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Intrinsic Vulnerability of the Alburni Karst System (Southern Italy)

D. Ducci

Sez. Geologia Applicata, Dip. Ingegneria Geotecnica, Università di Napoli Federico II, Naples, Italy (daniela@unina.it / Fax: +390817682162 / Phone: +390817682165)

In order to assess the aquifer intrinsic vulnerability of the Alburni karst system (Southern Italy) at medium scale (i.e. 1:50,000), the "European Approach" has been applied. In the year 2003, a task group of COST 620 (Action: "Vulnerability and Risk Mapping for the Protection of Carbonate - Karst - Aquifers") proposed this Approach. The European Approach uses four factors in assessing intrinsic vulnerability: Overlying layers (O), Concentration of flow (C), Precipitation regime (P) and Karst network development (K). The factors O, C and K represent the internal characteristics of the system, while the P factor is an external stress applied to the system. The O factor may comprise up to four layers – soil, subsoil, non-karst rock and unsaturated karst rock. The C factor recognizes that in karst areas the overlying protective layers may be bypassed by runoff, which is concentrated at or near the surface of the ground and which then enters the groundwater system via a doline or a stream sink. The K factor should affect the transfer of karst water towards boreholes and/or springs.

The Alburni massif (1742 m a.s.l.) stretches NW-SE, about 23 km long and 9-10 km wide, covering 246 $km^2$with an average elevation of about 940 m a.s.l.. This massif, with more than 500 caves, is the most important karst area of southern Italy, the drainage network is not continuous, and there are several endoreic basins and large zones without superficial drainage but with many sinkholes and dolines.

The areas of concentrated infiltration are represented by little graben located on the plateau, especially in the central sector, feeding one or more ponors that show high discharges, in coincidence with heavy rainfall.

The karstic channels ($>$ 100), well explored in the past, directly communicate with the above mentioned infiltration areas. The most important ones are well hierarchised

and with a wide extension. Some of them feed an important spring ($1m^3/s$) with a very short transit time; others instead communicate directly with the basal water table related to other springs ($Q > 3$ m3/s).

Some ponors are just above the basal water table and located in urbanized areas; for years in the past a ponor has been transferring directly pollutants into the aquifer.

A groundwater vulnerability map has been created using the “O” and “C” factors on basis of the evaluation of karstification from speleological data deriving from field investigation. Soil thickness and soil properties were obtained from stratigraphic data from boreholes and pedological maps.

The unsaturated zone thickness has been calculated from groundwater levels. Land-use data were partially derived from Corine Land Cover maps and slope characteristics from a digital elevation model using a GIS. Every lithological unit has been classified assigning a corresponding permeability value.

The thematic maps and the vulnerability maps were drawn up using a GIS.

The final vulnerability map shows that the prevalent vulnerability degrees are high and very high, due to the widespread karstification of the area and to the presence, on the plateau, of large vegetated areas with gentle slopes favouring fast infiltration.

Interpreting the information on the map in the light of land use, development planning and groundwater protection, the Alburni karst area requires great care regarding the location of the potential contamination sources.