IS THERE ANY RELATIONSHIP BETWEEN THE DEWATERING OF THE FUCINO LAKE (1875) AND THE OCCURRENCE OF THE M7 FUCINO EARTHQUAKE (1915)?

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We explored the possibility of a relationship between the dewatering of the great lake that formerly occupied the Fucino intermountain basin (central Italy; Fig. 1) and the occurrence of seismicity recorded in the area since the 20th century and culminated with a M=7 earthquake in 1915 (Cucci and Tertulliani, 2015).

The Fucino lake occupied a depressed area of almost 150 km^2 with a rather constant depth of ~20 m; it was the largest lake of peninsular Italy. The area, agriculturally developed since Roman time, suffered severe floods during the rainy season due to the huge amount of water provided by karst aquifers in the surrounding mountains, the lack of natural effluents and the flatness of the surrounding shores. In order to mitigate the flood hazard a number of engineering projects aimed to the drainage of excess waters have been carried out (see Ward and Valensise, 1989 and references therein for additional details). The first dewatering project started in 52 A.D., with the excavation of a tunnel beneath the lake in order to drain excess waters into the deeper Liri Valley to the west. After a number of attempts to keep the water level within a limited portion of the depression, the lake was completely drained in 1875 following an ambitious engineering project lasted twenty years. By 1900, the old lake became the most important agricultural site of the region. Several small villages located around the lake shore rapidly developed, the most populous being Avezzano (Fig. 1).

The Fucino basin was struck by a M7 earthquake on 13 January 1915; such an event represents one of the most destructive seismic events ever occurred in Central Italy (see Rovida *et al.*, 2016 for additional details). The basin is bordered to the east and southeast by some quaternary faults (the Parasano and Serrone faults; Fig. 1), which were reactivated by the 1915 event, with a recognized rupture of about 23 km in length (Amoruso *et al.*, 1988). This earthquake aroused

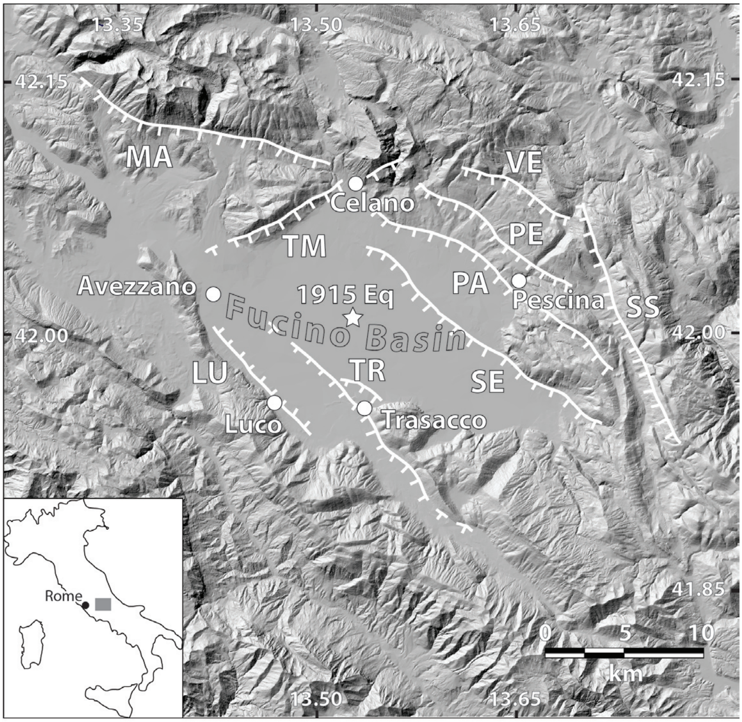

Fig. 1 - Map of the study area. A white star indicates the epicentral location of the 1915 earthquake from the Catalogue of Italian Earthquakes (Rovida *et al*., 2016). Faults modified from Cucci and Tertulliani (2015). Abbreviations: LU, Luco Fault; MA, Magnola Fault; PA, Parasano Fault; PE, Pescina Fault; SE, Serrone Fault; SS, San Sebastiano Fault; TM, Tre Monti Fault; TR, Trasacco Fault; VE, Ventrino Fault.

a large interest because it affected a part of the Apennine chain characterized, from a historical perspective, by a very modest seismicity (Baratta, 1915; Rovida *et al.,* 2016). Therefore, the event surprised a completely inadequate building stock (Oddone, 1915), causing a nearly total destruction of many villages within a large area, including the city of Avezzano, where about 10 000 casualties (90% of the population) occurred. Overall, the event caused about 30 000 fatalities. More than 230 localities suffered destructions and damage estimated greater or equal intensity VIII MCS. The epicentral area, where the destruction was the heaviest, resulted NW–SE elongated, including the Fucino basin and all the localities settled there. In the past decades, several seismogenic faults have been proposed as the source of the Fucino earthquake by means of geological, seismological, geodetic and macroseismic data (see Cucci and Tertulliani, 2015, for a complete overview). The different approaches and techniques used in these studies have led to a variety of speculations about the source mechanism and the fault location often contrasting with one another. Moreover, although it had been hypothesized that (see Castenetto and Galadini, 1999 and references therein for additional details) the dewatering of the Fucino Lake could have influenced (triggered?) the earthquake's occurrence, no quantitative attempts to verify such a hypothesis have been proposed in literature. Hence, a numerical poroelastic model is investigated to estimate the stress changes induced by the dewatering of the Fucino lake. The numerical simulations provide a computational framework to estimate the amplitude, extent and temporal scales of the medium response. The stress changes are computed along the seismogenic source to assess likely relationship between pore pressure variations and seismicity. We performed numerous simulations in order to cover the wide spectrum of seismogenic faults proposed in literature as the source of the Fucino earthquake. Preliminary results evidence that the crustal unloading stresses related to the dewatering of the Fucino lake were not able to trigger the 1915 Avezzano earthquake. In particular, we observe a negative variation of the coulomb stress on large sectors of the tested seismogenic faults, discouraging the slip on them.

References

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