

the entire catchment area of each source should be proclaimed a wider zone of sanitary protection.

The results of tracing experiments with groundwaters indicate that under convenient conditions, the pollution may migrate as far as 10 km of rectilinear distance as early as 24 hours. Active hydraulic connections between the ground and surface waters, where by the harmful components may be carried from great distances including nonkarst terrains and infiltrated into the narrowest spring zone, have a particular significance in this regard.

ENVIRONMENTAL ISOTOPES IN KARST

Hydrodynamics of Almyros karst aquifer, Crete island, Greece

M. Probst¹, H. Zojer¹, M. Knithakis², and W. Stichler³

¹*Institute of Hydrogeology and Geothermics, Joanneum Research, Graz, Austria*

²*Institute for Geology and Mineral Exploration, Rethimnon/Crete, Greece*

³*International Atomic Energy Agency, Vienna, Austria*

The brackish karst spring of Almyros is located about 8 km west of Iraklion one km inland from the coast. With its discharge between 3 and approximately 50 m³/s, it is the largest spring on Crete Island. Because of its complicated underground drainage system a number of hydrogeologists have carried out local and regional studies. The spring itself emerges along a large pre-Neogene N-S fault separating the Neogene and alluvial

plain of the Iraklion trench from the karst massif of dolomitic limestones.

Recent investigations were dealing with the mechanism of salinity, calculations of the seasonal fresh water components and its recharge dynamics. Almyros spring reacts quickly, though sometimes with a certain delay, to precipitation events. Looking at the mean flow duration curves for some investigated years one can see a very steep falling curve representing the fact that a discharge of 14 m³/s was only reached or exceeded for 30 days (<10%) in the year. This is caused by high runoff periods during the winter time mostly shown as direct runoff.

Chloride content of spring water usually decreases with increasing discharge. The highest sea water portion is calculated between 22 and 23%. As the maximum permissible chloride content for drinking water is given at 200 mg/l the spring ought to have drinking water quality with respect to chloride at a discharge of at least 11.8 m³/s.

During the season 1985 and 1986 the dynamic of the karst water body was investigated by the correlation of spring discharge, chloride content and concentration of oxygen-18. It is evident that the peaks of spring discharge are accompanied by an increasing of fresh water portion. At the same time the oxygen-18 content decreases since the fresh water is less enriched with stable isotopes because of the temperature effect. By calculating the ¹⁸O-curve of fresh water it is shown that the recharge



from high altitudes is reaching the spring about two months after the increase of spring discharge.

Finally the comparison of different methods leads to the conclusion of different storage capacities in the individual geological-tectonical units.

Isotopic and hydrochemical significance of a karst aquifer within the semi-arid Datong coal mine area, China

J. Zhimuo¹, Z. Pingsheng¹, F. Rongan², F. Guangchan², and G. Weizu³

¹Datong Coal Mining Administration, P.R. China

²Coalfield Geology Administration, P.R. China

³Nanjing Institute of Hydrology and Water Resources, P.R. China

Water resources become an urgent problem for the semi-arid Datong region, a main coal mine area of China. After decades of development of pore water from Quaternary aquifers, great attention has turned to the potential of the South-Kouquanguully karst aquifer of Ordovician period extended about 710 km² with depths 170 to 400 m. This aquifer is geologically formed on a large syncline. However, two kinds of karst water within this large aquifer have been identified isotopically and hydrochemically. It is formed due to the distribution of local faults and igneous rocks. It reveals that two different hydrochemical environments accompanied with different recharge and discharge conditions are existed.

Stable isotopic data shows that the δD vs $\delta^{18}O$ of local precipitation marches the world meteorological line WML, but this relationship of karst groundwater shows another picture. Two groups of karst water from this aquifer could be distinguished. Data of the first group is situated near to the WML, it implies that this kind of karst water is mixed by recent precipitation which could be demonstrated by comparing the annual variations of groundwater level within boreholes with that of precipitation. Data of the second group has a δD vs $\delta^{18}O$ paralleled to WML with a deuterium excess very near to zero, it implies that this kind of karst groundwater is originated during ancient climate environment.

Two kinds of karst water show its hydrochemical differences. The first group has a hydrochemical water type of $HCO_3^-/HCO_3^- \cdot SO_4^{2-}$ but second group is rich in Na^+ but poor in SO_4^{2-} which seems to be formed within a relatively isolated environment. Typical data of ions and other indexes e.g., carbonate-saturation etc. of these two kinds of karst water are compared and listed, and a piper diagram related to is shown.