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Current state of active fault mapping in Bulgaria

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Abstract

The territory of Bulgaria occupies the Alpine orogenic system in the Balkan Peninsula. The current tectonic regime has been established since the end of Miocene around 6-5 Ma BP being determined by extension of northern Aegean region. The extension is accompanied by normal faulting and seismicity. The faults are normal and oblique and affect upper 20 km of the crust. The seismicity is intermediate but five strong earthquakes of magnitude from 6.8 to more than 7 affected the country in 20th century. Knowledge about active faults in Bulgaria is of great significance for seismic hazard assessment.

Several maps of active faults have been prepared for the purposes of seismic hazard assessment in the country since the 1973. Those maps reflect the contemporary concepts for faults capable to produce earthquakes. Some of maps present neotectonic faults and deformations; some are based on the concept of fault lineaments and knots, in which almost all geologically known major faults are presented.

New data for active faults have been collected for the last five years. These data as well as the modern understanding for faulting and its relationship to seismicity allow a team from the Geological Institute in Sofia to begin revision of the previous maps and compilation a new map of active faults in Bulgaria. The first step requires definition of "active fault". We adopted active faults on the map should be those that are capable to produce an earthquake large enough for surface rupturing or near-surface deformations. Because the long-term activity of those faults usually reflects on recent topography and determines Neogene sedimentation, faults could be easily defined on terrains. However, variations in the stress field during the neotectonic stage and fault evolution cause variations in faulting; and therefore only a number of all faults could be a seismic source in our days. Unfortunately, data for paleoseismicity are not available for almost all the faults, and evidence for neotectonic activity should be accepted as sufficient reason for given fault to be present on the map. Another important topic in mapping faults relates to their segmentation. It is typical for previous maps that different faults have been generalized in one large fault, somewhere of hundreds kilometers length. Such large faults cannot be accepted as a separate seismogenic source, and they require segmentation. Better understanding of recent faulting needs additional studies on evolution of faults, interaction between neighbor faults, and paleoseismicity.

Active faults on the working map occupy mainly the periphery and the interior of Neogene depressions southward Balkan Mountain. The faults determined significant Pleistocene and Holocene depositional rate seem to represent very high slip rate. The absence of data for historical earthquakes related to concrete faults suggests that the period of strain accumulation is comparable with the recurrence interval established in trenches, which is 1-3 thousands years. It means that the seismic potential of those faults increases. Many geometric segments 5-15 km long are very closely situated, which makes the probability for connecting in one larger seimogenic segment high. Geomorphic analysis and trenching could help in resolving the problem.