NOBLE GAS COMPOSITIONS OF SEVEN CV, CO, AND CK CHONDRITES FROM DESERTS. J. Choi[1*], K. Nagao[1], J. M. Baek[1], R. Bartoschewitz[2], C. Park[1], J. I. Lee[1], and M. J. Lee[1], [1]Korea Polar Research Institute, 26 Songdomirae-ro, Yeonsu-gu, Incheon 21990, South Korea (*jisu@kopri.re.kr), [2]Meteorite Laboratory, Weiland 37, D-38518 Gifhorn, Germany.

Introduction: Carbonaceous chondrites have various noble gas components including trapped planetary and solar gases, and presolar noble gases [1]. These noble gas isotopic compositions could be preserved in carrier phases, or have been altered by loss of the gases and thermal processes. Cosmic-ray exposure (CRE) ages of CM and CI groups are similarly short (0.05–7 Ma), but those of CV, CO, and CK are longer CRE ages (0.15–63 Ma) [2, 3]. Scherer and Schultz [4] presented CRE ages ranging from 1 to 63 Ma calculated from cosmogenic ^{21}Ne for CV, CO, CK, and other carbonaceous chondrites.

In this study, we present noble gas compositions and CRE ages of two CO chondrites from Dhofar (Dho 1622 and 2005), and four CV and one CK chondrites from Northwest Africa (NWA 3304, 6743, 6746, 10670, and 7420).

Experimental method: Abundances and isotopic ratios of noble gases of seven carbonaceous chondrites (Table. 1) were measured by modified VG-5400 noble gas mass spectrometer at KOPRI [5, 6]. About 20–31mg of fragments is wrapped in Al-foil. The samples were preheated for a day at 150ºC in ultrahigh vacuum condition to remove atmospheric contamination. Noble gases were extracted from the samples by heating at 1800ºC for 30 min in Mo crucible and purified by Ti-Zr getters and SAES getters. He, Ne, Ar, Kr, and Xe were introduced into the mass spectrometer separately using a cryogenic trap. Abundances of noble gases were calculated by using sensitivities determined by measuring artificial atmospheric standard gas. Isotopes of noble gases were measured in peak jumping mode.

Results and discussion: Results are summarized in Table 1. The noble gas compositions indicate no pairing among the meteorites measured in this work.

Helium and Neon. NWA 3304 has a ^{3}He/^{4}He ratio closed to that of solar wind [7]. Its Ne isotopic compositions are distinguishable from those from other chondrites that plotted near cosmogenic composition (Fig. 1). Ne isotopic composition of Dho 1622 is plotted on a mixing line between Ne-HL and cosmogenic Ne, which is consistent with that trapped Ne of CO meteorites is dominated by Ne-HL and Q [8]. NWA 7420 is plotted at lower end of cosmogenic area in Fig. 1, and its ^{21}Ne/^{22}Ne of 0.77 is lower than the range of 0.81–0.96 for CK meteorites [9]. It might indicate a presence of Ne-E in this chondrite.

Argon, Krypton, and Xenon. Elemental ratios (^{36}Ar/^{132}Xe, ^{84}Kr/^{132}Xe) of trapped heavy noble gases are shown in Fig. 2. Chondrites studied are divided into three groups; (1) Dho 1622, Dho 2005, NWA 3304, and NWA 6743 plotted toward solar from Q, (2) NWA 6746 and NWA 10670 plotted close to Q, and (3) NWA 7420 plotted toward Earth's atmosphere, indicating an atmospheric contamination by weathering on desert [4, 10]. Although the NWA 7420 is plotted on the mixing line between Q and ^{244}Pu-fission Xe (Fig. 3), it might be accidental and moved from Q-HL mixing because of relatively heavier contamination as shown in Fig. 2. Relatively high ^{40}Ar/^{36}Ar ratio of 1500 for NWA 7420 is due to its high petrologic type. Neutron-produced ^{80}Kr and ^{82}Kr from ^{79,81}Br are exhib-

Table 1. Measured noble gas concentrations with isotopic ratios

Meteorite / Class	^{4}He (10^{-9}cc/g)	^{3}He/^{4}He	^{20}Ne (10^{-9}cc/g)	^{20}Ne/^{22}Ne	^{21}Ne/^{22}Ne	^{36}Ar (10^{-9}cc/g)	^{38}Ar/^{36}Ar	^{40}Ar/^{36}Ar	^{84}Kr (10^{-12}cc/g)	^{132}Xe (10^{-12}cc/g)
Dhofar 1622	14574	0.003834	22.1	2.4145	0.6447	1067.9	0.18886	13.04	5428	3737
CO3	± 1458	± 0.000021	± 2.2	± 0.0110	± 0.0022	± 106.8	± 0.00065	± 0.02	± 544	374
Dhofar 2005	14059	0.038528	108.2	0.9185	0.8792	469.6	0.21494	11.84	2558	1766
CO3	± 1406	± 0.000217	± 10.8	± 0.0028	± 0.0011	± 47.0	± 0.00073	± 0.04	± 257	177
NWA 3304	6038094	0.000494	11063.8	11.5903	0.1050	591.8	0.20223	4.78	2063	1228
CV3	± 603810	± 0.000004	± 1106.7	± 0.0260	± 0.0001	± 59.2	± 0.00069	± 0.05	± 208	123
NWA 6743	15094	0.039211	104.3	0.9618	0.8180	1024.7	0.20075	9.31	4615	3201
CV3	± 1510	± 0.000216	± 10.4	± 0.0019	± 0.0014	± 102.5	± 0.00068	± 0.02	± 462	320
NWA 6746	10095	0.005538	46.7	2.4809	0.7235	7.2	0.20005	101.54	1799	1844
CV3	± 1010	± 0.000035	± 4.7	± 0.0057	± 0.0013	± 0.8	± 0.00075	± 2.59	± 181	185
NWA 10670	17342	0.003464	32.8	2.0416	0.7181	28.6	0.22781	58.49	299	292
CV3	± 1734	± 0.000021	± 3.3	± 0.0070	± 0.0016	± 2.9	± 0.00083	± 0.72	± 31	30
NWA 7420	6165	0.001998	2.4	0.8988	0.7688	6.0	0.26871	1526.20	82	30
CK5	± 617	± 0.000015	± 0.2	± 0.0166	± 0.0026	± 0.6	± 0.00178	± 20.97	± 11	4

ited for all chondrites studied except Dho 1622.

Cosmic-ray exposure age. CRE ages of the seven chondrites in this study and those in [4] were calculated from cosmogenic ^{21}Ne using production rates and chemical compositions from [11, 12, 13, 14]. NWA 6743 was omitted from the calculation for its high proportion of solar wind Ne. CRE ages for chondrites studied are in the range reported so far (Fig. 4). An exception is NWA 6743 with 40 Ma, which is longer than the other CV chondrites, but in the wider ranges for CO and CK (Fig. 4). CRE ages of 9 Ma for CV and CK chondrites and 27 Ma for CO, CV, and CK chondrites are considered as hypothetical clusters indicating common impact events [2, 4, 15]. It can be possible that CO, CV, and CK have another common impact event at around 40 Ma.

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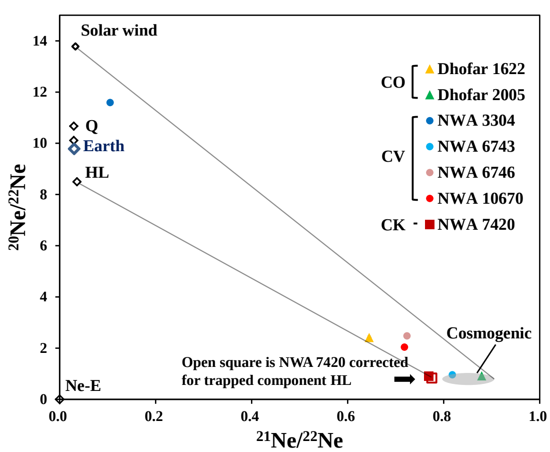

Fig. 1. Ne three-isotope plot. Open square with same color of NWA 7420 represents cosmogenic ^{21}Ne/^{22}Ne after correction for HL-Ne.

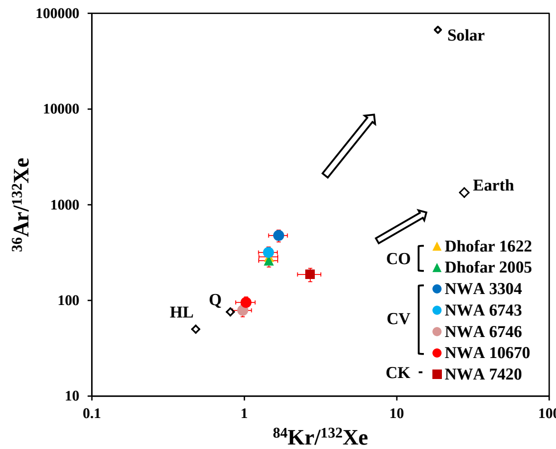

Fig. 2. Elemental ratios of trapped heavy noble gases. Arrows indicate components affecting trapped Q-like compositions.

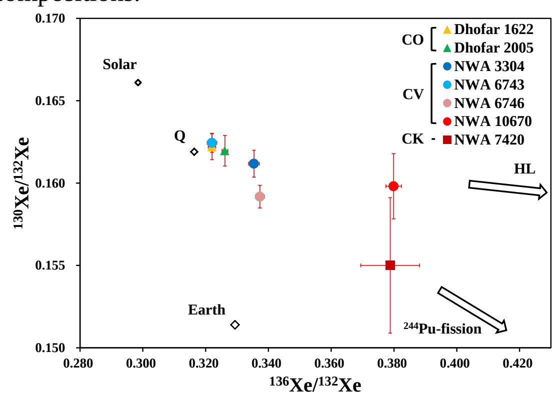

Fig. 3. ^{130}Xe/^{132}Xe ratios plotted against ^{136}Xe/^{132}Xe ratios. Arrows indicate addition of HL-Xe and ^{244}Pu-fission derived Xe.

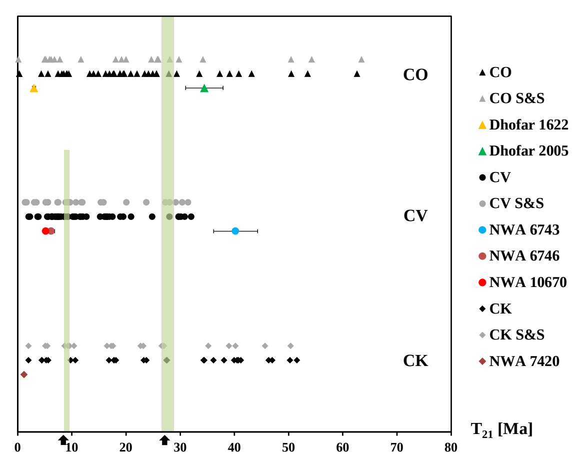

Fig. 4. Cosmic-ray exposure ages calculated from cosmogenic ^{21}Ne. Black dots are re-calculated from [9] assuming solar-Ne for CV and HL-Ne for CO as trapped Ne. Gray dots are from [4], and Green lines at 9 Ma and 27 Ma are hypothetical clusters in [4].