SEVEN MILLION YEARS OF EVOLUTION ON THE ANGRITE PARENT BODY FROM PB-ISOTOPIC DATA. Y. Amelin[1,2] and A. J. Irving[3], [1]Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A 0E8, Canada (yamelin@nrcan.gc.ca), [2]Planetary Science Institute and Research School of Earth Sciences, The Australian National University, Canberra ACT 0200, Australia (yuri.amelin@anu.edu.au). [3]Dept. of Earth and Space Sciences, University of Washington, Seattle, WA 98195 (irving@ess.washington.edu).

Introduction: Here we report preliminary Pb isotopic data for three angrites recently found in Northwest Africa: NWA 2999, NWA 4590 and NWA 4801. Petrologic data for NWA 4801 are presented in a companion abstract [1] and descriptions of the other two specimens were given previously [2].

Methods and results: Handpicked pyroxene separates from each angrite were washed in acids and analyzed by TIMS using ^{202}Pb-^{205}Pb double spike as described before [3]. A summary of the measured ages follows:

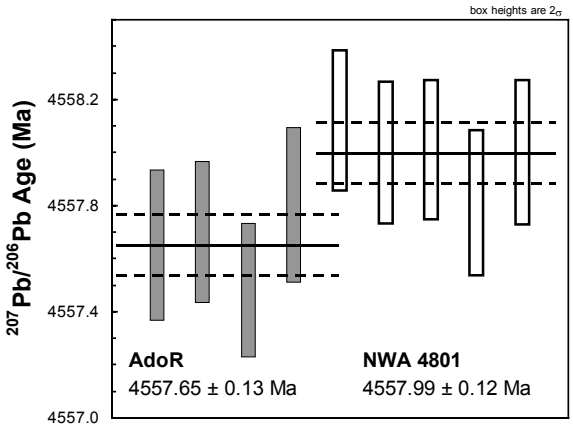
Meteorite	^{207}Pb/^{206}Pb date	2σ err	Pb-Pb isochron	2σ err
SAH 99555	4564.00	0.30	**4564.64**	**0.54**
D'Orbigny	**4564.42**	**0.12**		
NWA 2999	4561.39	0.40	**4561.79**	**0.42**
NWA 4590	4558.00	1.00	**4558.86**	**0.30**
LEW 86010	**4558.55**	**0.15**	4558.68	0.16
NWA 4801	4557.99	0.12	**4558.06**	**0.15**
Angra dos Reis	**4557.65**	**0.13**		

Dates for the angrites SAH 99555, D'Orbigny, LEW 86010 and AdoR were re-calculated with addition of new data points, and therefore differ slightly from the dates for the same meteorites reported at the LPSC-2007 [3]. Preferred dates (the weighted averages for the samples containing pure radiogenic Pb after washing and blank subtraction, and isochron dates for the samples containing common Pb) are highlighted with bold font.

NWA 2999 is unusual among the 13 known angrites in several ways. This specimen is unusually metal-rich, but also has a high abundance of spinel, a mineral that has low (but not negligible) solubility in HF under conditions of sample digestion. Spinel in NWA 2999 contains common Pb that cannot be removed by leaching. Furthermore, there is a pervasive brown coating (iron hydroxides) on all mineral grains, presumably due to terrestrial desert weathering. This coating is opaque and magnetic, obscuring both mineral picking and magnetic separation, and pure pyroxene was obtained from NWA 2999 only after additional washing cycles before mineral picking. The age obtained for NWA 2999 is intermediate between the ages of finer grained ("quenched") and coarser grained ("plutonic") angrites.

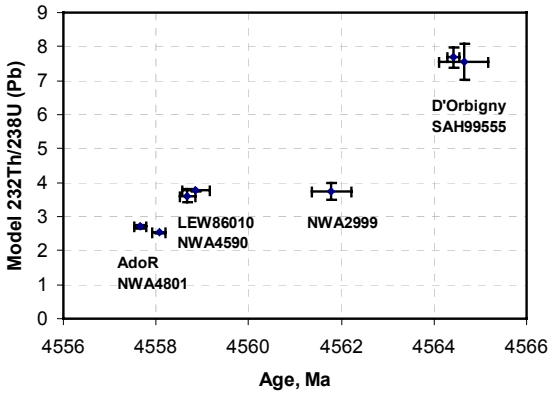
Two other new angrites have ages similar to those of two previously known "plutonic" angrites. NWA 4590 is coeval with LEW 86010, whereas NWA 4801 is slightly (but outside of the 2σ error limits) older than Angra dos Reis.

Age resolution of modern Pb-isotope chronometry: The age difference between the two youngest angrites, AdoR and NWA 4801, is probably close to the limit of age resolution of modern Pb-isotope chronometry. Pyroxenes from both angrites contain pure radiogenic Pb (two out of five fractions from NWA 4801 contain a very small amount of common Pb in excess of blank) - therefore the results are free from uncertainty in common Pb correction. The difference between weighted averages of ^{207}Pb/^{206}Pb is 0.34 ± 0.18 Ma, and appears to be resolved at 2σ level (Fig. 1).



However, the age determinations on these meteorites were obtained in the same laboratory at GSC using identical techniques, and their comparison is free from inter-laboratory analytical biases. It remains to be seen whether such small age differences can be resolved if analyses are performed in different laboratories and by different techniques (e.g., TIMS vs. MC-ICPMS).

Th/U ratios vs. age: The model ^{232}Th/^{238}U values (κ values) in angritic pyroxenes (calculated from isotopic compositions of radiogenic Pb) vary with age in a systematic manner (see Fig. 2).



Three pairs of coeval (or nearly coeval) angrites have very similar κ values, which decrease with age: from 7-8 for D'Orbigny and SAH 99555, to 3.5-3.9 for LEW 86010 and NWA 4590, to 2.5-2.7 for AdoR and NWA 4801. In contrast, NWA 2999 yields a similar κ value to the younger angrites LEW 86010 and NWA 4590, and falls below the trend line. If the falling of Th/U with time reflects the evolution of the sources of magmatism in the angrite parent body, then the deviation of NWA 2999 from this trend may be related to the addition of a chemically different (e.g., chondritic) component, which also may be responsible for the unusually high concentration of metal in this particular angrite [4].

Conclusion: The angrite parent body underwent prolonged high temperature igneous (both volcanic and plutonic) activity and metamorphism for at least 7 Ma during a period very early in solar system history. It is difficult to conceive of a thermal mechanism by which this could be accomplished unless the parent body was a relatively large, differentiated planet.

References: [1] Irving A. J. and Kuehner S. M. (2007) this meeting [2] Irving A. J. et al. (2006) *EOS, Trans. AGU 87, Fall Mtg. Suppl.*, Abstract #P51E-1245; Kuehner S. M. and Irving A. J. (2007) *LPS XXXVIII,* Abstract #1522 [3] Amelin Y. (2007) *LPS XXXVIII,* Abstract #1669 [4] Humayun M. et al. (2007) *LPS XXXVIII,* Abstract #1221; Gellissen M. et al. (2007) *LPS XXXVIII,* Abstract #1612.