

## Chronological analysis of earthquakes in the region of Kolubara

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This work represents chronological happening of earthquakes and consequences in the region of Kolubara, as one of the marked seismic places in Serbia. The period between 1998 and 2013 was analysed.

An earthquake is the result of a sudden release of energy in the crust of the Earth that creates seismic waves. The seismic activity of an area refers to the frequency, type and size of earthquakes experiences over period of time. Earthquakes are measured in seismological stations. Each seismological station recorded ground motions from seismometers.

Serbia does not represent an area of high seismic activity, but earthquake there have magnitude up to 5.8 Richter scale. Based on their energy, these earthquakes can be destructive. Serbia belongs to seismically active area, to the border of Mediterranean-trans-Asiatic earthquake zone, precisely the Mediterranean belt. Due to its position, it is on the edge of the plate, earthquakes in Serbia cannot be stronger than 6.2-6.3 Richter scale, according to seismologists. Seismic areas in Serbia are: Kopaonik, Rudnik, Krupanj, Maljen, Lazarevac, Svilajnac, Golubac, Vranje, Kraljevo and Urosevac-Gnjilane area. These earthquakes mark, by their position, the most important seismic zones in Serbia. The seismic area analysed in this work is Maljen's area with Kolubara region and the following municipalities: Valjevo, Osecina, Ub, Mionica and Ljig (presented in Fig. 1.). The area of the analysed region totals  $P = 2474 \text{ km}^2$ .

In the analysed area one of the strongest earthquakes in Serbia happened at the end of 20<sup>th</sup> century. This earthquake happened at midnight on 30<sup>th</sup> September, 1998. and the epicenter of 5.7 Richter scale was in Mionica region. Seismic waves of the earthquake at Mionica were registered by stations on over 10000km away. In Valjevo, the intensity of the earthquake at Mionica was VI degrees and in Mionica VIII degrees of Mercalli intensity scale. The same earthquake in Belgrade was V degrees and in Hungary II degrees of Mercalli scale as presented in Fig. 2.

The consequences of that earthquake were several weaker earthquakes in the next few months. Therefore in morning of April 30<sup>th</sup>, 1999, one of the strongest earthquakes happened in Mionica, with a magnitude of 5.4 Richter scale or VII degrees of Mercalli scale. Thereafter in chronology of earthquakes in the analysed area the magnitude and frequency of the earthquakes decreased as shown in Fig. 3. Only since 2006 their activity was gradually intensified and escalated in the period from 2009 to 2011, where stronger earthquakes happened. And from 2012 until August 20<sup>th</sup>, 2013, the seismic activity significantly decreased (as shown in Figs. 4-6.).

Well-known assumptions about the genesis of the earthquakes in Kolubara region are assumptions that claim that reasons for seismic activity are related to:

- Deep faults as old weakened zone
- Unequal speed of modern-day differential vertical movements
- Movements of tectonic plates, since Kolubara region lies on intersection of these plates

- The fact that Mionica, where the strongest seismic activity has been measured, lies on thermal water sources.

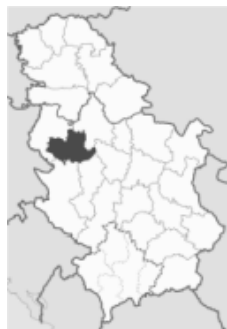


Fig. 1.: Kolubara county

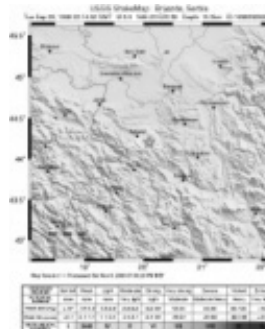


Fig. 2.: Earthquake in Mionica 1998

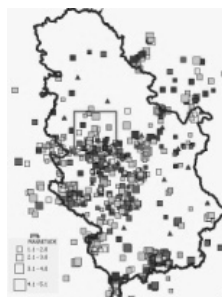


Fig. 3.: 2000-2005

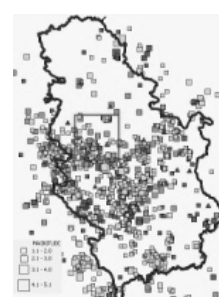


Fig. 4.: 2006-2008

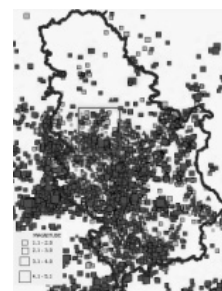


Fig. 5.: 2009-2011

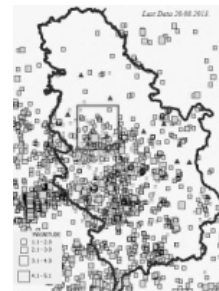


Fig. 6.: 2012-2013

The main goal of this work was to draw the attention of scientific audience to seismically active areas as high risk places, which could, due to reasons mentioned above, cause the appearance of the frequent earthquakes of different magnitudes. For that reason, it is necessary to make better informational systems with database with information about area and built environment (GIS) for the total management of seismic risk and risk of other natural disasters, as well as seismotectonic map of Serbia with active faults where the earthquakes are expected. This map would be used as base for making seismic hazard map, which predicts epicenters and magnitudes of earthquakes in longer time period.

All figures are taken from: <http://www.seismo.gov.rs/>