Noble gases in Northwest Africa 753 (NWA 753), Rumuruti chondrite

NORIKO EBISAWA, JISUN PARK AND KEISUKE NAGAO

Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo, Tokyo, Japan (n-ebisaw@eqchem.s.u-tokyo.ac.jp)

Rumuruti chondrites (R-chondrites) are characterized by higher degree of oxidation than ordinary chondrites (e.g., Kallemeyn et al., 1996). According to reported noble gas data, R-chondrites are mostly regolith breccia and half of them include a large quantity of light noble gases of solar origin. We measured noble gas isotopic compositions of a R-chondrite, North West Africa 753 (NWA 753), found in 2000.

Noble gas analysis was performed with a modified VG5400 (MS-II) mass spectrometer, with total melting and stepwise heating method. In the former method, several fragments of NWA 753, weighing 45 mg, were melted in a furnace at 1800°C. In the latter, 120 mg of them were heated at 600, 1000 and 1800°C successively and released noble gases at each temperature were measured.

The $^{20}Ne/^{22}Ne$ and $^{21}Ne/^{22}Ne$ ratios, 1.1 and 0.88 respectively, are close to those of cosmogenic ones, indicating that the Ne is mostly of cosmogenic and amounts of trapped Ne is negligible. The $^{3}He/^{4}He$ ratio of about 0.015 is much higher than the values of trapped components, suggesting that the He is composed of cosmogenic and radiogenic components. The concentration of ^{4}He, $1.8x10^{-5}$ ccSTP/g, is significantly lower than those of R-chondrites enriched in solar gases (>$3x10^{-4}$ ccSTP/g; Nagao et al., 1999). Therefore, NWA 753 belongs to the group of solar gas poor R-chondrites. The exposure age from cosmogenic ^{21}Ne (T_{21}) is 25 m.y., unlike to any other R-chondrites reported up to now. The $^{38}Ar/^{36}Ar$ ratio, 0.19, shows that trapped component is dominant in Ar, in contrast to He and Ne. Exposure age from cosmogenic ^{38}Ar is about half of T_{21}, which may have been caused by loss of cosmogenic Ar commonly found for meteorites from hot deserts.

The concentrations of trapped ^{36}Ar and ^{38}Ar are one or two orders of magnitude higher than those reported for R-chondrites (e.g., Nagao et al., 1999). The result of stepwise heating indicates that 90% of them are released at the temperatures over 1000°C, which is consistent with the release profile for most meteorites. Such a large amount of trapped Ar is uncommon in R-chondrites. The trapped noble gas elemental ratios, $^{36}Ar/^{132}Xe$ and $^{84}Kr/^{132}Xe$, are 360 and 2.0, respectively, characteristic of subsolar gas. It is probably trapped in some specific phases as in the case of enstatite chondrites (Okazaki et al., 2001). Identification of the phase(s) will be carried out by laser microprobe noble gas analysis.

References

Kallemeyn et al., (1996), *GCA* **60**, 2243-2256.
Nagao et al., (1999), *Antarct. Meteorite Res.* **12**, 81-93.
Okazaki et al., (2001), *Nature* **412**, 795-798.

Open system U-series dating of marine mollusc shells

S.M. EGGINS[1], R. GRÜN[1], AND C. MURRAY-WALLACE[2]

[1] Research School of Earth Sciences, The Australian National University, Canberra 0200, ACT, Australia Stephen.Eggins@anu.edu.au Rainer.Grun@anu.edu.au
[2] The University of Wollongong, Wollongong, NSW, Australia (colin_murray-wallace@uow.edu.au)

Marine terraces and shoreline deposits preserve a rich record of sea-level change in response to past climates and tectonic processes. Since Kaufman et al. (1971, Geochim. Cosmochim. Acta **35**. 1135-1183) demonstrated U-series dating of mollusc shells to be notoriously unreliable because fossil material was subject to open-system behaviour (uptake or loss) of uranium, accurate and independent dating beyond radiocarbon limits has been limited largely to U-series dating of marine deposits that contain corals. Subsequently reported U-concentrations and $^{234}U/^{238}U$ ratio distributions in fossil bivalve shells indicate differing rates of post mortem U-uptake in different shell parts and species, and account for different uranium concentrations and closed-system U-series ages obtained from different mollusc species at single localities. However, rather than taking into account this open system behaviour, most mollusc dating studies have pursued closed-system U-series dating of those shell parts that appear to accumulate their uranium shortly after burial (early U-uptake). Moreover, where inconsistent or a range of dates are encountered they are typically attributed to unresolved open-system uranium behaviour or the reworking of shells from older units. This approach is clearly of limited value because it cannot be used to obtain independent age estimates. We have taken a new open-system approach to U-series dating of mollusc shells, that employs laser ablation ICP-MS to profile uranium and U-series isotope distributions within fossil shells. These high spatial resolution profiles provide the basis for constraining the U-uptake history and accurate U-series dating of fossil shells using physically meaningful open-system models. We have determined the distribution of uranium and U-series isotopes in fossil (MIS 5e and Holocene) and modern shells of the bivalve *Anadara trapezia*, a species that inhabitats intertidal flats and is a good indicator of sea-level. Fossil shells are observed to accumulate significant uranium (up to 10 ppm) in their outer layers and to develop U-concentration and U-series isotope ratio profiles that are consistent with open-system model U-uptake. Accurate $^{234}U/^{238}U$ and $^{230}Th/^{234}U$ activity ratios can be profiled *in situ* on samples that contain as little as 0.5 ppm U, using laser ablation multi-collector ICPMS. This approach, when combined with an appropriate open system model for U-uptake in marine mollusc shells, promises the possibility of more reliably dating fossil moluscs.