



## About technogenic influence over tectonic seismicity in the world and in Provardia

### Относно техногенното въздействие върху тектонската сеизмичност в света и в Провадия

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**Абстракт.** Увеличаващата се техногенна активност на съвременното общество влияе на геоложките процеси в повърхностните части на земната кора и причинява или усилва някои геоложки явления като склонови процеси, земетресения, слягания и т.н. Обърнато е специално внимание на района в Провадия, където продължително развиващия се солодобив, а до известна степен и ж.п. транспорта, постепенно дестабилизира локалните и регионални структури, като причиняват техногенно-тектонски тросове и други геоложки прояви.

**Ключови думи:** техногенна дейност, тектонска позиция, техногенно-тектонски земетресения

#### Introduction

At present in the well populated territories of the Earth including in the Balkan Peninsula the technogenic activities mark a significant increase. The influence of the noosphere over the geospheres augments very intensively. Technogenic and technogenic-tectonic earthquakes are among the response actions of the Earth crust.

#### Technogenic activity and the geoenvironment

The primary cover of our planet is geological one. But now the people create voluminous, high and deep based constructions. They ensure a regime of the intensive exploration of the modern constructions. The territories with a great concentration of immense man-made constructions with various exploration manifestations represent a secondary cover of the planet. It is a technogenic-geological cover of the Earth.

Numerous constructions take place also in areas with considerable tectonic mobility. When the man-made activities are developed in territories with significant or high tectonic mobility the appearance of deformation or even destructive effects in the constructions and in their geological surrounding represents logical consequence. These effects take place in short- or long-term periods. In these cases there are data for manifestations of earthquakes, land subsidence, slope processes etc.

The processes of the technogenic-geological cover creation develop more aggressive on the continents than in the seas and the oceans. The territories of the direct interaction between the primary and the secondary planet covers are progressively enlarging.

The rapid development of the secondary cover has positive and negative consequences for the people. The development of the secondary technogenic-geological cover marks the increase in the man creativity and power. It also provokes the decrease in the primary Earth cover, as well as reduction of the people's contact with the nature and natural processes.

The long-term influence of the increasing human activity over the Earth crust could not be very surely assessed for the present because our experience is relatively short. The next generations will meet various results of our activities over the Earth surface and the very shallow part of the upper crust.

#### Local manifestations of technogenic influence

The growth of the technogenic-geological cover takes place in various geological situations. Sometimes the localities with the concentration of technogenic manifestations are transformed from stable to unstable ones. In other times they are transformed from unstable to more unstable localities.

The big technogenic creations contribute to changes of local stress situation of some territories.

They influence on the value and direction of the stress. The appearance of the stress anomalies has local or regional effects.

The immense constructions contribute to the considerable changes in the groundwater levels, in the crust relief. These changes could reach unimaginable sizes in several localities or regions.

The recent very audacious constructions in the technogenic-geological cover of the planet have real or supposed potential to provoke local or regional destabilizations of the Earth crust. The destabilization could be as a result of structural and stress transformations in the superficial crust layers.

The influence of the man-made activity over the development of the geological processes varies from slightly small to considerably strong. The geological processes are numerous. They include the seismicity as well.

### Technogenic-tectonic earthquakes

Up to now the tectonic earthquakes are predominant ones. They occur in the lithosphere. They represent one of the forms of tectonic movements related to local or regional rapid disintegration.

The technogenic seismic events or the man-made earthquakes are relatively rare. They are related to mine's works, barrage exploration, also various other peaceful and military actions.

The earthquakes distinction of types is based on their principal characteristics. In our opinion a great part of the technogenic earthquakes represent real technogenic-tectonic earthquakes. These seismic manifestations are caused by technogenic factors, but they are developed and influenced by the local or regional tectonic situation.

### Provadia technogenic-tectonic earthquakes

A great part of Bulgarian territory is situated in tectonic active zones. The moderate and the strong seismic manifestations in the country show very often direct or indirect relations with active fault zones and photolineaments. These seismic events cause small or considerable impacts to the Bulgarian society and the geological environment.

The seismic events in the region of the town of Provadia (NE Bulgaria) need special attention (Fig. 1). It is a region of mines for rock salt exploration. The mines are situated in a territory with recent active faults and with salt tectonics. The locality is crossed by railway system Rousse-Varna. Several tens of years

### References

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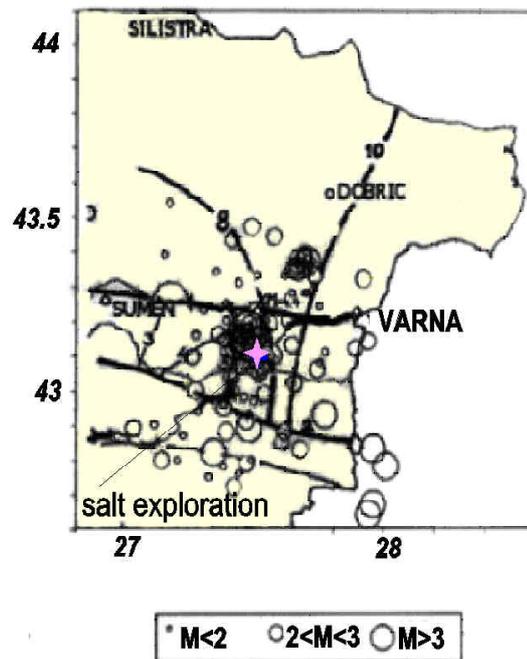


Fig. 1. Small and moderate tectonic and technogenic-tectonic earthquakes that were registered after 1995 in and around the town of Provadia, NE Bulgaria (after Botev et al., 2005)

Фиг. 1. Слаби и умерени тектонски и техногенно-тектонски земетресения, регистрирани след 1995 г. в и около гр. Провадия, СИ България (съгласно Botev et al., 2005)

the local seismicity was weak. Recently, during the last 2 or 3 decades, the seismicity notes considerably increase (Botev et al., 2005). The tectonic conditions, the salt exploration and maybe the railway exploration cause often manifestations of technogenic-tectonic earthquake sequences.

### Conclusions

The human plans for the technogenic adoption of the country and of Earth become more and more ambitious. They create the need to study the technogenic-tectonic influence on the geoenvironment including the respective earthquakes.

In Bulgaria there are manifestations of technogenic-tectonic earthquakes. There are also environmental laws. The correct following of laws could limit the effects of technogenic-tectonic earthquakes.

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