U-Pb and Pb-Pb DATING OF THE APATITE FROM IAB IRON METEORITES.

K. D. Litasov[1], Y. Sano[2], N. Takahata[2], T. Miki[2], S. N. Teplyakova[3] and A. Y. Skripnik[3], [1]Sobolev Institute of Geology and Mineralogy SB RAS, 3 Koptyuga Ave, Novosibirsk, 630090, Russia (klitasov@igm.nsc.ru); [2]Atmosphere and Ocean Research Institute, University of Tokyo, Chiba, 277-8564, Japan; [3]Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, 19 Kosygina St, Moscow, 119334, Russia.

Introduction: The IAB is a non-magmatic group of iron meteorites that has been classified into several sub-groups based on the trace element chemistry of metal. They include the main group (MG), multiple 'low-Au low-Ni' (sLL), 'low-Au medium Ni' (sLM), 'low-Au high-Ni' (sLH), sHL and SHH, and several grouplets and ungrouped samples [1]. The isotopic study indicates that high-Au sub-groups (sHL and sHH) may derive from a distinct parent body [2]. This is consistent with the appearance of silicate inclusions, which are mostly related to low-Au subgroups. The metal-silicate separation age was estimated at 6.0±0.8 Ma according to $\varepsilon^{182}W$ data [5], whereas catastrophic impact and re-assembly of parent body [3-4] appeared at 10-14 Ma after the formation of CAI [5]. Here we provide additional evidence for early formation of silicate-bearing IAB irons based on U-Pb dating of apatite from silicate-bearing inclusions.

Samples and Methods: The isotope ratios were measured in Copiapo (IAB-MG), NWA 6369 (sLL), Udei Station, Woodbine, Maslyanino (intermediate between sLL and sLM) and the anomalous meteorite Sombrerete. For all meteorites, from 3 to 10 grains of apatite or crystallized phosphate melt (Sombrerete) were studied. All samples were mounted into epoxy, polished, baked at ~100°C for 1-2 days and kept in the SIMS vessel at <5E-9 Torr for another 2-3 days before analyses. ^{238}U-^{206}Pb and ^{207}Pb-^{206}Pb datings were obtained on a NanoSIMS 50 instrument at the AORI, University of Tokyo. Apatite from the alkaline rocks (Ontario, Canada) aged 1155 ± 5 Ma was used as a standard. Other analytical methods were explained in the previous works [6].

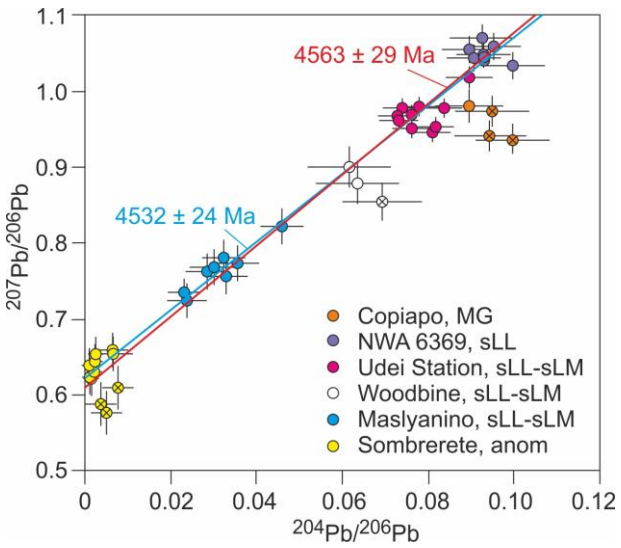

Fig.1. Correlations between Pb/Pb ratios for apatites from IAB iron meteorites and Sombrerete. Solid lines are regressions constrained using IsoplotR [7]. Red – for all samples. Blue – without crossed samples.

Results and Discussion: All studied apatites have rather low concentrations of U = 0.5-2.0 ppm. This made it difficult to obtain data with minimal measurement error. The obtained data for all meteorites quite densely fall on the isochronous age 4563 ± 29 Ma. However, without taking into account several points that deviate from the narrow trend, the age is 4532 ± 24 Ma (Fig.1). The data for anomalous meteorite Sombrerete are consistent with the IAB isochron.

Comparison with the Hf-W data for iron metal meteorites of the IAB group [2] shows that the formation of silicates probably was not much broken in time with the formation of metal. Most of the data for metal intersect in the region of 3-6 million years [2,5] after the formation of CAI (4568 Ma).

The obtained data are consistent with estimations of the early event during the formation of IAB parent body (e.g., based on I-Xe chronology 4558-4563 Ma [8]) and is older than some Ar-Ar ages (~4320 Ma) [8], which may correspond to later metamorphism, when Pb-Pb system was not reset.

Acknowledgments: *This work was supported by Russian Science Foundation (project No 17-17-01177).*

References: [1] Wasson J. and Kallemeyn G. (2002) *Geochim. Cosmochim. Acta* 66: 2445-2473. [2] Worsham E. A. et al. (2017) *Earth Planet. Sci. Lett.* 467: 157-166. [3] Benedix G. et al. (2000) *Met. Planet. Sci.* 35: 1127-1141. [4] Ruzicka A. (2014) *Chem. der Erde Geochem.* 74: 3-48. [5] Hunt A. C. et al. (2018) Earth Planet. Sci. Lett. 482: 490-500. [6] Koike M. et al. (2014) *Geochemical Journal* 48:423-431. [7] Vermeesch P. (2018) *Geosci. Front.* 9: 1479-1493. [8] Bogard D. D. et al. (2005) *Met. Planet. Sci.* 40: 207-224.