Transition metal isotope variations in North Pacific deep water

X.K. ZHU[1]*, J. LI[1], S.H. TANG[1] AND H.F. LING[2]

[1]Lab Isotope Geol., MLR, Inst. Geol., CAGS, Beijing, China (*correspondence: xiangkun@cags.net.cn)
[2]State Key Lab Mineral Deposits, Nanjing Univ, China (hfling@public1.ptt.js.cn)

Fe-Mn crust has been proved to provide excellent records of isotope composition of dissolved metals such as Fe, Cu and Zn in deep seawater. Three crusts collected from central North Pacific have been selected for this study. These crusts have been subjected to detailed investigation in terms of radiogenic isotopes, and their ages have been constrained using multiple approaches extending to ca. 80Ma (Ling *et al.* 2005). The sub-samples were obtained by micro-milling, and Fe, Cu and Zn isotope measurements were performed using a Nu Plasma HR MC-ICPMS after chemical purification. The results are expressed in ε units which are deviations in parts per 10^4 from the same isotope ratios of the reference materials IRMM-14, NBS976, Lyon-Zn, respectively.

All three crusts show consistent variations in Fe isotope compositions, an overall range from 0.9 to -12 in $\varepsilon^{57/54}$Fe units. In more detail, the Fe isotope compositions of the crusts start with ca.-5 ε^{57}Fe units at the surfaces, broadly increase to maxima at ca. 50Ma, then decrease sharply to minima at ca. 70Ma. Furthermore, the ε^{57}Fe values obtained from all three crusts are negatively correlated with $^{206/204}$Pb and $^{208/204}$Pb ratios.

In contrast, Cu and Zn isotopes obtained from three crusts are show much smaller variations, and somehow decoupled with the Fe and Pb isotopes.

These results illustrate for the first time that the evolution of Fe, Cu and Zn isotope compositions in North Pacific seawater back to latest Cretaceous. In general, the main Fe sources for open oceans are terrestrial aerosols and MOR hydrothermal plumes. The crust studied is far away from MOR, and there is no evidence of MOR hydrothermal contribution in terms of Pb- and Nd-isotopes. The main turning point in the trend of Fe isotope variation occurs at ca. 50Ma, which is broadly coincident with the switchover of terrestrial inputs from North America to Asia (Ling *et al.* 2005). The strong linkage between Fe- and Pb-isotope compositions strongly suggests that Fe isotope variation in North Pacific deep water is related with global climate change through source inputs.

The decoupling of Cu and Zn isotopes with Fe isotopes in the studied crusts implies different mechanism is required for the explanation of Cu and Zn isotope variations.

Groundwater modeling in Zhalute county, Inner Mongolia, China with the help of ERT used to build the hydrogeology conceptual model

XIAOBIN ZHU, J. WU AND Y. XIA

Department of Earth Sciences, Nanjing University, Nanjing, P.R. China (zxb@nju.edu.cn)

The industrialization and the rapid economic growth in Zhalute, a county located in the east of Inner Mongolia, China with a total area of 17,193 km^2, attributed to the survey and the exploitation of abundant natural resources, such as coal, rare earths, silica, Kaolin and so on in this area recently. The average annual precipitation and evaporation is about 387.0mm and 1137.6mm respectively. It's not an area with enough water resources. Therefore, the water resources should be used effectively and reasonably with the development of economics. The precondition of reasonable using is that we should know the quantity of water resources. So the evaluation of groundwater resources, an important supply source in this area, is of great significance to the sustainable development. The landform in Zhalute county includes mountain, which is the north part of this county and plain, which is the south part and the population is large. Groundwater resources are evaluated for the plain area with a total area of 2900 km^2 using GMS and the method of water balance. The study area is very large while the basic geology and hydrogeology datum are not sufficient. For the limited data, the Electrical Resistivity Tomography (ERT), a geophysical method, is used when we build the hydrogeology conceptual model, which is the base of simulation. 163 cross-sections are surveyed by ERT. The length of each cross-section is 300m. The space structure of the aquifers is constructed combining these cross-sections and the data of boreholes.

The simulation results show that the quantity of groundwater resources is almost the same with that got by the method of water balance. The average pumping, recharge of precipitation, recharge of rivers, recharge of irrigation, evaporation, boundary recharge and boundary discharge is $0.35\times10^8 m^3/a$, $1.3\times10^8 m^3/a$, $0.096\times10^8 m^3/a$, $0.12\times10^8 m^3/a$, $1.05\times10^8 m^3/a$, $0.078\times10^8 m^3/a$ and $0.22\times10^8 m^3/a$ respectively. The total exploitable groundwater is $2.38\times10^8 m^3/a$. The results give some advices to the exploitation of groundwater and provide evidence to the reasonable deployment of water resouces in the future. It's benefit to the healthy and the sustainable development of economics in this area.