**I-Xe AND OTHER XENON ISOTOPE SYSTEMATICS IN IRRADIATED GRA 06129.** J.L.Claydon, S.A.Crowther, C.K. Shearer and J.D. Gilmour. 1School of Earth, Atmospheric and Environmental Sciences, University of Manchester, Oxford Road, Manchester, M13 9PL, UK. jennifer.claydon@postgrad.manchester.ac.uk, 2Institute of Meteoroitics, Dept. of Earth and Planetary Sciences, Univ. of New Mexico, Albuquerque, NM 87131, USA.

**Introduction:** Graves Nunataks 06128 & 06129 (referred to hereafter as GRA 8/9) are ungrouped achondritic meteorites that have been paired by their proximity and petrographic description [1, 2]. GRA 8/9 are thought to originate in the crust of an asteroid and are dominated by Na-rich plagioclase (48.86 wt%) [1]. Diopside (19.24 wt%), nepheline (11.69), olivine (7.48), pyrite (4.88), orthoclase (1.48), apatite (0.44), ilmenite (0.13) and chromite (0.01) are also present.

Melting on the GRA 8/9 parent asteroid occurred early in the solar system, as shown by an Al-Mg age of 4565.9 ± 0.3 Ma [1]. All previous samples from asteroid crust have been basaltic in nature. GRA 8/9 provides evidence that the chemistry of asteroid crustal materials is more varied than previously thought and that crustal processes other than basaltic magmatism, occurred in the early solar system.

The decay products of short-lived isotopes, alive during the first 100 Ma of the solar system, can be used to calculate precise ages of early solar system materials. 129I decays to 129Xe with a half-life of 16 Ma and has been shown to be a reliable chronometer [3, 4]. A correlation between 129Xe and 127I (a stable isotope) during step-heating of a sample indicates the 129Xe is derived from iodine. By measuring the ratio of excess 129Xe and 127I the relative age of the material can be determined. This is then referenced to a standard of a known age (usually the meteorite Shallowater) to calculate an absolute age.

Results presented in [5] give a relative I-Xe age for GRA 9 of 75 ± 5 Ma after Shallowater. This corresponds to an absolute age of 4487.3 ± 5.02 Ma using the re-evaluated Shallowater age of 4562.3 Ma given in [6], and an initial 129I/127I ratio of ~4 x 10^-6.

Our previous analysis of unirradiated GRA 9 samples [1] showed excess 129Xe from decay of 129I, either in situ or inherited, and 131-136Xe from fission of 239Pu. After correction for a contribution to 132Xe from fission, the maximum observed 129Xe/132Xe ratio was 2.05 ± 0.088. Concentrations of iodogenic xenon (excess 129Xe over trapped xenon with the composition of Q-Xe [7]) varied between the samples (10^8 – 10^10 atoms g^-1) with 70% of iodogenic xenon in one sample released in a single step suggesting it was hosted in a minor phase.

Here we present first results from one of 5 irradiated whole rock (3.56 mg) samples of GRA 9.

**Methods:** Whole rock fragments of GRA 9, along with the irradiation standard Shallowater, were included in irradiation MN10a at the SAFARI-1 reactor in Pelindaba, South Africa. Samples were loaded into a sealed tube and exposed to thermal neutrons (~10^19 n cm^-2) to convert the stable isotope 127I to 128Xe. This allows simultaneous measurement of the 125I decay product (129Xe) and a stable iodine isotope (127I via 128Xe), since neutron irradiation produces 129Xe from iodine. In addition, 131Xe is produced from Ba or Te and 135Xe, 134Xe and 136Xe are produced from neutron-induced fission of 235U.

Following irradiation the samples were laser step-heated and xenon isotopes analysed using the resonance ionization mass spectrometer RELAX (Refrigerator-Enhanced Laser Analysers for Xenon) [8, 9]. Absolute amounts of gas were calculated, and a sensitivity correction made, by reference to measurements of terrestrial air interspersed throughout analyses. The blank of the instrument was also monitored over the time of the analyses. The 128Xe*/129Xe* ratio for the associated Shallowater standards was 0.95 ± 0.04 (where * indicates production from iodine).

**Results and Discussion:** Laser step-heating of the sample produced 114 consecutive releases. In a graph of 136Xe*/132Xe and 134Xe*/132Xe (not shown) mixing was observed between a trapped component (terrestrial or Xe-Q) and a fission signature isotopically consistent with either 241Pu or n-induced fission of 235U modified by n-capture on 135Xe [e.g. 10]. A correction based on 136Xe is ambiguous in distinguishing between the two possible fission components. However, it is expected that the fission component will be dominated by 235U in samples that have experienced neutron fluences this high, and this has been assumed to be the case here.

Releases 1-50 contained significant trapped 132Xe and iodine-derived 128Xe*. This is consistent with terrestrial contamination during the sample’s sojourn in the Antarctic [10, 11]. Releases 50-70 exhibited essentially mono-isotopic 128Xe*. These data challenged the dynamic range of the instrument and are still being examined. They are not discussed further here, where we focus on releases 85-114, after the major release of 128Xe*.

In this region there are four distinct releases (Figure 1), each of which exhibits 131Xe* (assumed to have been produced from Ba rather than Te), 134Xe* (assumed to have been produced from U rather than Pu), iodogenic 128Xe* and trapped 132Xe. Each group of
releases exhibits a distinct range of I/Ba and U/Ba ratios (Figure 2) suggesting releases from host phases of similar but distinct composition that evolve to lower I/Ba and U/Ba with increasing release temperature. These four releases account for 1.8% of total I, 93% of total Ba, 6.3% of trapped Xe and 27% of total U. The estimated total Ba concentration is in the range 10-100 ppm, consistent with that previously reported for this meteorite [1], suggesting that $^{131}$Xe* at least is sourced from plagioclase, the major Ba carrier [1]. Variable iodine and uranium concentrations implied by the varying ratios of daughter xenon isotopes to Ba in the 4 groups may reflect the presence of varying concentrations of inclusions rich in these incompatible elements.

Data from these releases are plotted in a conventional iodine-xenon isochron diagram, where they are compared to previous analyses of this meteorite (Figure 3). Data from G2 have approximately the maximum $^{128}$Xe/$^{132}$Xe ratio previously reported [1] and lie on the reported isochron [5], but the groups in general do not form an isochron suggesting greater complexity than simple mixtures of an evolved xenon component with varying proportions of iodine with a well defined $^{129}$I/$^{127}$I ratio. The data of G2 correspond to a model I-Xe age of ~45 Ma after Shallowater, but chronological interpretation should be made with extreme caution in the absence of an isochron.