PETROGENESIS AND CRYSTALLIZATION HISTORY OF QUENCHED ANGRITES.

T. Mikouchi[1], G. McKay[2], and J. Jones[2]. [1]Dept. of Earth and Planetary Science, University of Tokyo, Hongo, Tokyo 113-0033, Japan. E-mail: mikouchi@eps.s.u-tokyo.ac.jp. [2]Mail Code KR, NASA Johnson Space Center, Houston, TX77058, USA.

Introduction: Angrites constitute an enigmatic achondrite group characterized by unique mineralogies and old crystallization ages [e.g., 1]. By distinct textures, they can be divided into two subgroups, "quenched" and "slowly-cooled" samples. Because Mn-Cr chronology shows that quenched samples are ~5 Ma older than slowly-cooled ones [e.g., 2], quenched samples possibly represent primary igneous activity on the angrite parent body.

Petrogenesis: Quenched angrites show fine-grained ophitic to porphyritic textures, but some samples contain large (reaching several mm) olivine xenocrysts out of Fe/Mg equilibrium with the Fe-rich groundmass. There are strong correlations among major element contents in quenched angrites that can be well explained by olivine control [3]. Because olivine xenocrysts are absent or rare in Sahara 99555, D'Orbigny and NWA 1296, their bulk compositions may represent an angrite magma composition that is not contaminated by the xenocryst component. In fact, their bulk compositions are nearly identical [4,5]. These compositions are close to experimental partial melts of Allende CV3 chondrite at 1200 ^{o}C and logfO_2=IW+1~2 [6]. At this condition, the degree of partial melting is ~15 % and the solid residua are dominated by olivine. The calculated calcium and REE abundances of 15~20 % partial melting of Allende match with those of Sahara 99555 and D'Orbigny.

Crystallization: The Fe-Mg and Ca chemical zoning of olivine xenocrysts adjacent to the groundmass is useful to estimate cooling rates of quenched angrites. The cooling rate calculation of xenocryt-bearing quenched angrites gave 7-13 ^{o}C/hour [7]. The crystallization experiments using the Asuka 881371 groundmass composition with ~1 mm fragments of San Carlos olivine (Fo_{89}) well reproduced textures and mineral compositions of quenched angrites when cooled at 10-50 ^{o}C/hour [7], which is consistent with the result of the cooling rate calculation. Thus, quenched angrites formed by rapid cooling of magmas entraining magnesian olivine xenocrysts of locally different abundances. Minor differences in groundmass compositions may be attributed to locally different melt compositions in the same magma due to different degrees of dissolved olivine xenocryst component.

Conclusion: A possible parent melt composition for quenched angrites could be derived from the partial melts of carbonaceous chondrites. Then, these melts experienced rapid cooling, forming quenched angrites with addition of olivine xenocrysts in some samples.

References: [1] Mittlefehldt D. W. et al. 1998. *Reviews in Mineralogy*, 36:4-131. [2] Shukolyukov A. and Lugmair G. W. 2008. Abstract #2094. 39th Lunar & Planetary Science Conference. [3] Mikouchi T. et al. 2004. Abstract #1504. 35th Lunar & Planetary Science Conference. [4] Mittlefehldt D. W. et al. 2002. *Meteoritics & Planetary Science* 37:345-369. [5] Jambon A. et al. 2005. *Meteoritics & Planetary Science* 40:361-375. [6] Jurewicz A. J. G. et al. 1993. *Geochimica et Cosmochimica Acta* 57:2123-2139. [7] Mikouchi T. et al. 2001. *Meteoritics & Planetary Science* 36, Supplement:A134-A135.