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Extended Abstracts

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THE PROBLEM

Non-point sources pollution of groundwater by nitrates has been found rather serious and has profound effect on human health in some areas of North China. In order to control the pollution, it is necessary to understand the mechanism of pollution and identify sources of pollutants. For this purpose we have chosen Tangshan area as an example to conduct a detailed study, using isotope techniques in particular (Fig. 1).

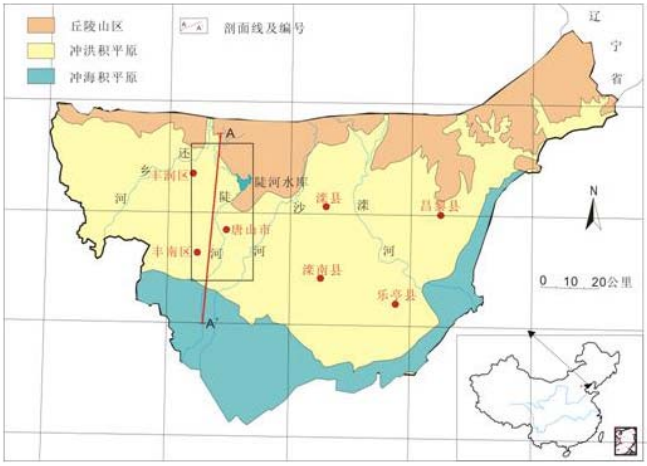

Figure 1. Location of Tangshan area.

Nitrate concentration in shallow groundwater is based on samples of 76 wells. Results show that groundwater from 33 wells exceeds the drinking water limit (50 mg/L-NO_3), with the maximum concentration of 226 mg/L. Sampling transects have been designed to go acroos these areas of high nitrate (Fig. 2).

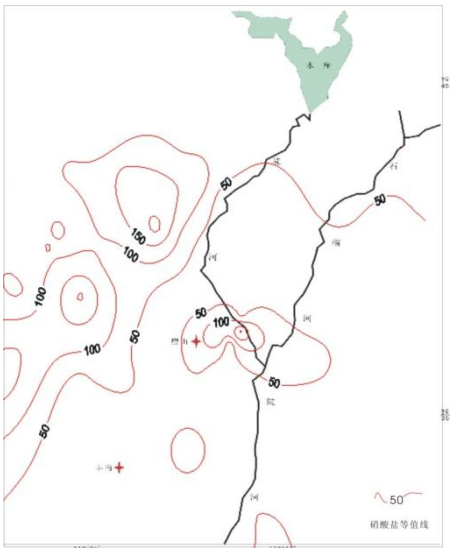

Figure 2. Isolines of nitrate concentration in groundwater.

SAMPLING AND ANALYSES

In order to define the sources of pollutants, we sampled natural waters from reservoir, river and water supply wells. Analyses include: water chemistry, oxygen and hydrogen isotopes, tritium, nitrate isotopes, sulfate isotopes, carbon-14 as well as CFCs.

MAIN CONCLUSIONS

It has been found that groundwater carries strong evaporative isotopic signature (Fig. 3). The top aquifer Q4 is recharged by precipitation, irrigation water. It is connected to the second aquifer Q3 but has limited connection to deeper aquifers. The Karst aquifer is recharged by precipitation in the mountains and is basically independent from the overlying aquifers.

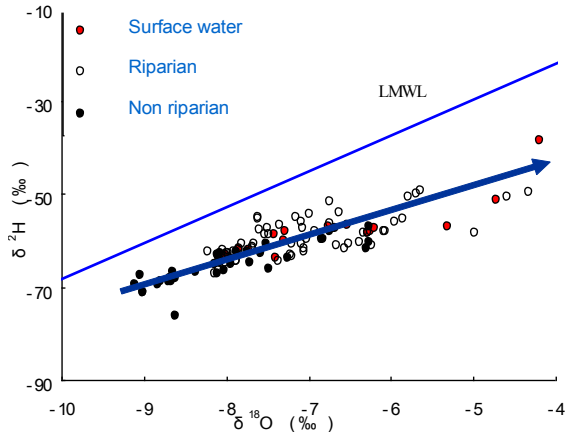

Figure 3. The relationship between δ^2H and $\delta^{18}O$ in the samples from the study area.

The average resident time of the karst aquifer is 20 a, changing to 27a towards central part of the plain. Tritium concentration varies with depth, and top one has the shortest residence time.

Other aquifers vary from 50a to 5a. Local circulation system is controlled by groundwater extraction. Q1 aquifer in the deepest part of the system was recharge by the water older than 50 a, and its stable isotopes indicate that the water is from early Pleistocene with cold and wet climate conditions. The high ^{15}N of river water shows that the source is sewage, there is no signs of denitrification or plant uptake in the river. Nitrate in groundwater is the mixture of manure and synthetic fertilizer, and later contributes about 60%. Non-riparian zone groundwater keeps the original $\delta^{15}N$ signature. Riparian zone groundwater has undergone denitrification of different extent.

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