

## *Abstracts of the contributions*

### Contributions by the participants: Presentation and comments

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The International Conference "Geodynamic hazards (earthquakes, landslides), Late Alpine tectonics and neotectonics in the Rhodope Region" is organized by the Geological Institute of the Bulgarian Academy of Sciences with the aim to open a broad discussion on problems of the pre-Alpine structure, the Late Alpine evolution, the neotectonics and the geodynamic hazards. All four principal topics are represented in the abstracts. Some of the topics will be discussed directly in the field, facing the outcrops of rocks, formations and structures.

The geology of the pre-Alpine and Alpine basement rocks of the Rhodope region is discussed in a few papers. **I. Haydoutov** stresses on the Late Precambrian to Cambrian evolution of the Balkan and Thracian terranes, and puts forward again the unsolved yet problem for the interrelations between the fragments of pre-Ordovician oceanic and continental crust in the region. New and old evidence cited confirms again the ages mentioned, on sharp contrast with the ideas (Ricou et al.) about an Alpine age of the diabase-phyllitoid complex (Frolosh Formation) and the Strouma diorite formation (an intrusive complex formed in the roots of an immature ensimatic island arc) in SW Bulgaria. Basement — cover relations in the Haskovo district are discussed by **S. Sarov** and **I. Gerdjikov**. The authors make a parallelization with the Sakar unit, and distinguish between a metamorphic basement (volcanogenic-sedimentary complex and Triassic Topolovgrad Group, both intruded by different granitoids) and an unconformable Palaeogene — Quaternary cover. Two major pre-Palaeogene deformation events are distinguished. The metamorphism is referred to

the time interval 120 — 95 Ma without taking into account the presence of metamorphic pebbles in the metaconglomerates of Late Palaeozoic and Early Triassic age present in Sakar and in the Maritsa zone. The metamorphic and tectonic events in the southern contact of the Rila-Rhodope batholith are studied by **Y. Malyakov** and **H. Belmustakova**. A clear pre-granitic polymetamorphic and polydeformational evolution is outlined, and an intense post-granite reworking in the conditions of epidote-amphibolite facies is described. **Ph. Machev** discusses the problems of granite magma generation, emplacement and exhumation in the central Pirin area. Based on some new geochemical evidence and on purely theoretical reasons, he is arguing against previous evidence about a polymetamorphic and polydeformational evolution and against Rb-Sr dating. In his views, all granitoids in the area (Spanchevo granite-gneiss included) have been formed during a single course of latest Cretaceous compression followed by Palaeogene extension and exhumation.

The Alpine evolution is subject of four contributions. **L.-E. Ricou** et al. expose the already published ideas about the evolution of the Tethys, and the presence of a Transit Plate that continuously travelled throughout the Tethys Ocean to be docked at its present place in Late Alpine times. **P. Gautier** et al. discuss the evolution of the southern parts of the Rhodope area (Northern Greece) in terms of the development of a Nestos shear zone. Two contrasting models are considered. The first model accounts for the interchange between a first thrusting movement followed by a second top-

to-SW normal-fault displacement in extensional conditions whereas the second model is claiming a continuous extension and exhumation since 36 Ma to present. **I. Dimitrov** makes a mechanical analysis on the feasibility of a synmetamorphic nappe complex in the Central-Rhodope area, and throws serious doubts on the presence of large synmetamorphic overthrusts pre-dating the widely recognized brittle thrusts in the area. **A. Kounov** et al. discuss the timing of Cenozoic extension in the Kraishte region on the basis of fission track analysis. The retrogressive greenschist-facies metamorphism in the area is referred to NE-SW directed extension in Palaeogene times along detachment surfaces. The model proposed is based mostly on laboratory data, with some deficiency of appropriate field evidence.

Neotectonic deformations in the Aegean and Balkan regions are of utmost importance for assessment of geodynamic hazards. The tectonics and relief formation in the Palaeogene — Neogene Pernik depression are exposed by **D. Angelova** on the basis of field geological and geomorphological studies. **N. Ognyanova** and **M. Yaneva** present new data about the stratigraphy and sedimentology of the Neogene in the Gotse Delchev graben. The other contributions are focusing mostly on the possible tectonic mechanisms as witnessed by deformations observed. **I. Mariolakos** emphasizes on the character of the motions of three principal plates in the Aegean region and the whole Eastern Mediterranean. Strike-slip motions (in particular, along the active North-Anatolian Fault Zone), normal faulting along most of the seismically-active faults, and geomorphological characteristics of the horsts and grabens in the region point at tilting and rotations in transtensional and transpressional conditions. Torsional stress field are deduced, and examples from Peloponnese and Athica are presented. **A. Okay** exposes the principal lines of the structure and neotectonics of the Turkish Thrace and the Sea of Marmara, a region that has been most severely struck recently by major earthquakes and related geodynamic hazardous phenomena. **I. Fountoulis** reports a composite neotectonic graben (MELYMITE STG) in central-western Peloponnese as a first-order neotectonic structure accompanied by second-order folds and faults in function of the present erosion level. Low-angle normal faulting is naturally in the focus of interest in view of the popularity of detachment tectonics hypothesis. The theoretical basis of the hypothesis is reviewed by **R. Westaway**. A strongly inclined stress tensor is

required, with development of unusually high stresses. These requirements are not met by many studies claiming presence of metamorphic core complexes exhumed along detachment faults in continental conditions. An example to such a failure is given by the abstract of **K. Shipkova** and **Z. Ivanov** who are continuing to insist on their "Djerman detachment" although the previously-published (in support of this idea) "autoclastic breccias formed in greenschist-facies conditions" (known for 150 years to be Tertiary sedimentary rocks with coaledified plant detritus and coal lenses) met a fiasco with the new evidence published. Field criteria are put forward by **I. Zagorchev** in his review of low-angle normal faults that have been produced by other mechanisms feasible in continental conditions, and have been erroneously referred to as large-scale detachments. The physical modelling of Quaternary surface uplift is another topic of utmost importance for geomorphology and neotectonics; its methodology is exposed by **R. Westaway**. **G. Alexiev** and **Tz. Georgiev** make an attempt to analyze the morphostructural features of the superimposed graben valley complexes on the territory of Bulgaria in order to account for the geodynamic hazards, and to develop a geodynamic model for Quaternary times. Active tectonics of the Bulgarian Rhodope Mountains is discussed on the basis of newly-acquired GPS data by **R. Nakov** et al.

The problems of the geodynamic hazards and minimization of their effects are exposed in several important posters. The seismicity of the northern part of the Moesian platform is exposed by **L. Besutiu**. It is based upon modern studies of the deep structure, and mostly, the modern studies of the unique Vrancea hearth. The recent tectonics of the FYRO Macedonia within the framework of the plate tectonics is given in the contribution by **R. Petkovski**. **M. Gorgieva** et al. expose the neotectonic setting of the seismicity and geothermal anomalies in the Skopje depression, and **Z. Iliovski** et al., that of the Pelagonian, Kicevo and Porec depressions and the neighbour horsts. Development of methods for earthquake prediction and damage reduction in Israel is considered by **B. Mavashov**. The seismicity of the Rhodope region is discussed by **E. Botev** and **S. Dimitrova**, and this of the western periphery (Strouma fault belt), by **S. Shanov** et al. Grouping of foci is related to the principal seismogenic fault structures, the deep structure of the crust, and the existing scarce data about the whole lithosphere. The Kroupnik seismotectonic knot that

hosted the strongest recorded earthquake in Europe (04.04.1904;  $M = 7.8$ ) is the subject of the contributions by **M. Matova** (seismotectonic and geodetic data), **B. Rangelov** et al. (full catalogue and macroseismic maps) and **E. Botev** et al. (principal tectonic stress tensor deduced from seismic and geodetic data). The social and economic problems relative to natural hazards in the Rhodope region are exposed by **M. Nikolova**. An extensive study of the geological and geomorphological conditions in the Bobovdol coal mines and the corresponding geoecological problems and geodynamic hazard assessment has been performed by **D. Angelova**. **D. Dimitrov** et al. supply the newest information about the monitoring of the recent movements along the Kroupnik fault.

It is evident that the complex tectonic history and structure of South-eastern Europe and the adjacent regions of the Black Sea, Asia Minor and the Eastern Mediterranean gives wide opportunities for establishment and/or application of different geodynamic hypotheses. One of the aims of the conference is to meet and even, to confront different viewpoints based upon different field experience and theoretical background. We do hope that both the presentation of the contributions, the discussions on

the round-table principles, and the visits of important outcrops will contribute to dissipation of some prejudiced opinions, and to make an approach to the Truth as ultimate goal of any research.

The practical value of discussions and field work should be sought in obtaining of positive new knowledge about the geologic history and tectonic structure of the Rhodope region, as a setting for important geodynamic hazards. Newly-activated enormous landslides in the East Rhodope areas as demonstrated by the specially made film (**I. Brouchev, G. Frangov and Y. Yanev**) are a new warning about the weight of the landslide threat in the Rhodope region. The dangers of anthropogenic activities in the unstable areas of young grabens with unstable slopes and heterogeneous, loose and water-saturated filling will be demonstrated in the field. Monitoring of seismogenic faults will be demonstrated at the example of the active Kroupnik fault. The dissemination of the newly-acquired knowledge would be of utmost importance for the participants and the research institutions in their countries for their future research activities and practical work directed towards the sustainable development of the European Union and its associated countries.