PCG32-08 会場:101B 時間:5 月 20 日 11:15-11:30

Northwest Africa 6704 のウラン一鉛年代学
U-Pb chronology of Northwest Africa 6704

飯塚 毅[1*], アメリン ユーリー[2], 山口 亮[3], 高木 康成[4], 野口 高明[4], 木村 眞[4]
Tsuyoshi Iizuka[1*], Yuri Amelin[2], Akira Yamaguchi[3], Yasunari Takagi[4], Takaaki Noguchi[4], Makoto Kimura[4]

[1] 東京大学, [2] オーストラリア国立大学, [3] 極地研, [4] 茨城大学
[1]University of Tokyo, [2]Australian National University, [3]NIPR, [4]University of Ibaraki

Northwest Africa (NWA) 6704 is a very unusual ungrouped fresh achondrite. It consists of abundant coarse-grained (up to 1.5 mm) low-Ca pyroxene, less abundant olivine, chromite, merrillite and interstitial sodic plagioclase. Minor minerals are awaruite, heazlewoodite, and pentlandite. Raman spectroscopy shows that a majority of the low-Ca pyroxene is orthopyroxene. Bulk major element abundances are nearly chondritic and distinct from those of howardite-eucrite-diogenites. Oxygen isotopic study demonstrated that 18O/16O and 17O/16O of this meteorite plot within the acapulcoite-lodranite field, but these meteorites differ in mineralogy and geochemistry. These observations suggest that NWA 6704 originated on a distinct parent body from all other known meteorites. Here we report U-Pb chronology of the unique achondrite NWA 6704.

U-Pb dating was performed on nine 10?20 mg fractions of pyroxene. All fractions were washed 4-5 times in ca. 0.5 ml of 0.5 M HNO3. Subsequently, the fractions were washed twice with hot 6 M HCl, followed by twice washing with hot 7 M HNO3. All residues were spiked with mixed 202Pb-205Pb-229Th-233U-236U tracer. Spiked residues were digested in a HF+HNO3 mixture, converted to a soluble form by repeated evaporation with 7 M HNO3, 6 M HCl, 9 M HBr, and dissolved in 0.3 M HBr. The Pb separation was performed using 0.05 ml of anion exchange resin AG1x8 200?400 mesh. After the Pb separation, U and Th were separated using 0.05 ml of UTEVA resin. Pb isotopes were measured on a TRITON Plus TIMS at the ANU. U and Th isotopic analyses were carried out on a Neptune MC-ICPMS at the Australian National University.

Two residues yielded higher 206Pb/204Pb values (148 and 213) relative to the others (from 344 to 5494). Model 207Pb*/206Pb* dates (assuming primordial Pb as initial Pb, and 238U/235U=137.88) for seven most radiogenic residue analyses with 206Pb/204Pb more than 500 yielded a weighted average of 4563.34 +/- 0.32 Ma. The U-Pb discordance of residue analyses range from -3% to -6% for more radiogenic data, and up to -10% for the two residues that contain less radiogenic Pb. A Pb-Pb isochron for the seven radiogenic residues yielded a radiogenic 207Pb/206Pb value (y-intercept of the regression line) of 0.62351+/-0.00017. This corresponds to a 207Pb/206Pb date of 4563.75 +/- 0.41 Ma, assuming a 238U/235U=137.88. Yet this assumption may be invalid likewise for Ca-Al-rich inclusions (CAIs) and basaltic achondrites. Hence, to establish an assumption-free reliable 207Pb/206Pb date, precise 238U/235U needs to be determined for this meteorite. Using, instead, the 238U/235U value of 137.79+/-0.02 (an approximate estimate for most Solar System materials except CAIs), yields the isochron age of 4562.80+/-0.46 Ma. This age estimate is valid unless 238U/235U in NWA 6704 is significantly lower than in the angrites and chondrites. Determination of the 238U/235U is in progress.

The estimated U-Pb age of NWA 6704 is substantially older than those of plutonic angrites, and only marginally younger than those of quenched angrites. NWA 6704 is about 4-5 Ma younger than the CAIs. Considering the old crystallization age, the expected simple geologic history (suggested by nearly concordant U-Pb systems), the mineral assemblage including pyroxene, plagioclase, olivine, chromite and metal, and the considerable sample size (8.4 kg in total), NWA 6704 has the potential to serve as a reliable reference point of various short-lived isotopic chronometers such as 26Al-26Mg, 53Mn-53Cr and 182Hf-182W chronometers. A new reliable reference point is essential for checking uniform distribution of the short-lived radionuclides and for building a consistent time scale of the early Solar System.