

## On the seismicity of the Rhodopes

*Emil Botev, Sonia Dimitrova*

*Geophysical Institute, BAS, Sofia*

The zone of Rhodopes is situated between Mesta and Maritza river valleys and comprises the area of the Rhodope mountains. It is characterised by heterogeneous crust with strongly decreasing thickness from the west (45- 50 km for the West Rhodopes) to the east (30-35 km for the eastern periphery of the zone). The gravity field is positive in the East Rhodopes and becomes strongly negative to the west; the gradient belt has N-S direction and is associated with the boundary between central and eastern Rhodopes. The magnetic field has a complex mosaic structure, and, again, the central and eastern sectors of this zone are strongly differentiated.

The seismic activity in the Rhodopes is moderate and is mainly associated with the Chepino, Dospat, Devin, Ardino and Momchilgrad (Tzarichina) depression fault systems. Further small seismic faults represent the boundaries between uplifted local dome structures within the Rhodope mountain. The maximum observed earthquake in the 20th century is the event of 1905 with magnitude  $M=5.4$ . There is no information for larger events before 1900 in the Bulgarian territory of this zone, but the strong historical earthquakes of 1829 (magnitudes 7.2 and 6.9) in the Greek territory can be assigned to this zone. These quakes occurred at the southern margin of the Rhodope mountain and are associated with the activity of the Middle Mesta fault.

Since the beginning of the XX century, the seismic activity instrumentally recorded is rather moderate and scarce in the Rhodopes. Because of very small number of instrumentally recorded moderate earthquakes the investigation of the weak seismicity is required to overcome the existing laps. The registration of

smaller shocks allowed to complete the describing of seismology information about the seismicity of the region, to recognise and detail the localisation of seismogenic structures and peculiarities of earthquakes source zones, and also to confirm the historic seismological data.

Conditions for detailed investigations of the weak seismicity in the Rhodopes are created after 1980 with the starting of NOTSSI operation. In such a way for a twenty years period (1980 — 1999) in this area more than 1400 earthquakes have been recorded in a magnitude interval  $M = 0.6 - 4.6$ . The basic kinematic parameters of the earthquake sources are calculated by a computer program, an adaptation of HYPO '71 and a regional velocity model. The magnitude of the earthquakes has been estimated according to the duration of the record of the seismic signal. The inaccuracy of the solutions concerning the events in the region of investigation in some cases reaches up to 4-5 km, but average varies around 1 - 2 km. The depth distribution of the epicentres of the weak earthquakes as well as the stronger earthquakes at the beginning of the century are located till the depth of 20 km confirming the small thickness of the seismogenic layer.

Three relatively outlined zones of grouping of the epicentres can be marked at the background of the everywhere space distribution of the weak seismicity during the last twenty years. The north-south elongated linear zone of concentration of seismic events in the central part of the region is relatively more active. This zone can be related with the manifestations of the Varbitza river fault line, which marks the morphological contact between the eastern and central parts of the Rhodopes. Of course, the earthquakes are not uniformly distributed

along the whole contact belt - a higher density of the epicentres is observed around the known source regions. Generally, the detail analysis of the obtained territorial distribution of the earthquakes shows an agreement with the known tectonic structure, confirming the deci-

sive role of the fault systems in the west border regions (Kovachevitza, Chepino and Middle-Mesta depressions) and around the boundary between central and eastern Rhodopes (Kardzhali, Momchilgrad and Dzhebel depressions).