

Impact analyses of earthquake in epicentral area of Kraljevo

Magdalena Markovic, Martina Stokic, Isidora Spasojevic, Ivana Stupar, Aleksandar Jankovic
University of Belgrade, Faculty of Mining and Geology, Belgrade, Serbia (magdalena.markovic@rgf.rs)

This paper presents the impact and consequences of the strongest earthquake in XXI century in Serbia, which happened in Kraljevo town on 3.11.2010. Otherwise, this area is one of the seismically active regions in Serbia

Kraljevo is a city in Republic of Serbia, located in the centre of the country (Fig. 1.). This area follows, chronologically speaking, very active seismicity.

For analyses of earthquake and its affection we shall take into account the date 03.11.2010., when an intense tremor magnitude 5.4 of Richter scale occurred. Figure 2. shows the map of Serbia with places marked where earthquakes have happened.



Fig. 1.: Map of Serbia, the area of the observations are marked with black

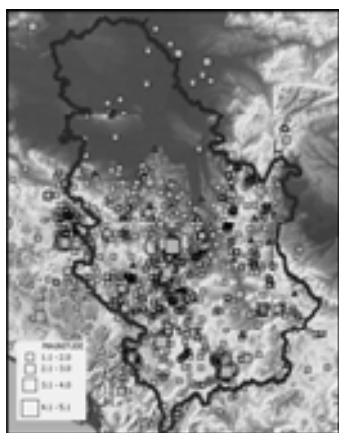


Fig. 2: Map of earthquakes in Serbia (dark grey triangles are seismological stations, while the gray squares marks the value of magnitude of the earthquakes happened in 2010)

After the main earthquake in epicentral area in Kraljevo, its effects in the soil were also observed. In Sira village, a long crack has appeared, longer than 20m (see Fig. 3., marked as number 1.) from which it has expired warm gray-black sand. In the same location (see Fig. 3., marked as number 4.) in the spa of Siran, one of the wellheads has increased munificence five to six times. Enhanced concentration of sulfur was observed in the water which returned to the previous concentration within two days.

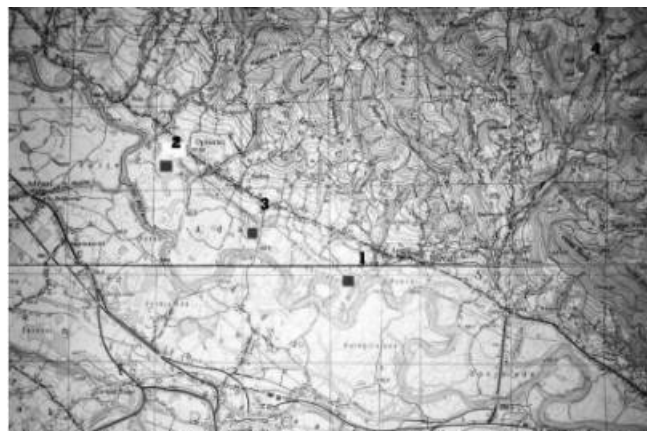


Fig. 3: Locations of appearance of liquefaction in the epicentral area of the earthquake

Nearby, at Oplakic place (Fig 3., marked as number 2.), a crack was also observed, 4-5 m long, from which also warm gray-black sand expired. In Sira, in one well (Fig 3., marked as number 3.), in which the water level was on a depth of 5m, has thrown water and the well was filled in with sand.

These phenomena of seismic deformation in soil are possible consequences of the earthquake and they are classified in four categories:

1. Hydrological effects: level changes of water in wells, waves on water surfaces, changes of capacity of wellhead
2. Effects of slope instability: attrition, small landslides, smaller rockfalls, landslides and massive rockfalls;
3. Horizontal processes in the soil: little and big cracks in soil;
4. Convergent processes or complicated cases: landslides, liquefaction.

Earthquakes are the major natural hazards that lead to loss of life and economic losses due to damage of the buildings. The low quality of old masonry constructions represents a significant hazard in areas of high seismic hazard on the territory of Serbia and studies of the risk of earthquakes is necessary, as well as to develop a correlation between the intensity of the earthquake and extent of damage to buildings in an area or to define vulnerability of buildings to the effects of the earthquake and funds needed for reconstruction. Citizens often want to settle on places which can be easy affected by some hazard. However, it is much more damage, if the settlements built in places that are constantly under the threat of disaster that may cause tremendous damage, such as, for example, earthquakes.

<http://prezentacije.mup.gov.rs/svs/2010-11-03.html>
http://www.seismo.gov.rs/Vesti/aktuelna_Kraljevo-1.pdf
<http://www.seismo.gov.rs/Seizmicnost/Aktuelna.htm>
<http://www.seismo.gov.rs/Vesti/analiza.pdf>