

IGCP448 academic annual meeting "World Correlation on Karst Ecosystem"

Application of hydrogeochemistry in quantification of karst water circulation

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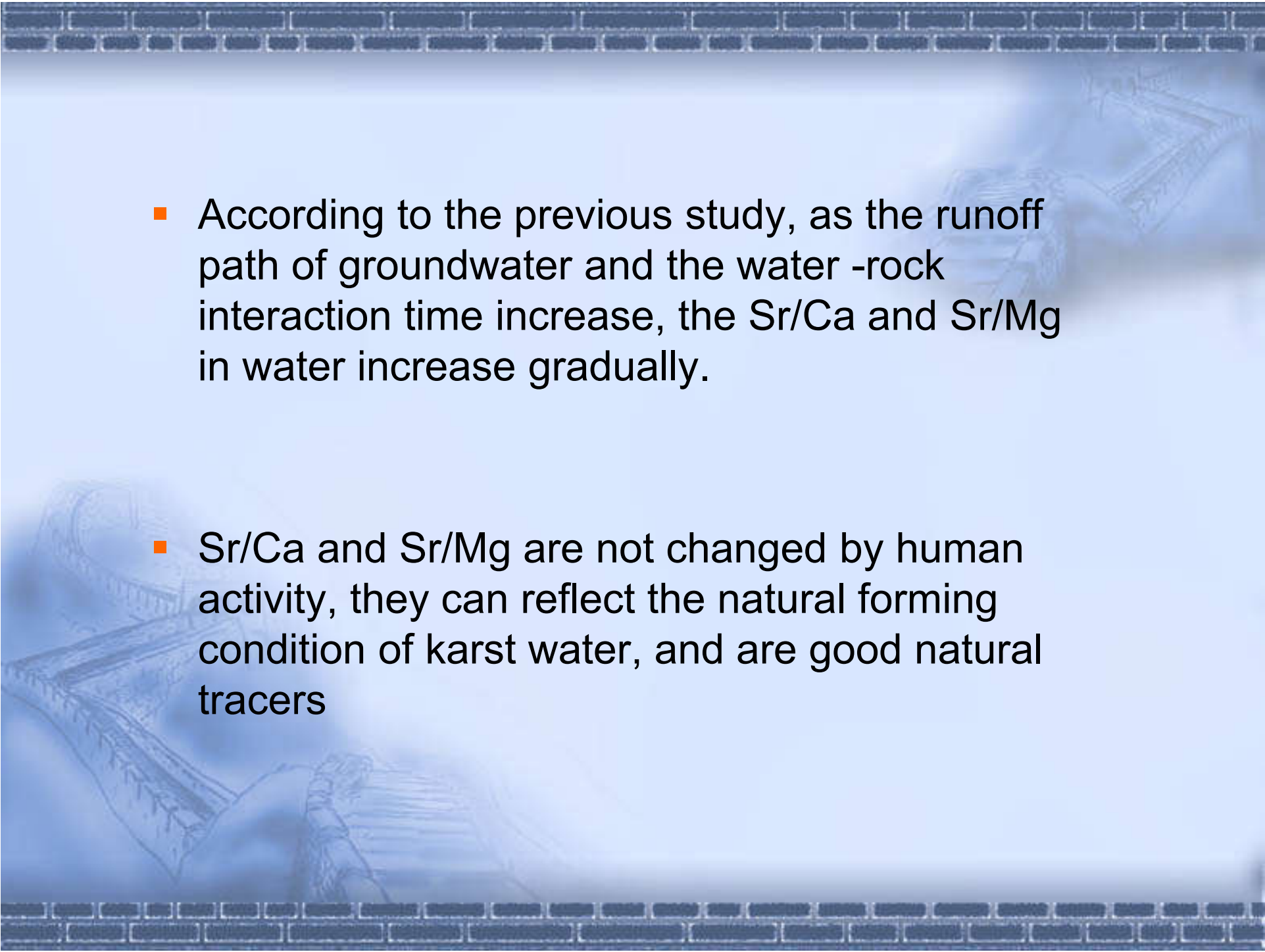


subterranean river water has three parts :

- epikarst water
- fracture water in saturated layer
- surface overland flow

Precipitation first recharge the epikarst zone:

- A part of it permeates into the saturated-aquifer through crevasses, recharges subterranean river system.
- The other part overflows on the earth's surface (or in the form of runoff flow) in proper position, then flows into the sinkhole to recharge the subterranean river.
- Precipitation, only when it exceeds the regulating ability of the epikarst zone, forms into surface overland flow, inflows into sinkhole and recharges subterranean river directly.

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- According to the previous study, as the runoff path of groundwater and the water-rock interaction time increase, the Sr/Ca and Sr/Mg in water increase gradually.
 - Sr/Ca and Sr/Mg are not changed by human activity, they can reflect the natural forming condition of karst water, and are good natural tracers

1. Overview on Langshi subterranean river

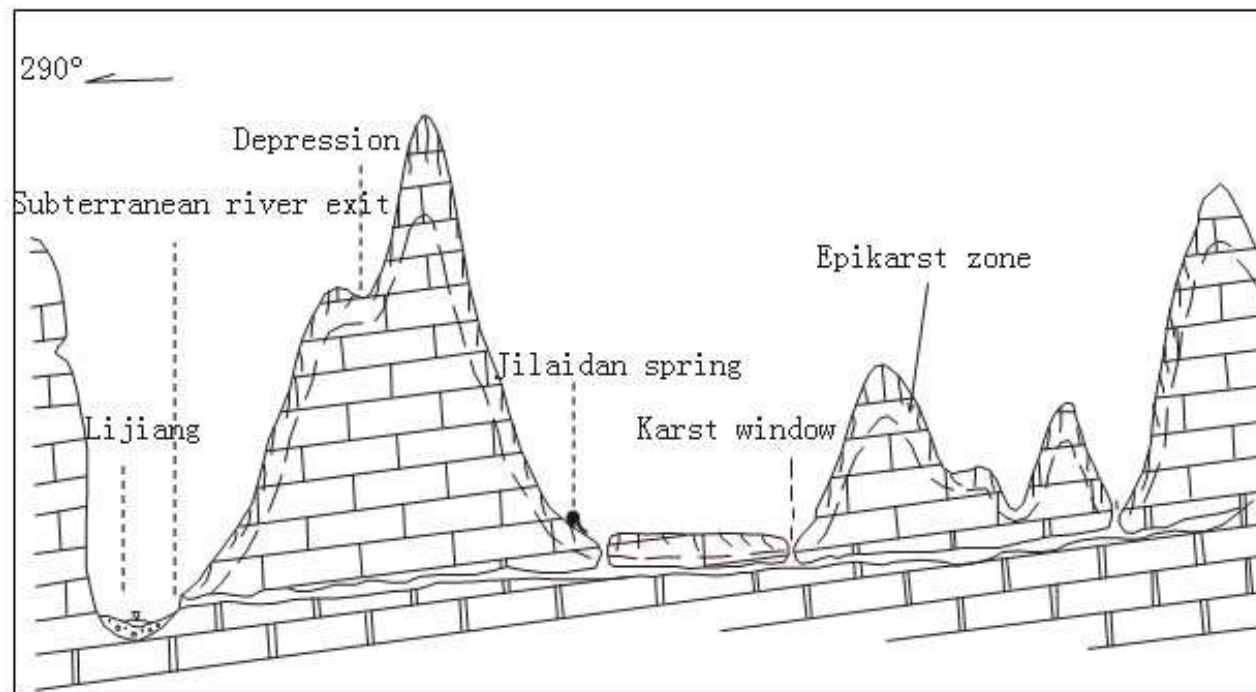


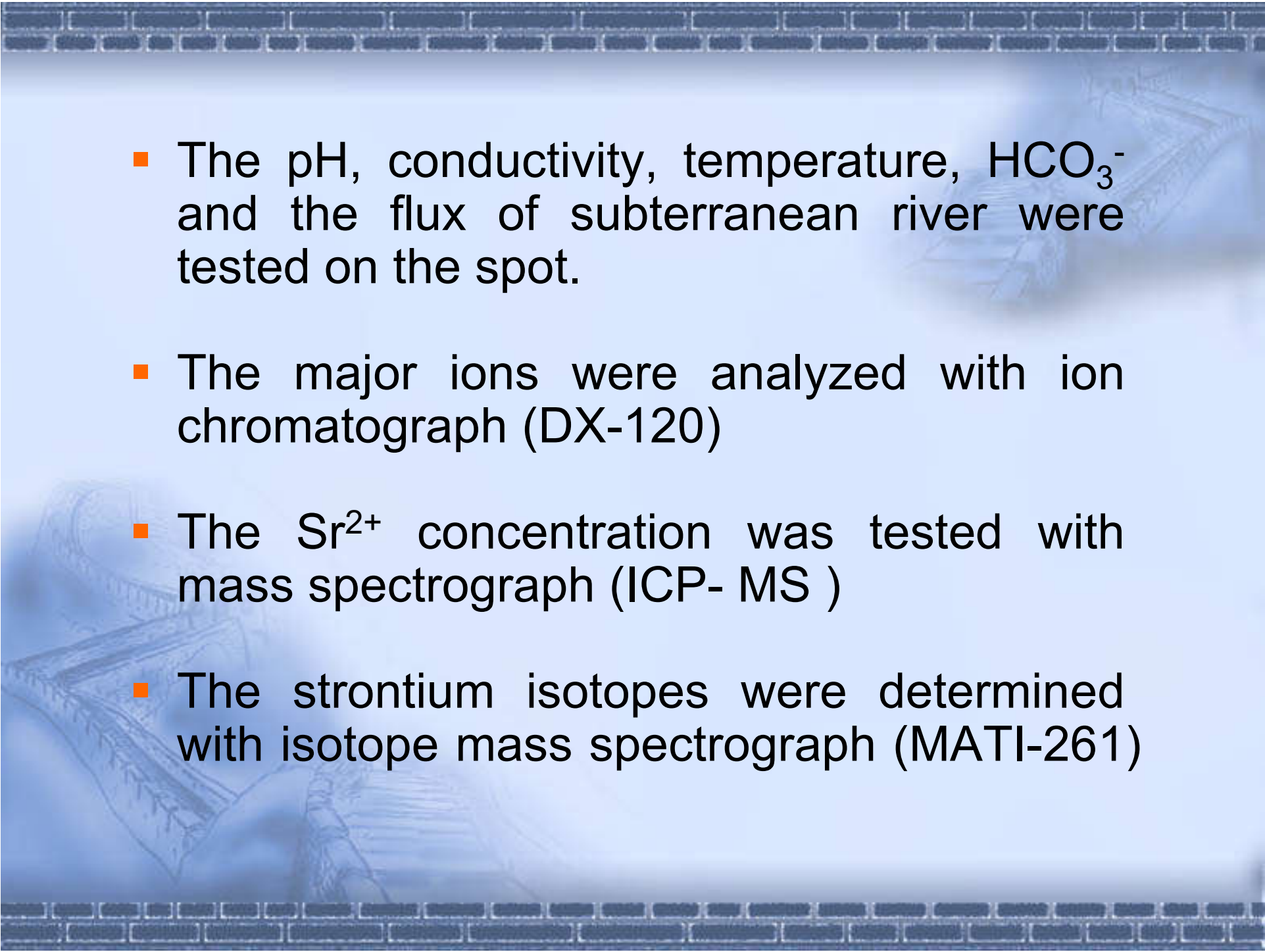
Fig.1 Hydrogeological section of Langshi subterranean river system

2.Sampling and analyzing

monitoring spots:

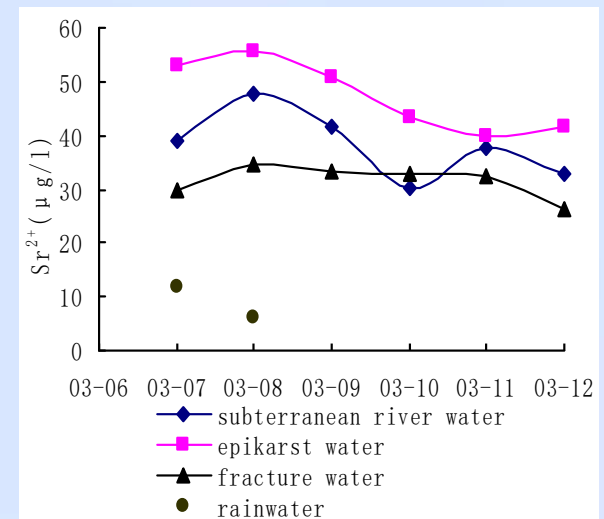
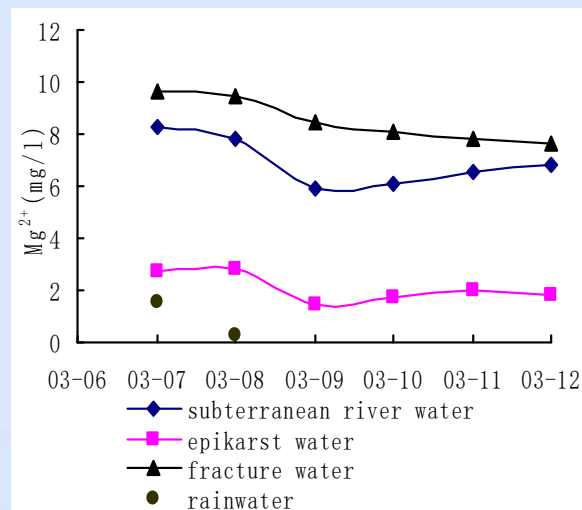
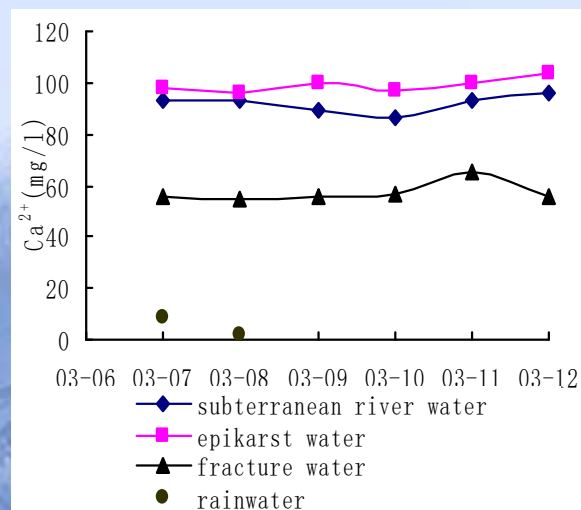
- Jilaidan spring
- subterranean river exit
- CF1 drill in Yaji subterranean river

Samples were gathered monthly from July to December in 2003

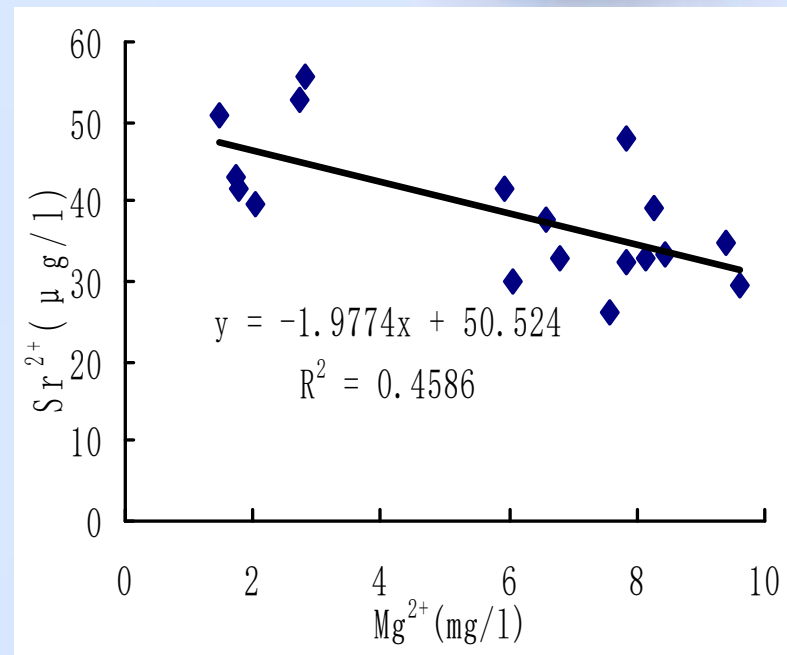
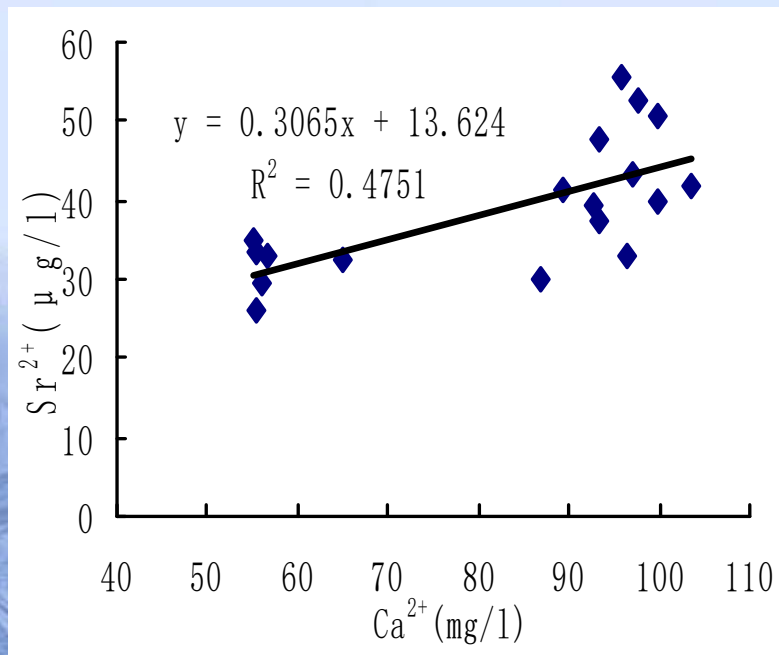
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- The pH, conductivity, temperature, HCO_3^- and the flux of subterranean river were tested on the spot.
 - The major ions were analyzed with ion chromatograph (DX-120)
 - The Sr^{2+} concentration was tested with mass spectrograph (ICP- MS)
 - The strontium isotopes were determined with isotope mass spectrograph (MATI-261)

3. Hydrochemical characteristics of karst water

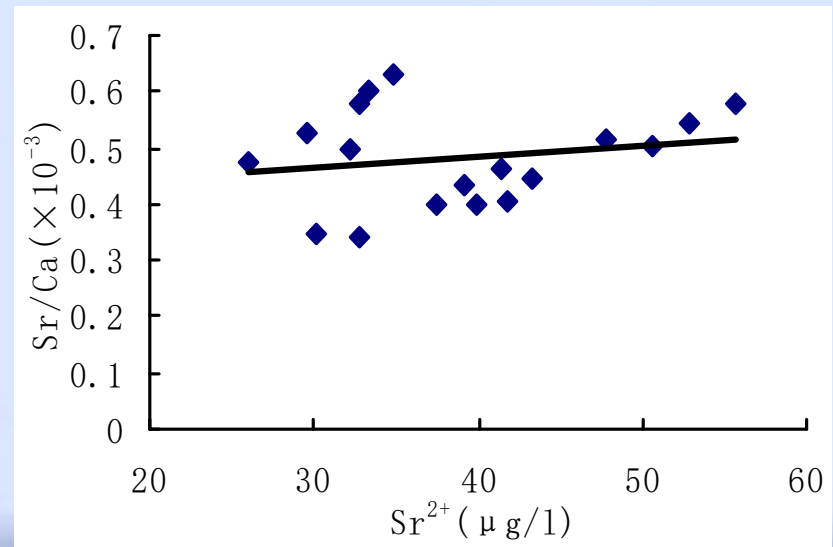
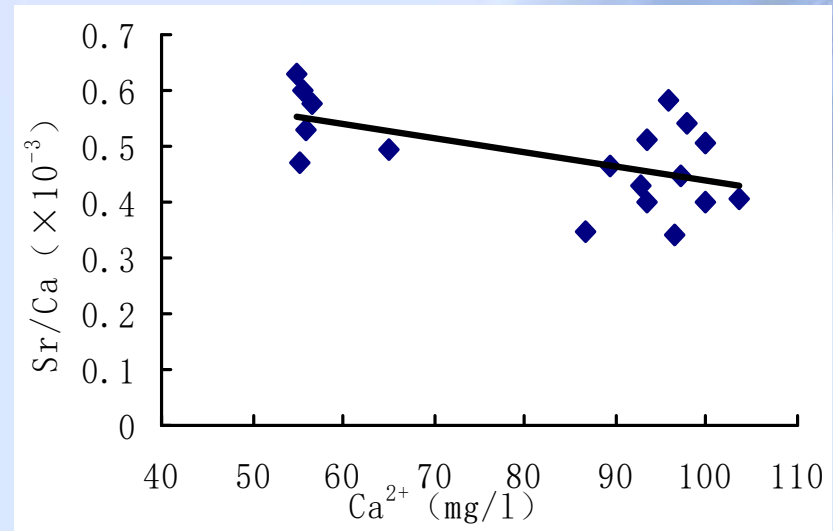
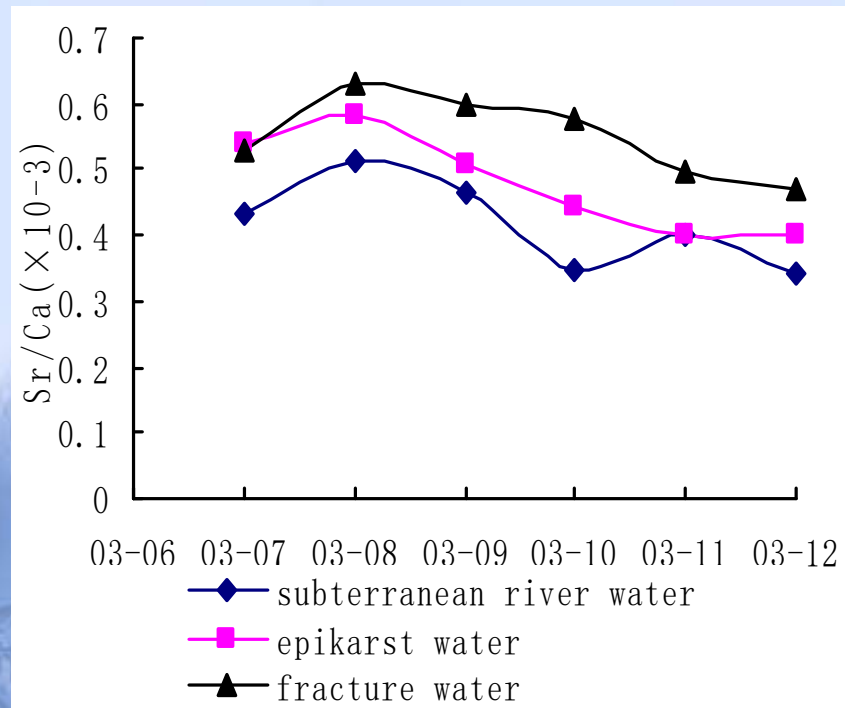
- characteristics of Ca^{2+} , Mg^{2+} and Sr^{2+}



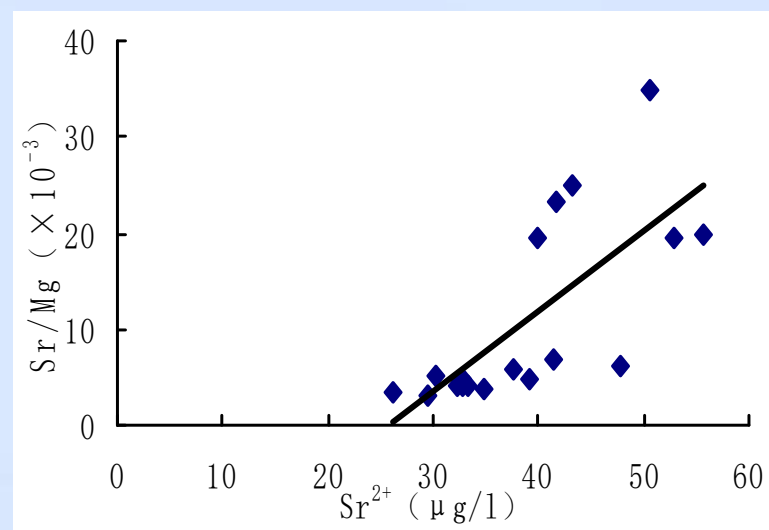
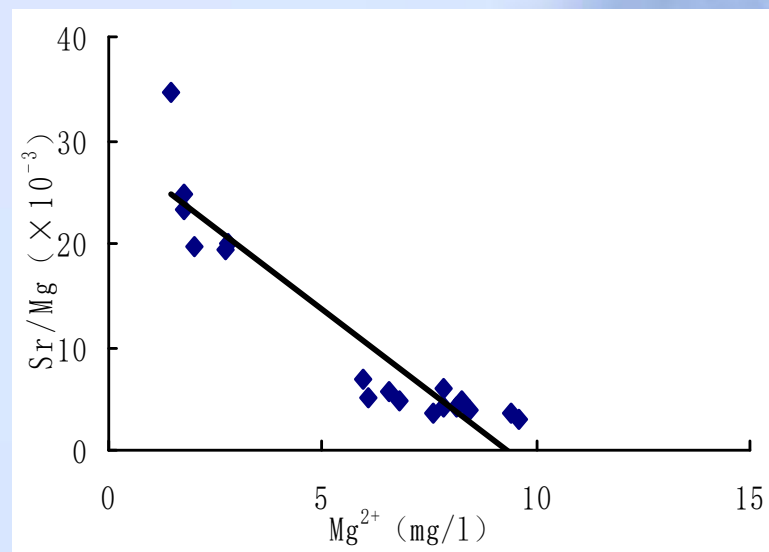
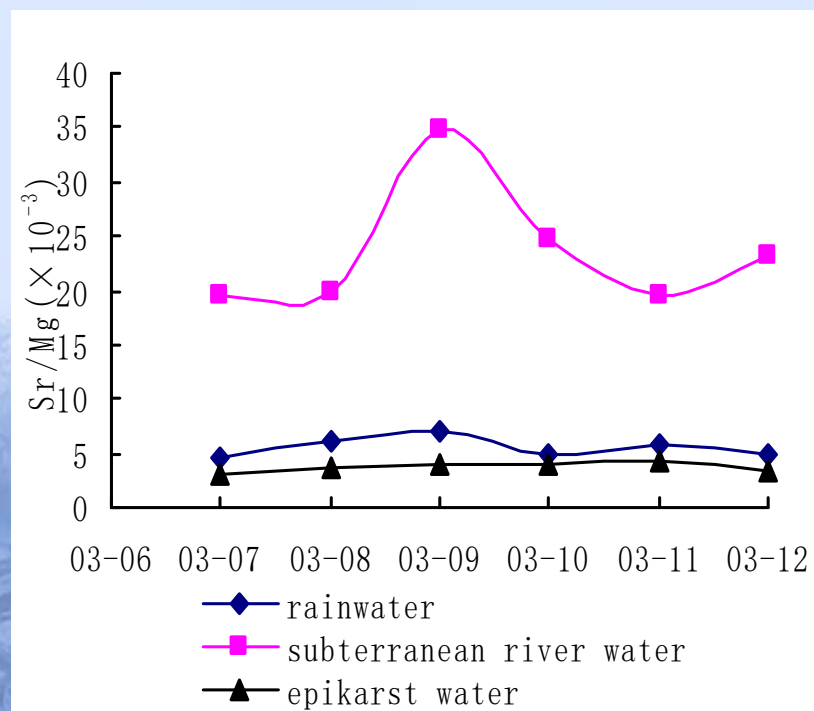
- Relationship between Sr^{2+} and Ca^{2+} 、 Mg^{2+}



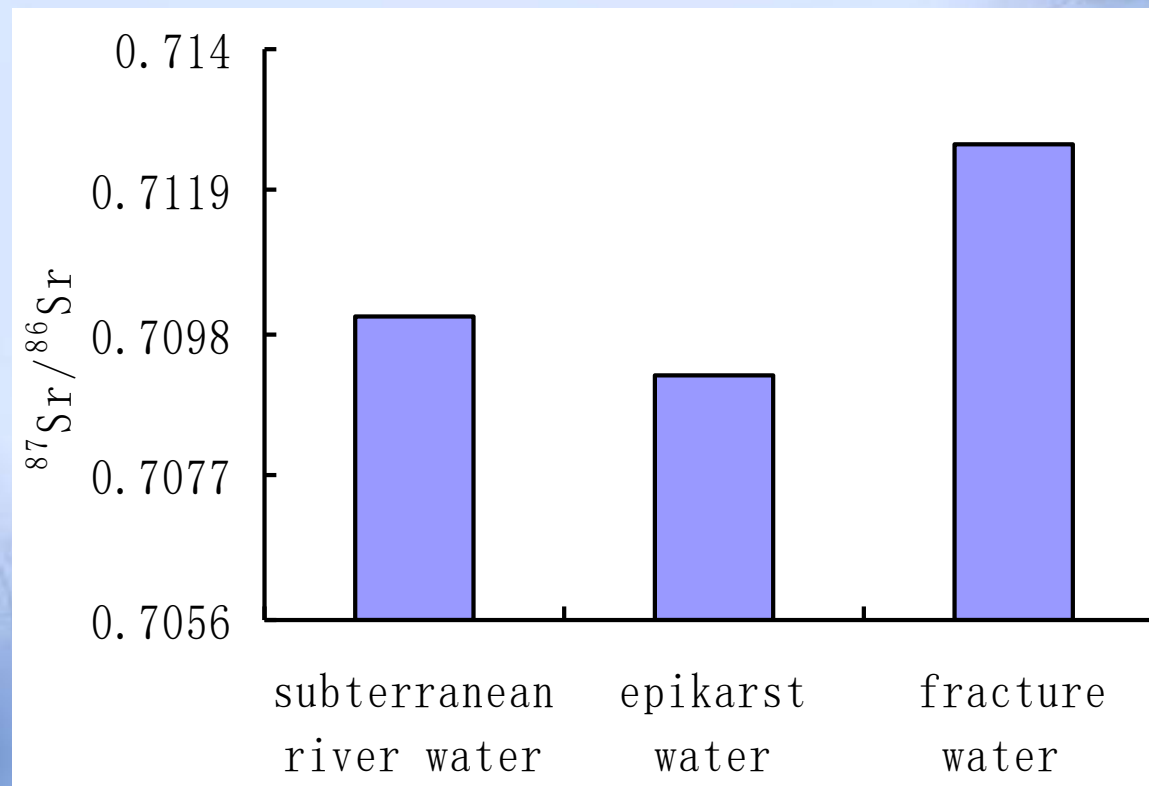
•Sr/Ca characteristics



•Sr/Mg characteristics



•Characteristics of $^{87}\text{Sr}/^{86}\text{Sr}$



4. Evaluation on epikarst water resource

- Evaluating model

$$x_i = \frac{1}{1 - \frac{(C^a / C^b)_m C_i^b - C_i^a}{(C^a / C^b)_m C_j^b - C_j^a}}$$

$$\frac{x_i}{x_k} = \frac{\left(\frac{C^a}{C^b}\right)_m \left[C_j^b \left(1 - \frac{1}{x_k}\right) - C_k^b \right] + C_j^a \left(\frac{1}{x_k} - 1\right) + C_k^a}{\left(\frac{C^a}{C^b}\right)_m (C_i^b - C_j^b) + C_j^a - C_i^a}$$

- Calculation of water resource amount in epikarst

$$M_i = \frac{Q_i}{F}$$


- Use $^{87}\text{Sr}/^{86}\text{Sr}$ value to verify the evaluation results

•Calculation result

- The proportion of epikarst water in the subterranean river is 0.212.
- The runoff flow modulus of the epikarst zone is 0.7l/s.km².
- The verification error of $^{87}\text{Sr}/^{86}\text{Sr}$ is less than 5%

5. Conclusion

- Using karst hydrochemical method to evaluate the quantity of epikarst water resources has a advantage ,it does not need to set up a long-term monitoring station to test the flux of the epikarst spring
- It is smaller in evaluating epikarst water resources by the flux of epikarst spring. Because not all epikarst water overflows by way of the spring, a part of it flows into a sinkhole and recharges to subterranean river in the form of runoff flow.
- It is a scientific, practical, convenient, and effective method to evaluate the amount of epikarst water with Sr/Ca, Sr/Mg and $^{87}\text{Sr}/^{86}\text{Sr}$. It can be used in the karst hydrogeology survey and research work in mountain areas.

The background is a light blue gradient. At the top and bottom are horizontal borders with a dark blue brick pattern. In the lower-left corner, there is a faint, sketchy illustration of a stone bridge with arches and a walkway. In the upper-right corner, there is a faint, sketchy illustration of a stone wall or structure, possibly a fortification or a large building.

THANK YOU!