaboration in geoenvironment and its main results

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*М. Матова, Г. Франгов, Пл. Иванов — Полезное Балканское гео-экологическое сотрудничество и его основные результаты.* Геологическим проблемам окружающей среды на территории Балканского полуострова посвящены два Международных Проекта: «Экспертная оценка проседаний, связанных с гидрогеологическими и инженерногеологическими условиями в районах городов София, Скопье и Тирана» (1996–2001) и «Сейсмо-гидрогеологическая уязвимость геологической окружающей среды и общества Балканских стран» (2004–2009). Организаторы Проектов: ЮНЕСКО и Болгарская Академия Наук. Международный координатор Проектов: М. Матова.

From 1996 two Balkan geoenvironmental Projects are accomplished according contracts with UNESCO and the Bulgarian Academy of Sciences.

The first Project had the title “Expert Assessment of Land Subsidence Related to Hydrogeological and Engineering Geological Conditions in the Regions of Sofia, Skopje and Tirana”. The Project was based on the scientific collaboration of experts from Albania, Bulgaria and Macedonia. The Project started in 1996 and it was finalized very successfully in 2001. The second Project with the title “Seismic-Hydrogeological Vulnerability of the Geoenvironment and the Society in the Balkan Region” has participants-experts from seven countries – Albania, Bulgaria, F.Y.R. of Macedonia, Greece, Montenegro, Romania and Serbia. The Project begun in 2004 and it will be finalized in 2009. Multinational teams of experts from Balkan countries perform the studies of the both Projects.

During the first Project the subject of study was only one – the land subsidence capacity assessment in three Balkan capitals. The investigations answered to the definition of geological factors for the land subsidence, the assessment of its values and the recommendations for the mitigation of its effects.

The subject of the second Project includes numerous seismic hydrogeological phenomena – liquefactions, landslides, earthflows, land subsidence, also seismically triggered quantitative and qualita-

tive changes in the groundwater characteristics in Balkan areas. The Project is developing now. The creation of data bases for seismic hydrogeological events, the analyses and the unification of the information, the research about the spatial-temporal distribution of studied events and recommendations for actions are included in Project plans. The Project will have also other final aims to synthesize the collected information in a catalog of studied phenomena and to draw schemes of their past and of their future distributions.

The First Project contributed to the accumulation of recent geodetic data for the land subsidence in three Balkan capitals during 1996–2001. The subsidence depended from the levels of the groundwater, the rock characteristics and the tectonic activity. The maximal measured subsidence was of 19.2 mm/y in Sofia city. The areas showed susceptibility for subsidence due to the increase of the effective stress after the groundwater table drawdown. The investigated rocks were weakly or no cemented. During the Project duration the tectonic movements, including the seismic manifestations, were very limited in the three Balkan capitals and respectively their influence over the subsidence processes was neglected. The assessed values of the subsidence in Sofia and Skopje were of 1.00–2.00 cm/y and in Tirana – about 1.00 cm/y. The prognosis for the Sofia City subsidence becomes more representative when the tectonic

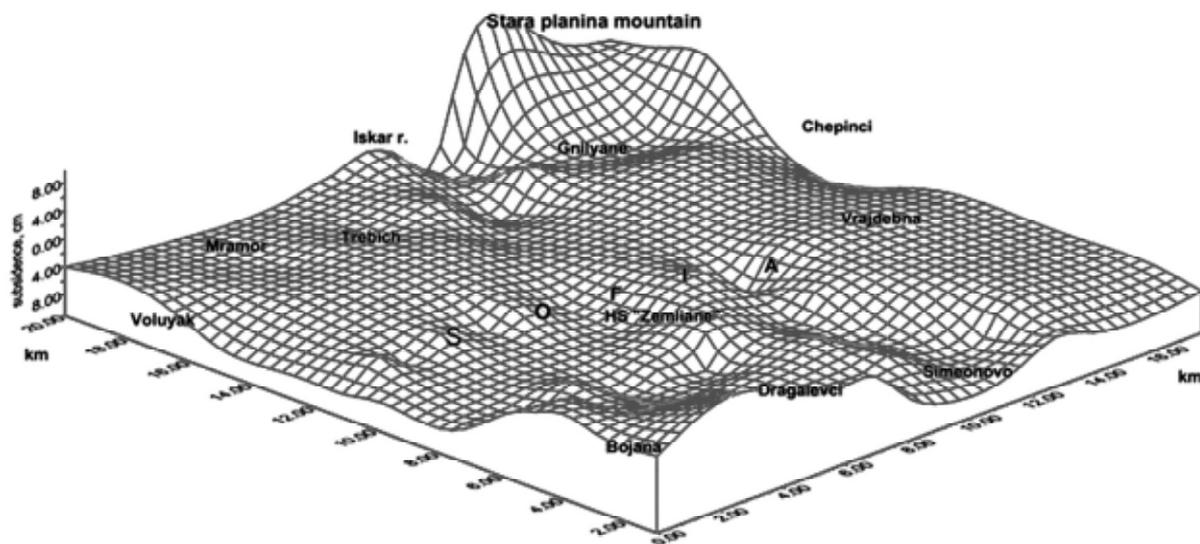


Fig. 1. 3D scheme for the prognostic maximal values of subsidence in Sofia City (Frangov, 2001)

activity increases. Locally it could reach up to 8.00–9.00 cm/y (Frangov, 2001) (Fig. 1).

The recommendations for the mitigation of the subsidence are based mainly over the good geological studies of the construction basement and its surrounding, also over the control about the quality of the construction exploration.

The First Project communications were included in five volumes of Proceedings. They were distributed in the Balkan countries, France, Russia and UNESCO.

The Second Project investigations are in process of enlargement. Seismological, seismotectonical, hydrogeological and engineering geological methods are used for the study of the seismic hydrogeological phenomena, their analyses and syntheses. The Albanian experts take in consideration the wide distribution of landslides and earthflows as a result of tectonic, including seismic movements and of the presence of mountainous relief. The Bulgarian experts make the accent over seismic hydrogeological events related to local national and regional Balkan (Vrancea) earthquakes in the country. They propose also a primary seismic hydrogeological catalog about the 1928 South Bulgarian earthquakes and new interpretations for the seismic origin of several mineral sources in the territory of the Hissar town (S Bulgaria). The Greek experts study landslides along seismically very active sectors of the Egnatia highway (NNE of Thessaloniki). They prepare a small catalog of liquefaction phenomena in the Balkan area. The Macedonian experts observe local seismic hydrogeologic manifestations related to earthquakes during 1904–1994. The experts of Montenegro give numerous data for the liquefaction and landslide phenomena during the 1979 Montenegro-Albanian earthquakes. The Romanian experts propose data mainly

for liquefaction events along the Danube, the Dambovita, the Arges and Jiu Rivers that were caused from the 1977, 1986 and 1990 Vrancea earthquakes. The Serbian experts share their experience with the monitoring research in seismic active area of the Kopaonik Mountain and with the use of hydro-geo-seismological precursors of the earthquakes. The Balkan experts prepare data basis of seismic hydrogeological events and the earthquakes that had provoked them for the first Balkan catalog and for schemes about the occurred and the supposed seismic hydrogeological manifestations in the studied territories.

The communications of the second Project take place in two volumes. They are distributed in the Balkan countries, their scientific libraries and UNESCO.

The Balkan experts-participants in the Projects are numerous. Only several experts of national Working Groups (WG) take part the Project Meetings. During the first Project five Meetings were accomplished in 1996, 1997, 1998, 1999 and 2001. Several of them were followed by field trips. During the second Project two Meetings occurred in 2004 and 2006. The field trips demonstrated manifestations of seismic-hydrogeological phenomena (Fig. 2). The Final Conference of the Second Project is planned to be in 2009.

The UNESCO and the Bulgarian Academy of Sciences ensured generally financial supports of the international activities related to the Projects. In each country the research was made mainly on the basis of national resources. The Bulgarian National Representative Dr. G. Frangov ensured a good activity of the Bulgarian experts and an important financial support of the Project from the side of the High School for Civil Engineering “L. Karavelov” and the Private agency “Stiv-88”.



Fig. 2. Field trip in the area of the Iskrets River during the Meeting of 2006

The Coordinator of the first and the second Balkan Projects Assoc. Prof. Dr. M. Matova is responsible for the regular contacts with UNESCO, its European Bureau of UNESCO in Venice, the Bulgarian institutions and the National Representatives. During the first Project three National Representatives

(Prof. Sh. Aliaj – Albania, Assoc. Prof. G. Frangov – Bulgaria, Assoc. Prof. R. Petkovski – Macedonia) and their Working Groups showed very significant activity. In the second Project the National Representatives are mainly new persons (Prof. C. Durmishi and Dr. Y. Muceku – Albania, Prof. B. Christaras – Greece, Prof. V. Mircovski – F.Y.R. of Macedonia, Prof. S. Ivanovic – Montenegro, Prof. R. Vacareanu and Prof. S. Bala – Romania, Prof. S. Komatina – Serbia) and their responsibilities are bigger. Only Assoc. Prof. G. Frangov accomplishes again the functions of Bulgarian Representative.

The both UNESCO-Bulgarian Academy of Sciences Projects were proposed and accomplished as a result of the initiatives and the efforts of colleagues from the Geological Institute. The first Project gave correct information about the values of the land subsidence in three Balkan capitals, the second one – about seismic-hydrogeological events in Balkan areas. The aims of the second Project answer to the ambitions of its scientific staff to make a new kind of research and to become a regional center for seismic-hydrogeological investigations in the Balkans. These aims correspond with the Lisbon strategy for the considerable scientific development in the European Union that is of importance for the world.

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