Halogen-derived noble gases in the Allende meteorite: A laser microprobe study

N. EBISAWA[1], R. OKAZAKI[1], K. NAGAO[1] AND A. YAMAGUCHI[2]

[1]Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo, Japan (n-ebisaw@eqchem.s.u-tokyo.ac.jp)
[2]Antarctic Meteorite Research Center, National Institute of Polar Research, Japan

Introduction

Micro-distribution of halogens in meteorites still remains unsolved due to the difficulty of their *in situ* microanalysis. We intend to make the matter clear with noble gas isotopes produced by decay of extinct nuclide ^{129}I and by neutron capture on ^{35}Cl, ^{37}Cl, ^{79}Br, ^{81}Br and ^{127}I in space. A high sensitive mass spectrometer with a laser microprobe allows us to determine the small quantities of halogen-derived noble gases. In addition, it is convenient that we can investigate only the intrinsic halogens of meteorites independent of terrestrial contamination.

In this study, we investigated micro-distribution of noble gases in the Allende meteorite, mainly a CAI. 7-10 micrograms of meteorite material was melted with laser heating and the extracted noble gases were measured. These mass spectrometers were modified to be available for various extraterrestrial materials such as meteorites [1, 2, 3] and single micrometeorites [4].

Results and discussion

Prior to noble gas analysis, electron microprobe analysis revealed that marginal areas of the CAI were partly enriched in chlorine.

Noble gas analysis was performed in about 70 points in the CAI and neighbouring matrix. The chlorine-rich areas of the CAI have significantly high concentrations of ^{129}Xe than the chlorine-poor areas. Excess of ^{80}Kr produced by neutron capture on ^{79}Br correlated with the ^{129}Xe distribution. Several ^{129}Xe-rich points had relatively low $^{38}Ar/^{36}Ar$ ratios, which would be caused by the difference in cross section of neutron capture between ^{35}Cl and ^{37}Cl. The results show that the halogen-rich area was formed in a period when ^{129}I was still alive. Although we cannot determine the absolute time scale of the event when the halogens were enriched in some parts of CAIs, it must have occurred in the early stage of solar system formation.

References

[1] Nakamura T., Nagao K. and Takaoka N., (1999), *Geochim. Cosmochim. Acta* **63**, 241-255
[2] Nakamura T., Nagao K., Metzler K. and Takaoka N., (1999), *Geochim. Cosmochim. Acta* **63**, 257-273
[3] Okazaki R., Takaoka N., Nagao K., Sekiya M. and Nakamura T., (2001), *Nature* **412**, 795-798
[4] Osawa T., Nagao K., Nakamura T. and Takaoka N., (2000), *Antarct. Meteorit. Res.* **13**, 322-341

The geochemical impact of MSWI bottom ash on the environment

U. EGGENBERGER[1], R. BUNGE[2] AND K. SCHENK[3]

[1]Institute of Geological Science, University of Bern, Switzerland (eggenberger@geo.unibe.ch)
[2]Hochschule Rapperswil, umtec, Rapperswil, Switzerland (rainer.bunge@hsr.ch)
[3]Swiss Agency for Environment, Forests and Landscape, SAEFL, Switzerland (kaarina.schenk@buwal.admin.ch)

Introduction

In Switzerland domestic waste without thermal treatment is no longer allowed to be stored in land fills. Consequently, the production of MSWI bottom ash has reached 650’000 tons per year, which have to be stored in special landfills. The present study is the first nation wide investigation to chemically and mineralogically characterize the bottom ash of all 27 incinerators. Special attention was also directed to the possibilities to separate metal fraction of the bottom ash using mechanical separation techniques, to recover metal fractions, to reduce landfill volume, and to evaluate possible changes to legislation for disposal.

Results and Conclusions

Regarding major elements the chemical compositions of the of the 27 bottom ash do not show big differences and are comparable to mafic/ultramafic rocks. Indicator for the different observed melting conditions can however be found using the Ca/Si ratio forming melilithes and/or anorthite. Relatively small variation is observed for conservative behaving trace elements such as e.g. Zr which is rarely used in consumer products. Volatile elements such as Pb, Hg, and Cd are found as good indicators for thermal conditions of the incineration process, and C_{org} content for reaction time and temperature. Today’s legislation prescribes bulk chemical analyses and leaching tests for the classification of e.g. “inert material” (TVA, 1990). In respect to inert material thresholds, some bulk metal concentrations are significantly elevated: Pb, Zn and Cu (3’000-40’000ppm). In contrast, leaching behaviour of the bottom ash in respect to TVA tests are mostly below legislation thresholds. To obtain better information about possible long-term behaviour of the residue in the hydrosphere, also alternative leaching tests have been adopted considering buffering capacity and leachability of trace metals under defined pH conditions.

Today still large amount of metals in waste enter incinerator plants, and most of them remain unaltered in the bottom ash. Using special mechanical treatment of the bottom ash, large amounts of ferrous metals, Cu, and Al could be separated in the fraction >2mm.

References

Technische Verordnung über Abfälle (TVA; 10. Dez. 1990); SR 814.600