

KINDS OF AQUIFER RECHARGES IN CARBONATE ROCKS

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What are the kinds of aquifer supplies in carbonate rocks?

Why is it important to know the supply factors of an aquifer in carbonate rocks?

The aquifers in carbonate rocks are mainly fed by contribution connected to primary recharge (autogenic) and/or from contribution linked to the secondary recharge (allogenic) (White 1969; Dreybrodt 1988; Bakalowicz 2005; Ford & Williams in 2007; Palmer 2007; Vigna 2016).

The contributions from the autogenic recharge are related to the direct recharge (rainfall or water of snow melting) which affects over time, only the carbonate massifs. The contributions from the secondary recharge, consist of water runoffs amount from low permeability rocks bordering the carbonate aquifer or of water circulating in secondary aquifers. These aquifers, usually detrital or fractured rocks, cover the carbonate ones and transfer their water to the karst aquifers. In order to examine the different recharge contributions of an aquifer in carbonate rocks, a series of karst systems located in the Southern Piedmont area, characterized by different hydrological situations, are examined. The springs of such systems have been equipped for several years with multiparameter loggers, in order to detect flow rate, electrical conductivity and groundwater temperature. Where surface water infiltrates in the ground, tests with artificial dyes and chemical analysis have also been carried out. In the same way in the spring areas, chemical analyses of groundwater have also been performed.

The hydrodynamics and the main chemical-physical parameters of the spring waters are in part influenced by different recharge contributions to the karst aquifers. In various studied karst systems, the contributions provide by runoff waters and/or overlying or adjacent aquifers, are proved particularly important. The monitoring data and the breakthrough curve of the tracer tests have allowed to reconstruct the kind of circulation of infiltration water into the karst aquifers and to calculate the velocity of groundwater flow. The chemical analysis of the water provided additional information to understand the correlation between runoff and spring waters. The study highlighted the importance of allogenic recharge coming from portions of insoluble rocks bordering the karst aquifers. In relation to these study cases, it is possible to define three different situations: aquifer with predominant primary supply, aquifer with primary and secondary supply, aquifer with predominant secondary supply.

References

- Bakalowicz M (2005) - Karst groundwater: a challenge for new resources. *Hydrogeol J.* 13: 148-160
- Dreybrodt W (1988) – Processes in karst systems, physic, chemistry and geology. Ed. Springer verlag: pp.288
- Ford D., Williams P (2007) - Karst hydrogeology and geomorphology. Ed. Wiley: pp. 562
- Palmer a. N. (2007) – Cave geology. Cave books - Cave research foundation: pp. 454

- Vigna B. (2016) – Modelli concettuali relativi agli acquiferi in rocce carbonatiche. Atti Conv. “La ricerca carsologica in Italia” Frabosa Soprana (CN) – Grotte di Bossea, 22-23 giugno 2013: 177-188
- White W.B. (1969) – Conceptual models for carbonate aquifers. Ground Water 7 (3): 15-21.

