INFERRING THRESHOLD BEHAVIOR OF THE SUPRAMONTE KARST AQUIFER FROM TRACER TEST AND ITS IMPLICATION FOR GROUNDWATER PROTECTION (SARDINIA, ITALY)

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Karst aquifer are very susceptible to contamination and the release of pollutant might be quickly transport over large distances in high water conditions or could reach springs with long delay during dry periods. For an efficient protection of karst water against contamination it is essential to understand the characteristics of the solute transport within the aquifer in different hydrological conditions. This can be investigated performing an artificial tracer test as simulation of a contamination event.
This approach was applied to the Supramonte massif, a karst aquifer hosted in a remote area of Sardinia (Italy), unfavourable for dense human settlement. For this reason, the quality of its groundwater is still relatively high. Nevertheless, due to its rapid recharge from allogenic and autogenic water, this aquifer is especially vulnerable to an eventual toxic substance infiltrated in its underground network.
At the end of July 2014, the fluorescein was diluted in the sinking stream just below the waterfall within the Dorgheddie Cave in the fluviokarstic canyon of Gorropu at the eastern side of the Supramonte aquifer, while 3-bags of charcoal were placed into the water of Gorrupu and Su Gologone springs, the main outflows of the karst aquifer,. The charcoal captor analysis were carried out after alcoholic potash extraction using a Turner Designs Digital fluorimeter equipped with a UV photomultiplier detector tube armed with fluorescein filters (E_{ex}=520 nm and E_{em}= 550 nm) with a detection limit 0.01 ppb. The water physical parameters were determined with a portable Hanna HI991301 sensor measuring pH, temperature and electrical conductivity. The alkalinity was determined in situ as bicarbonate ion concentration by titration.
In autumn and winter 2014-15 an extraordinary dry period lasted a few months. In the four months after the injection only one efficacious rain event occurred that was not sufficient for the mobilization of the tracer toward the spring. At the beginning of February 2015, six months later from dye injection and after few days of intense rainstorms, the fluorescein was detected at the Su Gologone spring with maximal concentration of 0.3 ppb. Even after several weeks of sampling no fluorescent tracer was detected in Gorropu spring.
The tracer test results proved the underground connection between the central-east area of Supramonte and the Su Gologone spring, in the northern sector of the aquifer. It also showed that at low water discharge there is a geological threshold that avoids water from the eastern drainage network to reach the main outlet in the northern side.
This study has contributed to the hydrogeological knowledge of the of Supramonte karst area

determining a new underground water flow connection. It has also delineated the catchment area of the Su Gologone spring at the eastern margin of the aquifer and the hydrodynamic behaviour for the water movement in the saturated zone towards spring in low flow conditions. It was also highlighted the groundwater vulnerability of this karst system to a hypothetic contaminant transport and the impact of drastic temporal variation on particular hydrological conditions.