# $^{182}$Hf-$^{182}$W chronometry for Renazzo and Bencubbinites

D-C. LEE[1], A. N. HALLIDAY[1] AND B. ZANDA[2]

[1] Institute of Isotope Geology and Mineral Resources, ETH-Zentrum, 8092 Zürich, Switzerland (lee@erdw.ethz.ch)
[2] Laboratoire de Minéralogie, Muséum national d'Histoire naturelle, 75005 Paris, FRANCE

Renazzo (CR2) is classified as a rare type of primitive carbonaceous chondrite that experienced little thermal alteration, and contains abundant Fe-Ni metal grains that are located within the chondrules, along their rims, and also in the matrix. The origin of these metal grains has been postulated to have been extremely early, condensed directly from primordial solar nebula (Weisberg et al., 1995), or somewhat later and caused by reduction of oxidized or sulfidized Fe within molten chondrules (Zanda et al., 2002). To further evaluate the relationship between Renazzo and the other groups of primitive chondrites and the origin of its metal grains, we have studied Renazzo with the short-lived chronometer $^{182}$Hf-$^{182}$W system ($t_{1/2}$ = 9 myrs), which is well suited for determining the timing of the formation of the metal. To further complement the data, we also analyzed metal grains from Bencubbin and Weatherford, which show a genetic relationship with Renazzo in their O and N isotopes.

The preliminary data for the bulk metal and metal-rich whole rock of Renazzo show a positive correlation in a Hf-W isochron diagram with a slope of ~ $10^{-4}$ and an initial εw ~ -2.2. The slope and the initial W are both consistent with an age post-dating the formation of the solar system by > 10 myrs (Lee and Halliday, 2000). This late timing is inconsistent with direct condensation from the primordial solar nebula. Although our preliminary results favor metal formation within molten chondrules, the timing is later than normally associated with chondrule formation. More work is needed to test if the metal grains in the matrix formed at a different time from those associated with the chondrules, and also to extend the study to other metal-rich primitive meteorites such as CH chondrites.

In contrast, the metal grains of both bencubbinites yield εw ~ 0, identical to that of bulk carbonaceous chondrites and the terrestrial W. This suggests that the metal of these two meteorites must have formed from a reservoir with identical Hf/W to that of the carbonaceous chondrites while there was no live-$^{182}$Hf around, post-dating the formation of the solar system by at least 50 myrs.

## References

Lee D-C. and Halliday A. N. (2000), *Chem. Geol.* **169**, 35-43.
Weisberg M. et al. (1995), *Proc. NIPR Symp. Ant. Meteorit.* **8**, 11-32.
Zanda B. et al. (2002), *LPSC* **XXXIII**, #1852.

# Geochemical Characteristics of AMD from Dalsung Tungsten Mine, Korea

J. E. LEE, Y. KIM, AND C. O. CHOO

Department of Geology, Kyungpook National University, Daegu, Korea (z9728346@hanmail.net, ygkim@knu.ac.kr, and chooco@knu.ac.kr)

## Introduction

Dalsung Mine in Korea was one of the most productive W-mine in Korea. It had been operated for W, Cu, Au, and Ag since 1938, stopped mining in 1975, and completely closed in 1994. Major ore minerals in abandoned tailings are wolframinte, pyrite, chalcopytie, molybdenite and sheelite. After closing, uncontrolled management caused serious soil and upstream contamination in Daegu, the third largest city in Korea. Field measurement and laboratory analyses were carried out for geochemical characterization of AMD from Dalsung Mine. pH, Eh, and EC were measured in the field and chemical analyses were carried out in the laboratory by ICP-AES and IC. Precipitates collected from the bottom of creek were analyzed by XRD with Co target.

## Results and discussion

Small creek runs approximately 1km before its confluence with another creek and measured geochemical parameters changes progressively from the head of creek until it meets another one. pH of acid mine drainage changes from 5.9 to 4.0, Eh 46 mV to 161 mV, EC 1664 µs to 1053 µs, and sulfate 922 ppm to 532 ppm. Most of the precipitates are reddish to brown and were identified as schwertmannite ($Fe_8O_8(OH)_6SO_4$). Schwertmannite has been reported from precipitates in heavy metal and sulfate loaded drainage systems especially at low pH (less than 4.5). However, in our study area, even for the water sample with pH higher than 4.5, schwertmannite is the only phases identified with some other detrital minerals. Some white precipitates were also found on the bottom of creek at pH 5.9 and it is thought to be amorphous aluminium sulfate. In this creek, the decreasing amount of sulfate and decreasing pH are mainly controlled by preicipitation of schwertmannite.

## Conclusions

The creek from Dalsung Mine is severely polluted by the oxidation of pyrite. Schwertmannite is the only identified precipitated phase and its precipitataion controls the geochemical changes in this creek.

## References

Bigham J.M., Schwertmann U., Traina S.J., Winland R.L., and Wolf M. (1996) Geochim. Cosmochim. Acta **60**, 2111-2121.
Swedlund P.J. and Webster J.G.(2001) Appl. Geochim. **16**, 503-511.