Noble gas and bulk chemistry study of three eucrites, Juvinas, Stannern and Dhofar 007.

M. Takeda[1], A. Yamaguchi[2,3], K. Nagao[4], and M. Ebihara[1] [1]Department of Chemistry, Graduate School of Science, Tokyo Metropolitan University, Hachioji, Tokyo 192-0397 (takeda-mituyo@ed.tmu.ac.jp), [2]Antarctic Meteorite Research Center, National Institute of Polar Research, Tokyo 173-8515, [3]The Graduate University for Advanced Studies, Tokyo 173-8515, [4]Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo, Bunkyo-ku, Tokyo 113-0033.

Introduction: The eucrite meteorites possibly originate from the crust of the asteroid 4 Vesta or 4 Vesta like asteroids [1]. These meteorites have relatively high contents of incompatible elements like actinide elements (Th, U and Pu), so that ^{244}Pu contents and ^{244}Pu-Xe ages of eucrites have been investigated systematically [2, 3]. And because of high abundance of target elements for cosmogenic Kr as well as low concentrations of trapped Kr, ^{81}Kr-Kr ages of eucrites also have been determined [3, 4, 5]. In this study, we performed bulk chemical analysis and noble gas analyses for two noncumulate eucrites, Juvinas and Stannern and an anomalous cumulate eucrite, Dhofar 007 [6], and determined ^{81}Kr-Kr age and ^{244}Pu-Xe age for these meteorites.

Samples and analytical techniques: Each meteorite specimen was divided into two portions, one of which (130-185 mg) was used for noble gas analyses at Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo. The remaining portions (180-260 mg) were powdered for bulk chemical analysis using prompt gamma ray analysis, instrumental neutron activation analysis and instrumental photon activation analysis.

Analytical results: Our bulk chemical analysis data are in good agreement with the literature values except for Ti and Cr in Juvinas and for Ti, Ni and S in Dhofar 007 [6, 7]. ^{3}He, ^{21}Ne and ^{38}Ar contents of our samples are mostly cosmogenic, being similar to those obtained by Miura et al [3] and Miura and Nagao [8]. We decomposed measured Kr and Xe contents into cosmogenic, fissiogenic and trapped components following the procedure by Miura et al. [3] and adopted these results for the following calculations.

Cosmic-ray exposure ages based on stable noble gas contents: Concentrations of cosmogenic ^{3}He, ^{21}Ne and ^{38}Ar and cosmic-ray exposure ages (T_3, T_{21} and T_{38}) determined on the basis of these nuclides are summarized in Table 1. Production rates were estimated by using the functions proposed by Eugster and Michel [1] and Freundel et al. [9]. Our results are in good agreement with the literature values [3, 8].

^{81}Kr and ^{81}Kr-Kr age: Contents of ^{81}Kr, cosmogenic ^{83}Kr and ^{81}Kr-Kr ages (T_{81}) are also summarized in Table 1. We estimated a ratio of production rates of ^{83}Kr and ^{81}Kr from the equation by Miura et al. [3]. Although our

Table 1. Concentrations of cosmogenic ^{3}He, ^{21}Ne, ^{38}Ar, ^{81}Kr and ^{83}Kr, cosmic-ray exposure ages based on ^{3}He, ^{21}Ne, ^{38}Ar (T_3, T_{21} and T_{38}), and ^{81}Kr-Kr age (T_{81}).

Sample	(^{3}He)c	(^{21}Ne)c	(^{38}Ar)c	^{81}Kr	(^{83}Kr)c	T_3	T_{21}	T_{38}	T_{av}	T_{81}	Lit.
	10^{-8}cm^{3}STP/g			10^{-12}cm^{3}STP/g		Ma				Ma	
Juvinas	14.1	1.93	1.49	0.173	10.2	8.74	11.6	12.0	10.8	12.5 ± 1.9	
	13.1	*1.98*	*1.41*	*0.157*	*9.16*	*8.09*	*10.9*	*9.19*	*9.4*	*10.6 ± 0.8*	[3]
Stannern	35.0	5.14	5.75	0.242	59.0	21.5	27.1	44.4	31.0	48.4 ± 8.1	
	37.5	*6.19*	*6.07*	*0.263*	*49.9*	*22.7*	*32.7*	*38.7*	*31.4*	*35.1± 0.7*	[3]
Dhofar 007	14.5	2.42	1.32	0.099	7.40	8.91	12.1	11.5	10.9	15.1 ± 2.7	
				0.087		*10.9*	*13.6*	*10.2*	*11.6*	*13 ± 2*	[8]
				0.11		*9.2*	*13.1*	*9.5*	*10.6*	*11 ± 2*	[8]