

Evidence of a tectonic transient within the Idrija fault system in Western Slovenia

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Western Slovenia and North-eastern Italy are areas of medium rate seismicity with rare historic earthquakes of higher magnitudes. From mainly reverse component faulting in north-western part of the region where 1976 Friuli earthquakes took place, tectonic regime changes to mostly strike-slip faulting in the Dinaric region, continuing towards southeast. In the northern part of the Idrija fault system, which represent the broader Dinaric strike-slip system there were two strong earthquakes in the recent times - $M_w=5.6$ 1998 and $M_w=5.2$ 2004 earthquakes. Further to the south, along the Idrija fault system, Idrija fault is the causative fault of 1511 $M_w=6.8$ earthquake. The southeastern most part of the Idrija fault system produced a $M_w=5.2$ earthquake in 1926 and few historic $M_w>4$ earthquakes.

Since 2004 $M_w=5.2$ earthquake, no stronger earthquakes were recorded in the region covered by dense seismic network. Seismicity is mostly concentrated in Friuli region and north-western part of Idrija fault system - mostly on the Ravne fault which is the causative fault for the 1998 and 2004 earthquakes. In the central part of the fault system no strong or moderate earthquakes were recorded, except of an earthquake along the Idrija fault in 2014 of magnitude 3.4. Low magnitude background seismicity is burst like with no apparent temporal or spatial distribution. Seismicity of the southern part of Idrija fault system is again a bit higher than in the central part of the fault system with earthquakes up to $M_w=4.4$ that happened in 2014.

In this study, detailed analysis of the seismicity is performed with manual relocation of the seismicity in the period between 2006 and 2016. With manual inspection of the waveform data, slight temporal clustering of seismicity is observed. We use a template algorithm method to increase the detection rate of the seismicity. Templates of seismicity in the north-western and south-eastern part of Idrija fault system are created. The continuous waveform data within the period 2006-2016 is investigated. As a result, high temporal correlation in the years 2009 and 2010 of different bursts of seismicity all along Idrija fault system is observed. These bursts of seismicity located at seismogenic depths do also correlate well with clear changes within the pattern of surface deformation as exhibited by the continuous recording on the tm-71 extensometer in Postojna cave. Four small clusters of seismicity start in late 2009 in north-western part of Idrija fault system, migrating along the neighbouring faults in the region through 2010, together forming a swarm-like cluster of seismicity. In the same time period seismic swarm took place along Predjama fault, which is monitored by the Postojna extensometer and lasts more than 1 year. Finally, in September 2010 elevated seismicity of Idrija fault system finishes with two $M_w>3.5$ earthquakes in the south-eastern part of Idrija fault system.

In this study we report a clear time dependent tectonic transient that took place along the Idrija fault system between 2009 and 2010 and discuss the physics of earthquake swarms vs. the mechanics of active faults and the related seismogenesis.