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Geochemical continuous signals in seismic areas: the case of the Mugello Basin, Central Italy

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The Mugello basin (Tuscany, Italy) is one of the areas with the highest seismic risk of Tuscany, having been subjected in the past to earthquakes up to Mw 6.38 (Rovida et al., 2020). As detailed in the seismic risk map of Italy, this region is characterized by a quite high value of the Peak Ground Acceleration index (PGA> 0.175, Stucchi et al., 2011). As a part of a seismic prevention/prediction program of the Regional Government of Tuscany, the Mugello basin was chosen, ten years ago, as a monitoring site for possible hydrogeochemical precursors of seismic activity. For this purpose, the IGG-CNR of Pisa has realized an automatic continuous monitoring station, equipped with sensors for the concurrent measurement of temperature, pH, redox potential, electrical conductivity, CO_2 and CH_4 dissolved concentration (Cioni et al., 2007). According to literature guidelines (e.g. Martinelli and Albarello, 1997), after a preliminary hydrogeochemical screening carried out on 2011, the automatic surveying station was placed in correspondence of the Postignana spring. This spring is located at an altitude of 476 m a.s.l., in correspondence to a major extensional structure, the Ronta fault system (Sani et al., 2009), held responsible for the Mw = 6.8 destructive earthquake of June 29th, 1919. With a stable temperature of 13°C and a permanent outflow of a few liters/minute (with reduced seasonal oscillations), the Postignana spring discharges low salinity waters (600 mg/l). Here we present the anomalous variations in the dissolved content of CO_2 and electrical conductivity recorded by the automatic station, before the Mw 4.5 Mugello earthquake occurred on December 9th, 2019.

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