

**US ANTARCTIC CR CHONDRITES: A LIMITED RESOURCE PROVIDING MATERIAL FOR A BROAD ARRAY OF PLANETARY SCIENCES.** K. McBride<sup>1</sup>, C. Satterwhite<sup>1</sup>, and K. Righter<sup>2</sup>, <sup>1</sup>Jacobs Technology, NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058, kathleen.m.mcbride@nasa.gov, <sup>2</sup>Mailcode KT, NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058, kevin.righter-1@nasa.gov.

**Introduction:** CR2 chondrites have been steadily recovered from Antarctica (Table 1) and have enabled exceptional discoveries in a wide variety of subfields including chondrule formation, matrix CAI/AOA inclusions, metal stability, pre-solar grains, isotopic studies and organics (Table 2). Many Antarctic CR2s have provided materials for a variety of studies, however, they have been heavily requested (e.g., Figure 1), are of limited size and thus availability of material has become steadily smaller for some samples (Table 1).

**Examples:** GRA 95229 has been an important sample for organic geochemists, with a diversity of compounds being discovered and analyzed including amino acids, hydroxyl acids, and ammonia [1-3]. It has also provided for a variety of additional studies including chondrules, metal, isotopic, and inclusions (Table 2). This meteorite has been requested at a greater rate than other chondrites in the past decade, but has only ~50% of the original mass left for allocation (Figure 2a).

EET 92042 has provided organics, and also wonderful studies of pre-solar grains, chondrules and inclusions, because it is a highly primitive sample [4-7]. Even though it is a 45 g specimen, it is paired with nearly 50 other samples as part of a large pairing group spanning several collection seasons (1987, 1990 and 1992). Although only 45% is left from the original mass of EET 92042, but it is part of a large pairing group that includes 50 individual specimens with a combined mass of 1342.6 g. There are 304.2 g of material remaining at JSC (from 22 specimens or 22.7% of available mass) and 941.3 g of material at SI (from 46 specimens or 70.1% of available mass), with 97.1 g allocated to scientists for various studies (7.2% of available mass).

QUE 99177 is an unusual CR chondrite that has experienced much less aqueous alteration than other CRs, but also contains some diverse components such as pre-solar grains, hornblende-graphite clasts, and chondrules rimmed by metal (Table 2). This sample has been described as a CR3 chondrite given its primitive characteristics [8].

GRO 95577 is one of two Antarctic CR1 chondrites and has been of great interest due to its rarity (Table 2). Despite its similarly large mass (106 g) to GRA 95229, more material is available to allocate 74.5% vs. 50.3%.

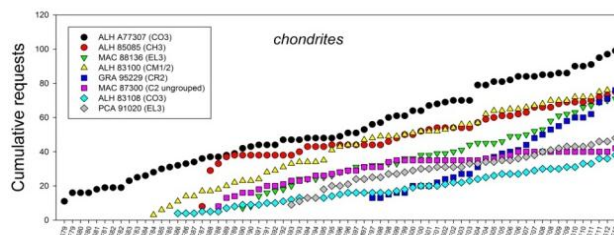
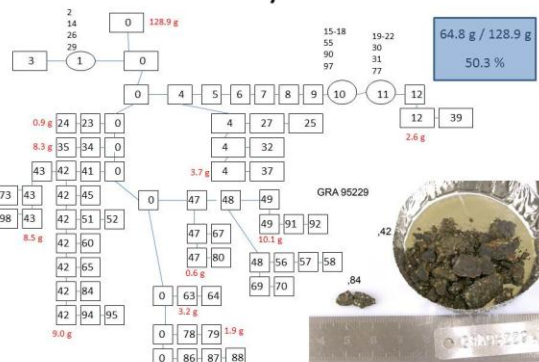


Figure 1: Cumulative requests versus MWG meeting year (S = Spring and F = Fall) for specific chondrites since the beginning of the US Antarctic meteorite program. Note steepest slope for GRA 95229 (blue).

### Allocation history of GRA 95229



### Allocation history of EET 92042

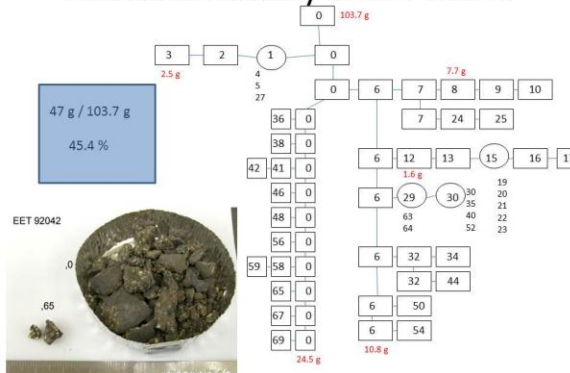


Figure 2: Allocation histories and sample photos of the remaining main masses of GRA 95229 and EET 92042.

**Conclusions:** Based on growing demand for CR chondrite material, and the existing specimens in the US Antarctic collection, the following conclusions can be drawn.

- Careful curation of this material is necessary to satisfy a broad range of sample studies from nano-scale to macro-scale, and from organic geochemistry to petrography.

-Careful decisions should be made in allocating these materials many of which are of limited availability.

-Additional recovery efforts are justified to recover more of this scientifically valuable material.

**Table 1:** CR chondrites in the US Antarctic meteorite collection

sample	mass	Type	% left to allocate
EET 87711 + 50 pairs	1342 g	CR2	45.4 (EET 92042)
GRA 95229	128.9	CR2	50.3
GRA 06100	421.76	CR2	90.2
GRO 03116	108.286	CR2	87.1
LAP 02342	42.438	CR2	81.4
MET 00426	31.326	CR2	63.0
QUE 99177	43.555	CR2	66.4
GRO 95577	106.20	CR1	74.5

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**Table 2:** US Antarctic CR chondrites and types of studies undertaken

EET pairs	chondrules	Matrix	CAI/AOA	metal	Pre-solar	Iso-	organics
EET pairs	[9,10,12,13,14,15,16]	-	[7,14]	[17,18,19,21]	[22]	[24,25]	[11,20,26,27,28,29,30]
GRA 95229	[10,12,14,15,16]	-	[7,14,23,35]	[19,21]	[22,41]	[24,42]	[1,2,20,27,29,33,34]
GRA 06100	-	[43,44]	-	[19]	-	[41]	-
GRO 03116	[9]			[19,21]			
LAP 02342	[9]	[31]		[19,21,32]			[2, 33]
MET 00426	[9]	[8]	[14, 35]	[19,21]	[22,37,38,39]		[20]
QUE 99177	[9]	[8]	[23]	[19,21]	[37,38,40]		[20,28]
GRO 95577		[36]		[19]	[22]		[11,20,26,27,29, 30]