CM RIMS: *IN SITU* RARE GAS ANALYSIS OF MURCHISOŇ; D.S. Woolum[1,3], K. Kehm[2], C.M. Hohenberg[2], K. Poelstra[1], E. Guntalilib[1]. [1]Dept. of Physics, California State University, Fullerton, CA 92634 USA; [2]McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130 USA; [3]Div. of Geological & Planetary Sciences, California Institute of Technology, Pasadena, CA 91125 USA.

Introduction. CM meteorites have been characterized as a product of the compaction of two lithologies [1]: (i) primary accretionary rock (PAR), comprised exclusively of sub-rounded inclusions (cores) completely coated with opaque, fine-grained dust mantles (rims), and (ii) clastic matrix (cmx) resulting from the compaction of comminuted fragments of the PAR. Based on textural, mineralogical, and chemical evidence, Metzler et al. [1] argued that the CM rims were formed in an accretional process in the early solar nebula rather than later in a parent body regolith. In addition, they noted a rough correlation between the vol.% of cmx and the bulk concentration of solar-wind implanted noble gases in the CMs; this suggests that the cmx rather than the PAR is the host phase for the solar gases. This is consistent with their model in which the PAR formed in the solar nebula when the dust opacity of the nebula was sufficient to shield the accreting mantles from solar wind implantation. The cmx was presumably exposed to the solar wind after the nebula was dispersed either in the regolith at the surface of the accreted parent body, or at the very late stages of accretion. In further support of their model, Metzler et al. [1] cited noble gas analysis of a dust mantle in which no significant solar Ne was found [2].

The notion that identifiable components of CM meteorites preserve a record of their nebula origins is important and should be tested. The siting of solar noble gases can provide crucial input in this, and we report here our initial *in situ* rare gas analyses of the Murchison CM meteorite using the newly-developed Washington University laser noble gas volatilization facility.

Technique. Thick, free-standing sections (~ 1 cm^2) of Murchison were prepared by slicing a potted chip of the meteorite and polishing circa 300 μm-thick slices. Standard epoxy-impregnation of the samples was not performed, since epoxy is incompatible with the high vacuum target chamber. As a result, high quality polishing became very difficult because of extensive plucking of the fine-grained regions. However, in the case of a few sections, the polish was sufficiently good to allow the identification of several rimmed inclusions in both reflected light optical and back-scattered electron SEM microscopy. The data we report here is from one of the two best sections prepared in this manner.

The sample was loaded into the extraction cell of an ultra-high vacuum, ion-counting noble gas mass spectrometer [3]. Noble gases were extracted from targeted features *in situ* by precision pulsed-laser volatilization using computer-controlled XY-rastering [4]. Based on preliminary laser excavation studies of Allende thick sections, optimum pulse frequency and pulse energy were determined to be 600 Hz and 0.4 $^{mJ}/_{pulse}$. Normal incidence optical viewing of the sample during gas extraction assured that the targeted features were, in fact, vaporized by the laser. Typical raster scans were ~150 μm × 150 μm in area and ~100 μm deep. To date, preliminary analysis of the Ne data has been completed.

Results/Discussion. Figure 1 shows the data plotted on a traditional three isotope plot. The error bars represent the 1 σ correlated uncertainties and the largest arise primarily due to low gas amounts. Within errors, our data all plot within the triangle representing a three component mixture of planetary, solar, and spallogenic compositions. We made no attempt to select random sites in order to obtain a bulk composition. Compared with previously published "bulk" material from Murchison [5], shown as crosses in the figure, these data are poorer in trapped Ne (solar +

planetary), which may reflect the inherent variability of gas-rich meteorites. The extracted Ne is also highly variable in composition, reflecting the unequilibrated nature of Murchison.

Focusing on the key results from the rims (Fig. 1, inset), of the eleven rim areas analyzed, approximately half contain an unambiguous (> 3 σ) solar Ne contribution. Of the remaining data points, all but two are elevated by at least 1 σ from the planetary-spallation mixing line, also strongly suggesting the presence of solar Ne. The two showing less evidence for solar Ne were obtained from the thinnest rims, and so were conceivably diluted by non-rim material. Alternatively, they may reflect a separate history. Seven of the eleven rim analyses were taken from a single, 2.4 mm diameter rimmed core (referred to as 'BB1'), with ~300 μm rim thickness. Comparisons among this data set showed: 1) no detectable difference between inner and outer rim analyses at two locations on the rim; and 2) a distinct angular asymmetry around the rim in both total and solar gas contents. It appears that these data are not consistent with the simple one stage model for rim formation proposed by Metzler et al. [1]. It is also difficult to reconcile with a simple one stage model for parent body formation. More complex multiple-stage histories appear to be required, at least for BB1.

References. [1] Metzler K. et al. (1992),*Geochim. Cosmochim. Acta.* 56: 2873-2897. [2] Nagao K. (1991) *Report of the 1989-1990 Monbusyo Scientific Research Program.* [3] Hohenberg C. M. (1980), *Rev. Sci. Instrum.* 51, 1075-1082. [4] Kehm K. et al. (1994), *Lunar Planet. Sci.* XXV, 683-684. [5] Bogard D. et al. (1971), *J. Geophys. Res.* 76, 4076-4083.

Fig. 1. Murchison Ne isotopic data. Inset: rim data only.