

3.5. ON THE GEODYNAMIC PROCESSES ON THE BALKAN PENINSULA AND THEIR INSTRUMENTAL CONTROL

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3.5.1. Introduction

The geodynamic processes provoke the main negative impacts on the population, the material funds, the cultural-historic heritage and the environment. Some of them acquire the scope of disasters and catastrophes. Almost all of the countries on the Balkan Peninsula had been subjected to strong earthquakes, active landslides, erosion, marine abrasion and other processes in the lithosphere and its boundaries with the other geospheres. The realization of effective counteractions against the geodynamic processes needs first of all results from scientific investigations on the regularities of their distribution in space and time, their mechanisms, range, impacts and consequences. An important share within the framework of these investigations belongs to the instrumental control on the contemporary dynamics of the processes.

3.5.2. The geodynamic processes in the geological past

Even the first glance at the geological maps of the Balkan countries shows that their lands had undergone turbulent geological history - rising and sinking, marine overflow, sedimentation in thick (massive?) series, magmatism and volcanism, folding processes and deep faulting. A large group of exogenous processes "worked over" the Earth's surface under conditions of changing climate and water regimes. All this occurred in congruence with the regularities of the Alpine-Himalayan orogen formation, the lands of the Balkan Peninsula being a component part of this orogen. Its contemporary outlook and outline were acquired during the Pleistocene and the Holocene, and continue their development in the contemporary stage as well. The result of the long chain of geodynamic processes during the geological history is: a complex mosaic of tectonic structures (folded zones, platform elements, upwarpings, depressions, grabens, horsts, thrusts, fault structures); a full range of geological formations from the Archaic to the Pleistocene; great diversity of petrological and lithological rock species from all genetic types – magmatic, sedimentary and metamorphic; dominating mountainous relief forms, hilly and plain areas, lowlands, river terraces, coastal flooded valleys, dismembered seacoasts; complex engineering geological conditions, diverse geomechanical models of the geoenvironment; high degree of the geological hazard.

Under these circumstances ancient civilizations emerged and developed on the Balkan Peninsula in historic time and together with utilizing the natural settings they were subjected to the impacts of the destructive geodynamic processes. Earthquakes, volcanoes, landslides, erosion, marine abrasion contributed to the demolition of the material culture of whole civilizations. Slowly but persistently with time, weathering obliterates the individual features of monuments and destroys them. Those that still exist, being in a deplorable state, need stabilization, rehabilitation and other protective

measures. Their successful performance has to be based on diverse scientific investigations, including monitoring ones.

3.5.3. Contemporary geodynamic processes

The action of a large group of endogenous and exogenous processes continues in present times at the Balkan Peninsula inheriting the events from the Pleistocene and the Holocene. They are usually in cause-and-effect relationships forming chains of subsequent phenomena. For example, the rising of blocks of the Earth's crust leads to activation of erosion, river network incision, relief dismemberment, emergence of slope process as landslides, rock-falls, screes, creeping, etc. In contrast, the subsidence of tectonic blocks leads to sediment deposition and occurrence of another category of processes related with the presence of shallow groundwater (Fig. 3.5.1).

The slow tectonic movements of blocks of the Earth's crust as rising, sinking, horizontal displacements and rotation continue. Strong earthquakes are frequently displayed in different parts of the peninsula, affecting one or more countries. Large landslides in the mountain areas alter substantially the relief within hours and days, causing severe demolitions of the settlements, infrastructure, communications and environment. Erosion affects broad areas, fertile soils are taken away, bridges and retention walls are undercut and destroyed and roads are broken off. The abrasion processes along the extended coastline of the seas surrounding the peninsula change its configuration and destroy the coasts and the material funds affiliated to them.

Coast protection is one of the problems of most of the Balkan countries. A large group of processes is connected with shallow groundwater – bogginess, salinity, liquefaction of weak soils, quick sands, suffusion, capillary rising, carbonate and sulphate aggression. These phenomena hamper the construction and exploitation of buildings and facilities and require special measures for restricting the negative impacts.

The destructive and hazardous processes and phenomena provoked by anthropogenic activities occupy a significant share in the structure of the geological hazards. These are: artificially provoked seismicity during dam construction; landslides and rock-falls during undercutting, overloading and moistening of slopes; raising the groundwater level in urban territories and irrigation fields. A large group of phenomena accompany tunnel construction and mining industry. Beautiful natural landscapes incorporate the dark spots of huge excavations, dumps, settling basins, ash dumps and tailing ponds. They are transformed into new risk factors threatening the life and health of the population and the material funds. They bring the hazard of technogenic catastrophes. The surface and ground water, the soil and the atmosphere are subjected to pollution. Taking also into account the wastes from the settlements, industry and other anthropogenic activities, it turns out that the environment is heavily loaded by harmful impacts acquiring the dimensions of a geological factor. The task of restoring and protecting the environment becomes of primary importance

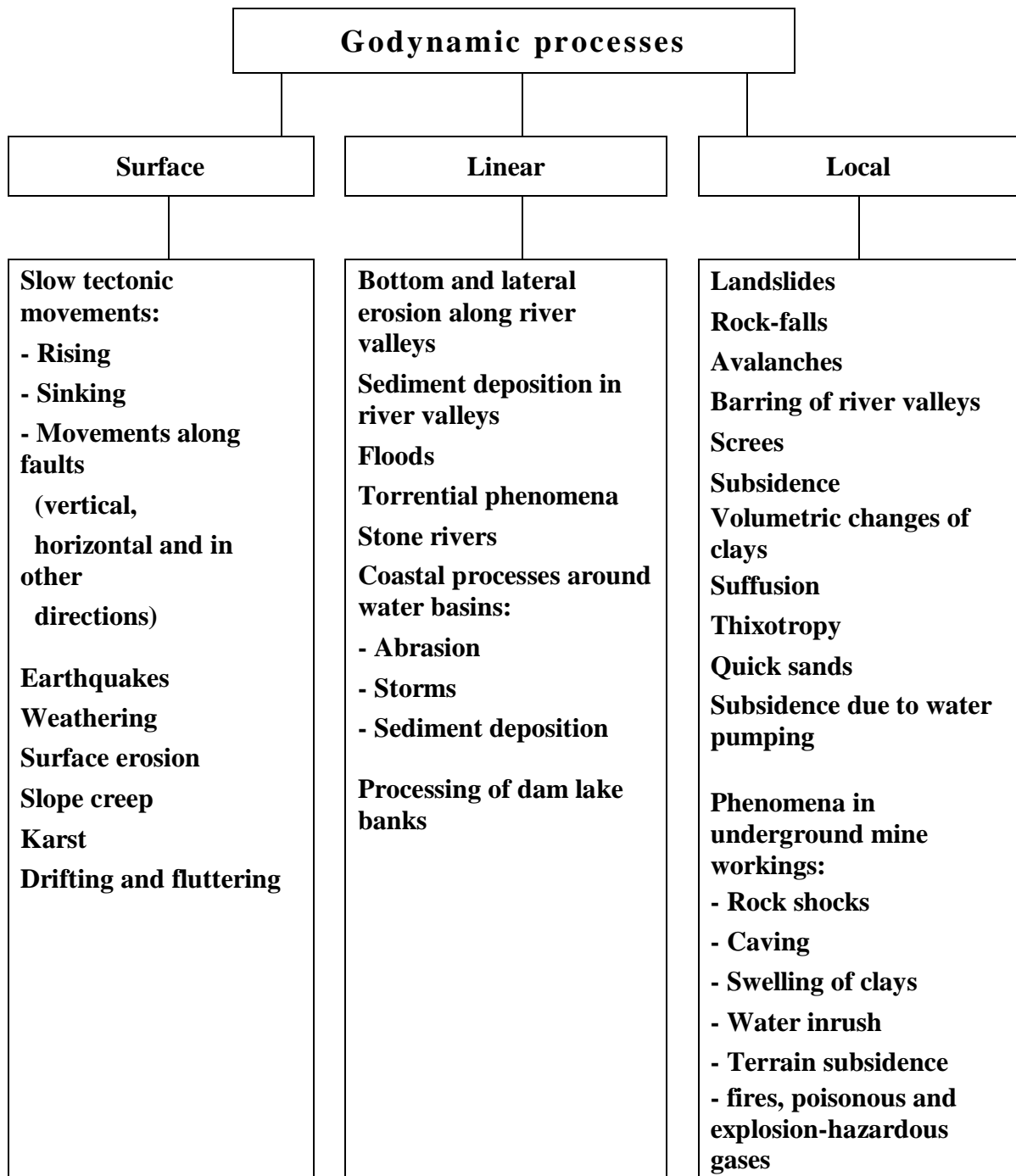


Fig. 3.5.1. Classification of the geodynamic processes with respect to their types and range of the affected territories

3.5.4. The need for instrumental control on the geodynamic processes

As far as the geodynamic processes represent an element of human environment, their investigation and quantitative measurement is crucially important for the planning and realization of appropriate and effective counteraction measures. This refers especially to the group of processes bringing hazards and risks of most diverse nature. For the countries on the Balkan Peninsula – a place with high geodynamic activity, it is relevant

and necessary to organize and realize instrumental control on the most important and dangerous processes. These activities proceed in the single countries according to their needs and possibilities. Useful results have been also obtained from seismic stations, geodetic polygons, GPS and mechanical, extensimetric and inclinometric techniques. The national control systems have to be further developed and improved – more types of phenomena and larger territories should be included, modern methods should be applied, continuous control with time should be realized for rapidly occurring processes. The obtained more complete information will be useful for establishing relationships and regularities, for scientific conclusions and for solving practical problems. The national control systems should also be designed with possibilities for establishing contacts with analogous ones in the neighbouring countries. It is high time to establish closer contacts between the neighbour-countries in this field and this will increase the effectiveness of the control instruments. This is still more important for the Balkan Peninsula because of the following reasons:

- The area is a separate geographic unit and a part of a bigger tectonic structure;
- The territory is with high degree of urbanization and has a rich history as a cradle of ancient civilizations;
- The realization of a new stage in the development of the region is impending with respect to its new European future, including the construction of transport corridors with the affiliated to them big bridges and facilities, oil- and gas-pipelines, modern airports and harbours, all of them being of continental and intercontinental importance;
- The boundary regions between the countries, which are as a rule more backward areas compared to the central parts, will be further developed and this is related with considerable volume of construction;
- The countries on the Balkan Peninsula have relatively small territories and a number of natural processes affect several of them simultaneously (earthquakes, floods, torrential phenomena, slow tectonic movements).

These circumstances, combined with the high geodynamic activity of a number of lithospheric processes on the Balkan Peninsula, make the idea of broader bilateral and multilateral cooperation between the countries in the area very important nowadays. It may incorporate the following activities:

- Development of joint scientific and other projects on geodynamic problems representing interest for two, more or all of the Balkan countries;
- Exchange of information, methodologies and results from investigations of processes on the national territories, which are useful for the other countries too;
- Establishment of a Balkan Geodynamic Centre as a union of the countries situated on the peninsula aimed at managing, coordinating, analyzing and summarizing the results from the investigations and making recommendations for the solution of common for all Balkan countries geodynamic problems. One of these problems concerns the instrument control. One of the final results could be the development of a Geodynamic Map of the Balkan Peninsula. It is necessary to discuss these issues, so that useful initiatives could be formulated.