Correction of initial-disequilibrium on U-Th-Pb system for dating of young zircons

SHUHEI SAKATA[1]*, SHINSUKE HIRAKAWA[1], HIDEKI IWANO[2], TOHRU DANHARA[2] AND TAKAHUMI HIRATA[1]

[1]Laboratory for Planetary Sciences, Kyoto University, Kyoto, Japan (junchan@kueps.kyoto-u.ac.jp)
[2]Kyoto Fission Track Co. Ltd., Kyoto 603-8832, Japan

Major analytical problems associated with U-Pb age determination of the young zircons (e.g. < 1 Ma) is the initial-disequilibrium in the U-Th-Pb decay systems through the crystallization of zircon in source magma. To correct the effect of initial disequilibrium, the ratio of the distribution coefficient between source magma and zircon crystal (D) for Th and U ($f_{Th/U}$ =D^{Th}/D^{U}) must be defined [1]. To achieve this, we have determined both the ^{238}U-^{206}Pb and ^{232}Th-^{208}Pb ages obtained for three tephra zircon samples collected from Kirigamine rhyolite (Ar-Ar age is 0.945±0.005 Ma [2]), Bishop tuff (Ar-Ar age is 0.7589±0.0036 Ma [3]) and Toga pumice (Ar-Ar age is 0.42±0.01 Ma [4]) by means of laser ablation-ICPMS technique. The resulting ^{232}Th-^{208}Pb ages were 0.940±0.010 Ma for Kirigamine, 0.759±0.016 Ma for Bishop, and 0.4296±0.0066 Ma for Toga, demonstrating that the resulting ages were consistent with the previously reported values. The $f_{Th/U}$ values could be calculated based on the measured ^{232}Th-^{208}Pb ages and $^{206}Pb/^{238}U$ ratios, and the resulting $f_{Th/U}$ values agreed well within the analytical uncertainties. The disequilibrium-corrected ^{238}U-^{206}Pb age can be calculated under the assumption that the $f_{Th/U}$ value did not vary significantly among the zircons. To evaluate this, we have measured the ^{238}U-^{206}Pb and ^{232}Th-^{208}Pb ages for zircons from Sanbekisuki tephra [5]. The $f_{Th/U}$ values used for the correction was based on the average of three $f_{Th/U}$ values obtained here ($f_{Th/U}$ = 0.51 ± 0.11). The corrected ^{238}U-^{206}Pb age was 92.1 ± 8.4 ka, which agreed with the ^{232}Th-^{208}Pb age (90.4 ± 9.5 ka) within the analytical uncertainties. The good agreement in the corrected ^{238}U-^{206}Pb age and ^{232}Th-^{208}Pb age demonstrates clearly that the present $f_{Th/U}$ value for the Sanbekisuki zircon was consistent with the averaged $f_{Th/U}$ value calculated above. In conclusion, we can construct more accurate and effective U-Th-Pb dating method based on the $f_{Th/U}$ value defined in this study, especially for the young zircons (0.1 – 1 Ma).

[1] Schärer (1984) *EPSL*, **67**, 191-204 [2] Wadatsumi *et al*. (1994) Fission Track News Letters, **7**, 7-8 [3] Sarna-Wojcicki (2000) *J. Geophys. Res.*, 1**05** 21, 431-21, 443 [4] Uto *et al*. (2010) *Volcano*, **55**, 201-206 [5] Machida and Arai (2003) Atlas of Tephra in and around Japan

Application of geochemical and statistical approach to assess metal contaminantion in marine sediments

FANI SAKELLARIADOU[1]

[1]University of Piraeus, Dept of Maritime Studies, fsakelar@unipi.gr

The two principal sources for heavy metals at the sea are lithogenic and anthropogenic ones. Sediments are considered as physical traps for many environmental pollutants [1]. At the present study, sediment samples from Lavrio port (located 60km SW of Athens, in Greece) were analyzed for the determination of metal content. The area is well known for the presence of mixed sulphide mineralisation (galena, sphalerite and pyrite) hosted within marbles and limestones. Samples were digested with a mixture of conc. acids at high temperature [2]. Metal contents were measured by AAS. Data set was treated with multivariate and geostatistical approach. The dendograms provided by hierarchical cluster analysis gave the (Zn, Pb, Mn) and (Cu, Cr, Ni) groups reflecting the mineralization clusters (the latter group representing also, to some extent, the ultramafic association) as well as the (Fe, Al) group standing for clays and other alluvial matter. Application of Principal Component Analysis showed that sampling sites have positive scores for Mn, Zn and Pb. Inter-element correlation coefficients corresponded to values greater than 0,92 for the pair (Zn, Fe), greater than 0,84 for the pairs (Mn, Zn), (Zn, Pb), (Mn, Fe), (Pb, Fe) and (Cr, Al), and greater than 0,68 for the pairs (Al, Fe), (Fe, Cu) and (Cu, Zn). The Simple Kriging geostatistical approach was applied allowing data interpolation [3]. Spatial patterns of Pb, Zn and Cu showed the highest enrichment around the new berth (cited at the eastern part of the harbour), with elevated content around the main harbour area.

[1] Burton (2002) Limnology, **3**, 65–75. [2] UNEP (1985) Reference Methods for Marine Pollution Studies, No 31-39. [3] Cressie (1990) Mathematical Geology, **22**, 239-252.

DOI:10.1180/minmag.2013.077.5.19