U-Pb AGE OF UNGROUPED ACHONDRITE NWA 7325.

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Introduction: Recently discovered ungrouped mafic achondrite NWA 7325 is a reduced, Fe-poor cumulate olivine gabbro composed of calcic plagioclase (~56%), diopside (~27%), forsterite (~16%) and a variety of minor and accessory minerals [1]. The chemical similarity (Al/Si, Mg/Si and Fe/Si ratios) between this rock and the composition of the Mercury's surface revealed by MESSENGER X-ray and γ-ray spectrometer mapping [2], plus an oxygen isotopic composition distinct from those for other achondrites, has led to suggestion of the possible origin of this rock from Mercury [1]. Here we report U-Pb age data for this unusual meteorite.

Analytical methods: Diopside was separated from crushed and sieved rock by hand picking. Six diopside and one whole rock fractions were washed, spiked and dissolved following [3]. Pb and U+Th were analyzed using a Triton Plus TIMS and Neptune Plus MC-ICPMS at ANU.

Results: A notable feature of this rock is the extremely low concentration of U, Th and radiogenic Pb in diopside: 0.7 ppb U, 3.4 ppb Th, and 2.5 ppb total Pb after acid washing in the fraction with most radiogenic Pb with measured $^{206}Pb/^{204}Pb$ = 82. The concentrations of U (0.2 ppb) and Th (0.9 ppb) in acid-washed whole rock are even lower. These concentrations are consistent with the previously reported extreme depletion in REE [1]. The low concentrations of U and Th in acid leachates suggest the absence of U,Th-rich phosphate minerals, and low weathering-related addition of these elements. Five Pb-isotopic analyses of acid-washed diopside fractions containing 20-40 pg Pb yield an isochron age of 4562.5±4.4 Ma (MSWD=1.9, assuming $^{238}U/^{235}U$ = 137.79). A regression through the same data forced through the primordial Pb data point yields a more precise age of 4559.3±2.4 Ma (MSWD = 2.0), but the accuracy of this age may be compromised by the presence of residual terrestrial Pb, so we prefer the age of 4562.5±4.4 Ma based on an unconstrained isochron as a tentative age estimate. U-Pb data for acid-washed diopside are nearly concordant, confirming closed system behavior.

Discussion: The Pb-isotopic age of NWA 7325 is indistinguishable from the ages of quenched angrites, and of ungrouped achondrites NWA 2976 [4] and NWA 6704 [5]. Still, these achondrites have clearly distinct oxygen isotope compositions, which, along with chemical and mineralogical differences, indicate that they formed on different parent bodies. The differences in their $^{54}Cr/^{52}Cr$ ratios [6] further strengthen this conclusion. There is growing evidence that a variety of bodies (planetesimals and maybe planets) accreted nearly simultaneously from chemically distinct domains in the protoplanetary disk, and then differentiated and crystallized within 3-5 Ma after CAI formation. Whether Mercury was among them is currently unclear.

References: [1] Irving A. J. et al. (2013) Abstract #2164. 44th LPSC. [2] Weider S. et al. (2012) *J. Geophys. Res.* 117, 15 pp.; Evans L. G. et al. (2012) *J. Geophys. Res.* 117. [3] Amelin Y. et al. (2010) *EPSL*, 300, 343–350. [4] Bouvier A. et al. (2011) *GCA* 75, 5310–5323. [5] Iizuka T. et al. Abstract #1841. 44th LPSC. [6] Sanborn M. et al. (2013), this conference.