IN SITU LASER MICROANALYSIS OF OXYGEN ISOTOPES IN UREILITES. G. J. MacPherson[1], R. D. Ash[1,2], and D. Rumble III[2], [1]Department of Mineral Sciences, MRC-119, National Museum of Natural History, Smithsonian Institution, Washington DC 20560, USA. [2]Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Road NW, Washington DC 20015-1305, USA (glenn@glennm.si.edu).

Among the more enigmatic features of ureilites is the observation [1] that their bulk oxygen isotopic compositions as a group define a line of slope ~ 1 on a three-isotope O diagram, and this line is approximately the same as an ^{16}O-poor extension of the Allende CAI mixing line. This is generally taken to mean [1] that the ureilites are not related to each other by igneous processes within a single differentiated parent body, and that their bulk isotopic compositions are inherited from nebular rather than planetary processes, even though many features of these rocks indicate that they formed by igneous processes [e.g., 2,3, etc.]. Clayton and Mayeda [1] noted that members of the Group I (high Fe; [4]) ureilites appear to define 2 subgroups that differ from each other in Δ^{17}O, and within each of which the oxygen isotopic data falls approximately along a slope-½ line on a three isotope diagram. More recent work has suggested that the Group I ureilites may consist of as many as four subgroups [5,6]

We analyzed individual mineral grains *in situ* within polished pristine slices of the Group I ureilites Kenna and Novo Urei, using the UV laser probe at the Carnegie Institution [7], and following SEM characterization of the slices. The beam diameter of the laser probe was approximately 400–500 µm. Precision of the data is better than 0.10‰ in δ^{18}O and δ^{17}O. Data for olivine and low-Ca pyroxene in each meteorite are given in Table 1, along with bulk data for the two meteorites from [1]. The Kenna olivine and pyroxene data are within analytical error of each other, although they appear to disperse along a line of slope close to ½. Our mineral data for Kenna bracket the bulk meteorite composition in δ^{18}O but are slightly higher in (although within error of) δ^{17}O relative to bulk. The Novo Urei olivine and pyroxene points are clearly resolved from one another, with the pyroxene being higher in δ^{18}O by ~0.3‰ relative to the olivine. As with Kenna, the Novo Urei data define a line of low slope. The enrichment of pyroxene in ^{18}O relative to the olivine in Novo Urei is consistent in sign with igneous partitioning between the two minerals. Unlike Kenna, our mineral data for Novo Urei do not bracket the bulk meteorite composition in δ^{18}O but rather are enriched in that isotope. It is likely that there is a ^{18}O-depleted phase (s) in Novo Urei not represented by our data. The Novo Urei mineral data are also slightly higher in δ^{17}O relative to bulk. For both meteorites, we attribute the displacement of our data by ~0.1‰ to higher δ^{17}O from the respective bulk compositions to systematic analytical differences between the Chicago and Carnegie labs. Weighted least-squares regression of combined mineral data for both meteorites gives a slope of 0.2712 ± 0.4346, within error of a slope-½ (mass dependent fractionation) line.

The data thusfar are obviously limited and not conclusive, but are nonetheless entirely consistent with an igneous origin for both ureilites, possibly on the same parent body. This conclusion is consistent with the suggestion of Clayton and Mayeda [1] for these meteorites, but differs from that of [8] based on ion probe analyses of two Antarctic ureilites.

References: [1] Clayton R. N. and Mayeda T. K. (1988) *GCA, 52,* 1313. [2] Goodrich C. A. (1992) *Meteoritics, 27,* 327. [3] Walker D. and Grove T. (1993) *Meteoritics*, *28*, 629. [4] Berkeley J. L. et al. (1980) *GCA*, *44*, 1579. [5] Franchi I. A. et al. (1997) *Meteoritics & Planet. Sci.*, *32*, A44. [6] Franchi I. A. et al. (1998) *LPS XXIX*. [7] Rumble D. III et al. (1997) *GCA*, *61*, 4229. [8] Ruzicka A. et al. (1998) *LPS XXIX*.

TABLE 1.

	δ^{18}O	δ^{17}O	Δ^{17}O
Novo Urei pyroxene	7.67	3.06	-0.93
Novo Urei olivine	7.34	2.97	-0.85
Kenna pyroxene	7.59	2.99	-0.96
Kenna olivine a	7.5	2.97	-0.93
Kenna olivine b	7.59	3.04	-0.91
Novo Urei bulk [1]	7.21	2.76	-0.99
Kenna bulk [1]	7.54	2.9	-1.02