Statistical examination of subsurface and surface water chemistry in Jeonju area, Korea: Possible tracers for water-rock interaction

M. PARK[1], J.-Y. YU[1], B.-K. CHOI[1], B.-W. YUM[2]

[1] Dept. of Geology, Kangwon Nat'I Univ., Chuncheon, Kangwon-Do 200-701, Korea, ferrihydrite@hanmail.net
[2] Center for Groundwater Research, Korea Institute of Geoscience and Mineral Resources, Daejeon 305-350, Korea, ybw@kigam.re.kr

Methods

Pairs of groundwater and surface water samples were collected at 7 different locations in Jeonju area, Korea and analyzed for major and minor dissolved constituents. The concentration variations of the dissolved constituents in the water samples were examined with various statistical analyses, including descriptive, factor, and discriminant function analyses. The results from the statistical analyses was then evaluated to find an appropriate tracer indicaing water-rock interactions to control the water qualities of groundwater.

Results and Discussion

The descriptive and factor analyses on the water chemistries of groundwater and surface water suggest that the most prominent controlling factors of the water quality are the water-carbonate reaction and pollution from poorly defined non-point sources. The role of silicate-water interactions in controlling the water chemistry is not evident. Simple examination of the correlation tables and eigen vectors from the factor analyses is not enough to clearly recognize the contribution of the carbonate-water interactions to the water quality apart from that of pollution.

Direct comparison of varitions in trace element concentrations in the water samples with those in the bed rocks suggests that Co, Ni, and Sr may be good tracers for measuring water-bedrock interactions to determine the groundwater chemistries. Discriminant analyses for the chemical compositions of the water samples indicate that Ni. Rb, Ba, Mo, and Fe nicely separate the groundwater cluster from the surface waters. The discriminant function of the aforementioned trace elements may serve as an indicator of relative contribution from pollution and water-carbonate interaction.

Conclusions

The extents of water-rock interaction in determing the groundwater quality may be estimated from the concentrations of Co, Ni, Sr, Rb, Ba, Mo and Fe, ratios of the concentrations, or combination of these two. Utilizing all the trace elements as a tracer should impractical, and development of an appropriate function composed of reduced number of trace element concentrations is required.

Isotopic compositions of the meteoric and surface water in Chuncheon area, Korea

Y. PARK AND J.-Y. YU

Dept. Geology, Kangwon Nat'l Univ., Chuncheon, Kangwon-Do 200-701, Korea (pyy612@lycos.co.kr)

Methods

Precipitation of rain and snow in Chuncheon had been collected whenever it precipitated and surface waters had been monthly collected at 20 different locations along rivers and lakes in the study area since July, 2002. These collected water samples were filtered and part of the filtered samples were acidified in the field. pH, temperature, Eh, conductivity of the water were also measured in the field. The oxygen/hydrogen isotopic compositions, alkalinities, and chemical compositions of the collected water samples were analyzed in the laboratory.

Results and Discussion

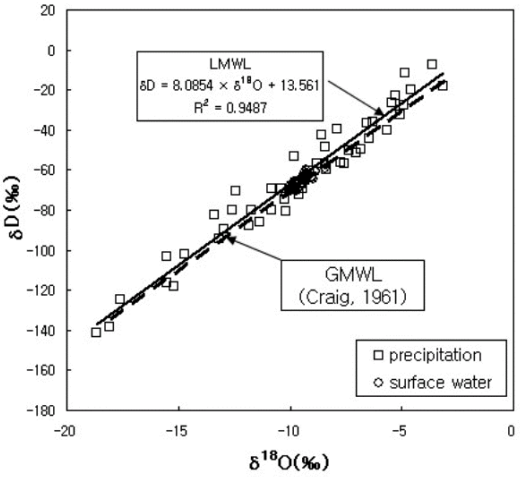

Figure 1: Isotopic composition of the meteoric ans subsurface water Chunhceon area, Korea.

The oxygen and hydrogen isotopic compositions of local meteoric water has the relationship shown in Figure 1, which is very close to the global meteoric water line by Craig (1961). The isotopic compositions of surface water are very densly clustered around the average composition of the meteoric water, $\delta^{18}O$=-9.34‰ and δD=-65.6‰, indicating little evaporation after precipitation to form surface water. The isotopic compositions of the meteoric water shows poor correlation with the average diurnal air temperature, which may be ue to diferent degrees of rainout of the moisture from various areas before reaching the study area. The regression lines of the isotopic compositions of the surface water show seasonally different traces of evaporation under various humidities.

References

Craig, H., (1961), *Science* , **133**, 1702-1703.