

A NEUTRON ACTIVATION STUDY OF THE GEOCHEMISTRY IN THE NATURAL WATERS OF LHASA, TIBET, CHINA

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INTRODUCTION

The state of elements in natural waters is significant to ecohydrology. However, information obtained from current hydrochemical analyses is insufficient to see the overall situation. The purpose of this work is to provide an observation of geochemistry of natural waters from Lhasa.

The Lhasa valley floor plain, at an altitude of about 3,660 masl, is situated by the Lhasa River, a tributary of Yarlung Zangbo River, to the north of Himalayan Mountain Ranges. Rainwater, river water, and groundwater were sampled, filtered, preconcentrated, and irradiated in the heavy-water cooled nuclear reactor by thermal neutron flux and analysed.

RAINWATER

Al, Cl, Mg, Mn, V, Ba, Br, Ca, Co, Cr, Cs, K, Li, Na, Rb, Sb, Sc, Sn and Zn are detected in the rainwater of July 1989. This is a list of the elements detected in rainwater sampled simultaneously from various regions of China. The content of Mn, Ba, and Cs are the highest and Sc is the lowest.

RIVER WATER

As the mean of samples from different seasons of the two years 1988 and 1989, 26 elements with Ce, Fe, Hf, Sr, Th, U, and Mo other than those elements found in rainwater are detected. The contents of some elements, e.g., Zn, U, and Cs, have increased significantly in 1989. The annual mean content

of Cs, V, Ce, and Cr is somewhat higher than the mean reported content in world freshwater (Bowen 1979). The content of Cs and Cr is the highest in samples taken from 10 main rivers of China during the same period, which is four to eight times as high as that reported in world freshwater.

GROUND WATER

It contains all the elements detected in rainwater and river water other than Nd and La. There are 15 elements with concentrations higher than the reported mean value as shown in Fig. 1. The content of rare and rare earth elements are influenced, in general, by the natural abundance in the earth's crust.

COMPARISON BETWEEN WATERS

Concentrations of most elements in groundwater are higher than in river water and rainwater, especially of rare earth elements, such as Ce, La, Sc, Sm, etc. However, the content of Zn and Sb in rainwater is the highest. And the highest contents of elements in river water are of Al and Br. The content of various elements in rainwater, river water, and groundwater are compared and graded into eight groups, with concentrations from $10^4 \mu\text{g/l}$ to $0.01 \mu\text{g/l}$.

REFERENCES

Bowen, H.J.M., 1979. *Environmental Chemistry of the Elements*. New York: Academic Press.

Figure 1. Comparison of the variations of element concentrations determined by neutron activation of shallow groundwater samples in the vicinity of Lhasa (shaded boxes), with the ranges of world freshwater reported by Bowen (1979)

