



Definition of a Sinkhole hazard methodology in the Pontina Plain (Latium Region, Central Italy)

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The work presented here is the continuation of "Sinkhole Project of Latium Region" (2002), carried out by Researchers of the Laboratory of Applied Geology and Hydrogeology of the Department of Geological Sciences of the University "Roma Tre", Rome (Italy), through which were found, in different plain of the whole Region, Sinkhole prone areas, using a methodology based on the superimposition of thematic layers corresponding to geological and anthropogenic breaking factors.

In the last years several specific investigations have been conducted by Researchers of the Laboratory in the Pontina Plain, that is located in the south west of the Latium Region, concerning the geological-stratigraphic setting, the sketch of flow in the aquifers located in the Pontine depression, the chemophysical groundwater characteristics, the density of wells, the amount of well pumping and piezometric changes. This required the implementation of several piezometric and chemophysical surveys, the collection and validation of a large number of stratigraphic and geophysical data.

All data in the archive have been computerized and the maps vectorized. This makes it possible today to address the analysis with Geographical Information Systems and to start numerical flow simulations, regarding both the heavily drained deep confined aquifer, and the areas subject to the presence of an important water exchange between the recharge area in the Lepini Mountains (carbonatic ridge) and terrigenous aquifers of the plain.

Among the main causes that trigger the catastrophic collapses there are, in fact, all the phenomena that cause the mass density reduction through erosion, leaching, dissolution. All these agents are associated with water circulation: flow, velocity, CO₂ saturation rate, carbonates saturation rate.

The spread in the Pontina plain of deep and high pumping wells, wrongly built without the correct way of progress, and without the realization of cemented portions properly located, can lead to the rise of the artesian groundwater that flows into sandy horizons scarcely thickened, carrying out liquefaction and collapse phenomena. Thus, thanks to the numerous piezometric surveys, different areas have been identified in the plain: artesian wells areas with full water rise, areas with few artesian wells and areas with partial water lift.

The analysis of geophysical data has allowed to draw deep profiles that show how along the axis of the plain the roof of carbonates has very changeable heights, due to a complex tectonic evolution. In correspondence to one of the most senior buried structural heights in the carbonate substratum of the plain, a karst cave was intercepted during a drilling on the vertical of a sinkhole opened in 1989, which could be interpreted as a paleospring. The right application of technologies for drilling and completion of the hole, however, has prevented against the recurrence of the phenomenon of collapse.

This poster illustrates a matrix calculus implemented by the authors, by which you can come to an assessment of the distribution of Sinkhole hazard in the Pontina Plain. The matrix takes into account different parameters that are related to the breaking causes of the phenomenon. Each parameter is assigned a value (index) representing its variation. The area studied was divided into 150 m square cells, each cell is assigned the value of the Sinkhole hazard index, that is the sum of the various indices assigned to that cell. Such a methodology widely used in other scientific research must be improved by optimizing the values and weights that were assigned to each parameter and implementing the matrix by adding more parameters that influence the phenomenon. A discussion about the importance of these characterizing parameters is presented for further development of the methodology.

