SINGLE CRYSTAL ^{40}AR/^{39}AR AGES FROM GRA 06129

F.N. Lindsay[1,3], T. Haavisto[1,3], B. Turrin[2,3], G.F. Herzog[1,3], and C.C. Swisher III[2,3] [1]Chem. & Chem. Biol., [2]Earth Planet. Sci., [3]Rutgers Univ., Piscataway, NJ 08854, US.

Introduction: The unusual meteorite GRA 06128/9 has brachinite affinities [1]. Prior ^{40}Ar/^{39}Ar release studies indicate closure ages of ~4.4 Ga and subsolidus reequilibration of lithology lasting up to 144 Ma [2,3]. Some disturbance in the Ar release patterns has been attributed to Cl in apatite grains [4]. Ar step-heating experiments on single, monomineralic grains may produce simpler release spectra than whole-rock material. Laser ablation studies done *in situ* offer petrographic context, but with some risk of interference from surrounding phases [5]. Here we show the feasibility of obtaining useful ^{40}Ar/^{39}Ar ages from single-grain samples.

Experimental methods: We separated 13 feldspar grains (0.13<volume(μm^3)<1.31; 35<mass(μg)<348), by heavy liquid and/or handpicking techniques. The grains were irradiated (with Cd shielding) for 80 h at the USGS Triga reactor along with reference minerals FC-2 sanidine (28.02 Ma) and Hb3Gr amphibole (1073.6 Ma). Single grains were heated in 6-8 steps with a CO_2 laser. The Ar isotopes were analyzed using a MAP 215-50 spectrometer operated in pulse-counting mode. Ranges for the total amounts of Ar isotopes (10^{-16} mol) in the samples are: ^{40}Ar=200-1300; ^{39}Ar=0.3-2.7; ^{38}Ar=0.01-0.06; ^{37}Ar=1.0-10; ^{36}Ar=0.03-0.08. A typical system blank (10^{-17} mol) is: ^{40}Ar=20; ^{39}Ar=0.02; ^{38}Ar=0.1; ^{37}Ar=8.0; ^{36}Ar=0.4. With a few exceptions, each heating increment yielded 1/6th to 1/8th of the total amount of gas.

Results & Discussion: Elemental compositions for comparable feldspar grains were measured on a JEOL JXA 8200 electron microprobe. Compositional ranges (wt%) of the analyzed grains are as follows: SiO_2, 61.1-66.1; Al_2O_3, 21.7-22.9; CaO, 2.9-3.7; Na_2O, 9.4-12.2; K_2O, 0.3-0.3; plagioclase endmember composition, $An_{15}Ab_{85}Or_2$-$An_{12}Ab_{88}Or_{2)}$, which agrees with previous studies [3,6]. On a plot of ^{40}Ar/^{36}Ar *vs.* ^{39}Ar/^{36}Ar, the slope indicates a reset (isochron) age of 4437 ±18 Ma and a trapped ^{40}Ar/^{36}Ar ratio close to 0. The unweighted average (N=13) plateau age (Avg.±1-σ; ±SEM) is 4370 ±41; ±11 Ma; the weighted average is 4410 ±4 Ma. The total fusion age is 4402 ±57; ±16 Ma with a weighted average of 4413 ±5 Ma. The plateau, total fusion, and isochron ages are concordant (α=95% CL). Our ages agree with those of [3] and are 100 Ma older than those of [2]. Evidence for a low-temperature event is equivocal: 3 of 13 grains show slight disturbance (1-4% of the total $^{39}Ar_K$), which is likely due to terrestrial weathering. Although the ^{38}Ar measurements are near the detection limits, low measured ^{38}Ar/^{36}Ar ratios (0.2-0.8) indicate minimal Cl, as expected for these samples. Our ages for ~150 μg plagioclase grains reproduce ages measured on samples 10 to 100 times larger. The low mass capability should be helpful in studying meteorites with scarce K-bearing phases and/or more complex histories.

References: [1] Zeigler R. A. et al. 2008. Abstract #2456. 39th Lunar & Planetary Science Conference. [2] Park J. et al. 2010. Abstract #1365. 41st Lunar & Planetary Science Conference. [3] Shearer C.K. et al. 2010. *Geochimica et Cosmochimica Acta* 74:1172-1199. [4] Fernandes V.A.S.M. et al. 2010. Abstract #1008. 41st Lunar & Planetary Science Conference. [5] Walton E.L. et al. 2007. *Geochimica et Cosmochimica Acta* 71: 497-520. [6] McCoy, T. et al. 2007. *Antarctic Meteorite Newsletter* 30:26.