I-Xe AND ^{39}Ar-^{40}Ar AGES OF THE UNIQUE ACHONDRITE GRA 06129

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Introduction: The paired Antarctic achondrites Graves Nunatak (GRA) 06128/06129 are composed of the high abundance of sodic plagioclase, Fe-rich silicates and phosphate [1, 2]. They were formed in the very early solar system, because early crystallization ages, ^{147}Sm-^{143}Nd age of 4.559 ± 0.096 Gyr [3] and ^{207}Pb-^{206}Pb age of 4.517 ± 0.060 Gyr [4] were reported. Later metamorphic ages were indicated by the ^{39}Ar-^{40}Ar ages of 4.35 - 4.46 Gyr [2, 5]. The meteorite is characterized by high ^{40}Ar concentration with high ^{40}Ar/^{36}Ar. The excess in ^{129}Xe and $^{80, 82}$Kr, the latter produced by neutron capture on $^{79, 81}$Br, imply high halogen abundance for achondrites [2, 6]. We determined the I-Xe and ^{39}Ar-^{40}Ar ages and concentrations of Cl, Br and I.

Experimental: A chip of 48.5 mg was irradiated by neutrons in JRR-3 reactor. Standards for I-Xe and ^{39}Ar-^{40}Ar ages and neutron fluence were Shallowater and Hb3gr, respectively. Isotopic compositions and abundances of Ar, Kr and Xe were measured by stepwise heating method to obtain the I-Xe isochron, ^{39}Ar-^{40}Ar plateau age and halogen concentrations.

Results and Discussion: The I-Xe isochron defined by the data for the high temperature fractions (≥1200°C) yields an absolute age of 4.491 ± 0.006 Gyr, 75 ± 5 Myr after that of Shallowater [7]. Initial ^{129}Xe/^{132}Xe ratio of 1.50 ± 0.02 obtained from the isochron assuming trapped ^{128}Xe/^{132}Xe = 0.0827 [8] is much higher than that in ordinary chondrites. This indicates that the I-Xe system was reset at 4.49 Gyr ago, with a part of radiogenic ^{129}Xe which had been produced from ^{129}I and accumulated being left in the system. Given that ^{147}Sm-^{143}Nd, ^{207}Pb-^{206}Pb and I-Xe ages correspond to the primary crystallization of the parent body, the crystallization had continued for ~50 Myr. The reset of the I-Xe system occurred at relatively low temperature, because the ^{147}Sm-^{143}Nd age was not reset [3]. The ^{39}Ar-^{40}Ar plateau age is 4.392 ± 0.038 Gyr, probably representing a secondary thermal metamorphism ~100 Myr after the I-Xe age.

Concentrations of Cl, Br and I are 1620 ± 150 ppm, 1.53 ± 0.16 ppm and 155 ± 8 ppb, respectively. The Cl concentration is twice that in Orgueil CI chondrite [9], while Br and I are approximately half of Orgueil. Such elemental fractionation can be explained by preferential incorporation of Cl to apatite during the metamorphic event at 4.35 - 4.46 Gyr.

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