# Antarctic Meteorite Newsletter

Volume 38, Number 2     August 2015

## Curator's Comments

*Kevin Righter, NASA-JSC*

This newsletter reports 46 new meteorites from the 2012 and 2013 ANSMET seasons from the Miller Range (MIL13), Graves Nunataks (GRA12), Larkman Nunatak (LAR12), Szabo Bluff (SZA12), and Scott Icefields (SCO12) areas. Meteorites from the 2012 season include several LL3.8 chondrites, EH4 chondrite, ureilite, and a winonaite (the second for the US Antarctic meteorite collection). Meteorites from the 2013 Miller Range season include a beautiful large aubrite, a lunar polymict breccia (anorthositic), two eucrites, and 8 carbonaceous chondrites (1 CM1/2, 4 CM2, 2 CK5, 1 CV3).

### Reminder that annual inventory will be sent soon

US Antarctic meteorite inventories will be mailed to all PIs within a few weeks. You will receive a list of samples with a header at the top for two signatures – one for you (the PI) and one for an institutional official. When you receive this inventory, please follow these instructions:

- Print the list
- Compare your sample list to samples in your possession
- Confirm samples are in your possession unless consumed during research (if approval was obtained during original sample request)
- Sign/date top of first inventory page
- Institutional official must sign/date top of first page
- Scan and email it back to us

***PIs that do not respond to inventory queries by the NASA Curator will not continue to receive samples from the collection.***

### Reminder to acknowledge samples received from NASA-JSC

When publishing results of your research, please include the split numbers used in the research.

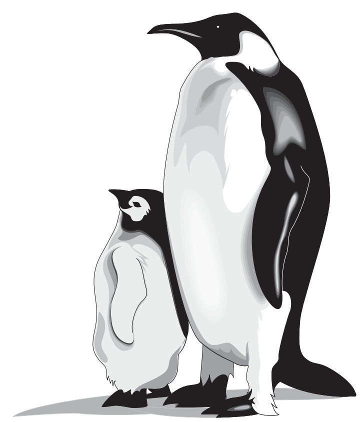
We also request that scientists use the following acknowledgement statement when reporting the results of their research in peer reviewed journals: "US Antarctic meteorite samples are recovered by the Antarctic Search for Meteorites (ANSMET) program which has been funded by NSF and NASA, and characterized and curated by the Department of Mineral Sciences of

A periodical issued by the Meteorite Working Group to inform scientists of the basic characteristics of specimens recovered in the Antarctic.

Edited by Cecilia Satterwhite and Kevin Righter, NASA Johnson Space Center, Houston, Texas 77058

## Inside this Issue





**Sample Request Deadline September 10, 2015**

**MWG Meets Sept. 24-25, 2015**

the Smithsonian Institution and Astromaterials Curation Office at NASA Johnson Space Center." Such an acknowledgement will broaden the awareness of the funding mechanisms that make this program and these samples possible.

We suggest you find out how to acknowledge samples received from all the collections/museums from which you have received materials so that all the institutions making samples available to you receive proper credit and acknowledgement.

## Staff changes at JSC

The past year, Mitch Haller has worked with the meteorite collection and has described many of the samples in this and the Spring 2015 newsletter. Mitch has decided to pursue a higher degree in the Geosciences, and we wish him well in his new position. Thanks to Mitch for all his hard work and dedication to the collection while he was in Houston. While we are saying goodbye to Mitch, we welcome Rachel Funk to the meteorite curation group at JSC. Rachel is graduating from the University of Houston with a Master's degree for which she studied the mineralogy and petrology of the Larkman Nunatak shergottites. We are excited to have Rachel working with us and welcome her to the JSC Astromaterials curation group.

## Reclassification

**RBT 04133** was classified as a CR2 in the February 2008 (vol.31 No. 1) newsletter. More detailed information has led to a better understanding of this sample, which we here re-classify to CV3 (reduced), based on the study of Davidson et al. (2014) Meteoritics and Planetary Science 49, No. 12, 2133–2151. Quoting from their paper: "Data presented here conflict with its initial classification as a CR2. Petrographically, RBT 04133 appears to be a $CV3_{red,}$ based on the presence of large CAIs and chondrules, the apparent lack of magnetite, and a matrix composition of $Fa5_{9-60}$. This is in agreement with its whole-rock C, N, and O-isotope compositions, and the Raman spectral characteristics of its IOM."

*Rachel Funk, Meteorite Processor*
*standing by Big Lew in MPL*

## A preview of the 2015-2016 ANSMET field season

*Ralph Harvey, Jim Karner and John Schutt*
*Case Western Reserve University*

Homecoming season will soon be upon us. The upcoming field season is a return to one of our most frequently visited sites, the Miller Range (home of the MIL meteorites). This modest range in the middle of the Transantarctic Mountains holds back the ice of the East Antarctic Plateau and shoves it northward to drain into the mighty Nimrod Glacier (and the lesser but still impressive Marsh Glacier to the south). This deviation of flow from its preferred eastward direction creates a lot of stranded ice in a lot of different settings throughout the Miller Range, including 3 big icefields (North, Middle and South) and about a dozen smaller icefields. The diversity of blue ice around the Miller Range is echoed by the diversity of recovered meteorites; roughly 2300 so far, including 65 different classes, some of which are quite rare (e.g. nakhlites, lunars, unclassified achondrites, olivine diogenites, etc.). This newsletter includes a few of those from the 2013-2014 field season.

2015-16 will be our ninth field season in the Miller Range; after a few early reconnaissance visits, we've been going back every other season since 2003. There's been diversity in our recovery numbers too; Variable weather, aircraft availability issues and/or government shutdowns have led to the Miller Range being the site of some of our lowest and highest total number of meteorite recoveries over the past several decades. Our 2013-14 visit was one of the low spots, with half the team stranded in McMurdo station until early January, resulting in what we can only call "limited" recoveries. The shortcomings of that season have highly influenced our plans for the coming season, when we hope to complete some of what we left undone (with a few modifications). After the usual pre-season activities in McMurdo, we'll stage everything up to the old CTAM site, and from there we'll put-in at the margins of the southern Miller Range icefields. If the weather is good and flights stay on schedule, it's conceivable we could complete systematic searching on that icefield (though our prior predictions on such things are woefully inaccurate). After about four weeks 6 members of the team will move camp to the northern end of the Miller Range, where preliminary visits (hampered by snow) revealed meteorites on patchy blue ice along the Nimrod and in some local alpine valleys.

Meanwhile the other two field party members will head back to McMurdo and then out to the ALH-EET region. We last systematically searched in the area in 1996. Since that time that region of the continent has seen increased and persistent snow cover, so we chose to concentrate our efforts further south where the effects seemed less severe. Over the past few years however local climate seems to have reverted to what we were familiar with in the late 80's, and with some blue ice remaining to be searched and anecdotal evidence of reduced snow cover we're giving the region another look.

As usual our field season will begin in mid-November and end in late January; make sure to visit our weblog for updates on how things are going in the field. I hope you see your favorite MIL meteorites there!

*Alex Meshik and Morgan Nunn Martinez collecting a meteorite in the Miller Range, 2013-2014 field season*

## Report from the Smithsonian – Fall 2015

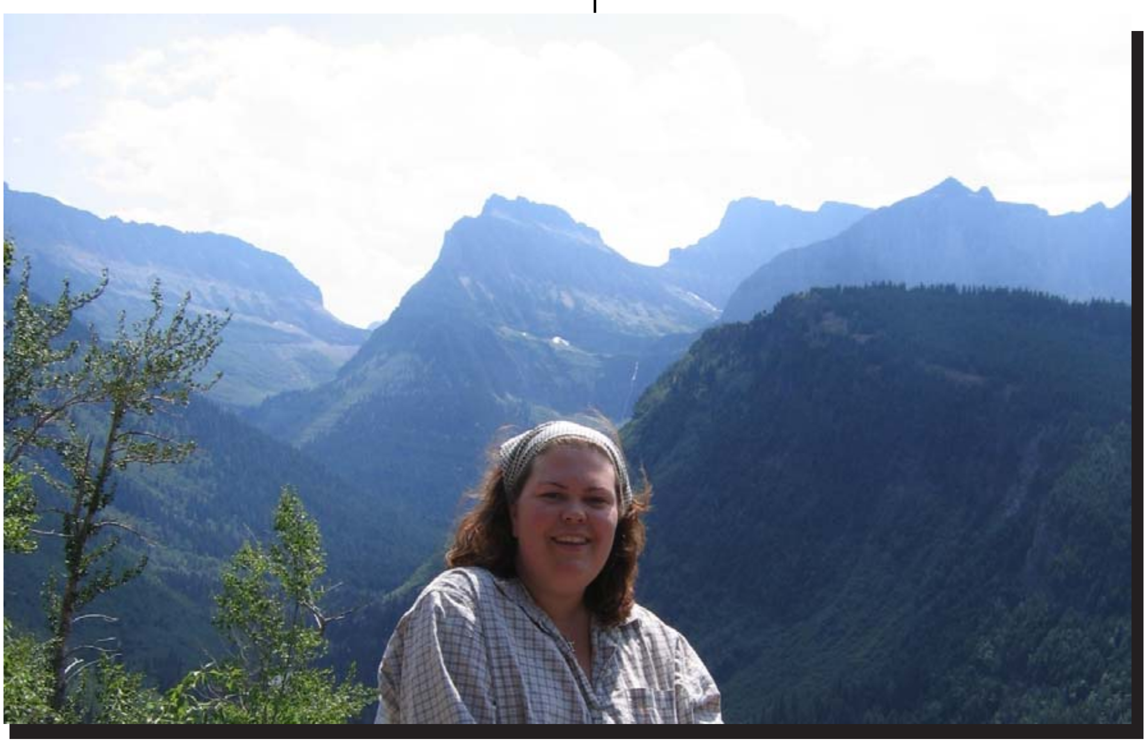
*Cari Corrigan*

This newsletter announces the classification of 46 meteorites from the 2012 and 2013 ANSMET seasons. Since the last newsletter, we have had a number of ups and downs in the Division of Meteorites.

We have said goodbye to Dr. Emma Bullock, a member of the Division of Meteorites who never failed to lend a hand when needed, and whose assistance was always greatly appreciated. Emma moved to a permanent position at the Carnegie Institution in May, running their FIB-SEM. We miss her smiling face, but wish her all the best! We also said goodbye to Pam Salyer in March. Pam worked with us on classifying meteorites and helping make things run in the absence of a Collections Manager. It has been a rough summer, with only a skeleton crew working in Meteorites at the Smithsonian, and the small number of meteorites classified in this newsletter is a direct reflection of that (however, we made sure to focus on those that required EPMA analyses and would be the most requested, as opposed to classifying just the ordinary chondrites).

However, we are very happy to report that we have hired a new Collections Manager. Julie Hoskin joined us on August 10$^{th}$ and, thanks to her 15 years of museum and collections management experience, she has hit the ground running! Julie has worked with a wide variety of collection artifacts and specimens from numerous museums, including; the National Museum of American History, the Hirshhorn Museum, the Virginia Museum of Natural History, the National Museum of Health and Medicine, the National Gallery of Art, and the National Museum of Natural History. With a passion for preserving collections for research and exhibition, she is an expert in environmental monitoring and control, constructing specialized housing and supports for objects, appropriate chemicals and materials to use with various specimens, digital imaging of specimens and associated information, as well as cataloging objects and recording specimen data. Julie has been a member of the Society for the Preservation of Natural History Collections (SPNHC) for a number of years and has presented at their annual meetings. We look forward to introducing Julie to the meteoritic community in the coming month. Her contact info is hoskinj@si.edu and 202-633-1825.

For those of you waiting for iron meteorite requests, our iron cutting saw is nearing the end of its repairs and we should be getting your samples to you soon. Apologies and please bear with us as our Museum undergoes major renovations, which required us to move the entire rock cutting lab.



*Julie Hoskin, Collections Manager, at Glacier National Park*

## 2012-2013 Collection

Pages 6-13 contain preliminary descriptions and classifications of meteorites that were completed since publication of issue 38(1), Feb. 2015. Specimens of special petrologic type (carbonaceous chondrite, unequilibrated ordinary chondrite, achondrite, etc.) are represented by separate descriptions unless they are paired with previously described meteorites. However, some specimens of non-special petrologic type are listed only as single line entries in Table 1. For convenience, new specimens of special petrological type are also recast in Table 2.

Macroscopic descriptions of stony meteorites were performed at NASA/JSC. These descriptions summarize hand-specimen features observed during initial examination. Classification is based on microscopic petrography and reconnaissance-level electron microprobe analyses using polished sections prepared from a small chip of each meteorite. For each stony meteorite the sample number assigned to the preliminary examination section is included. In some cases, however, a single microscopic description was based on thin sections of several specimens believed to be members of a single fall.

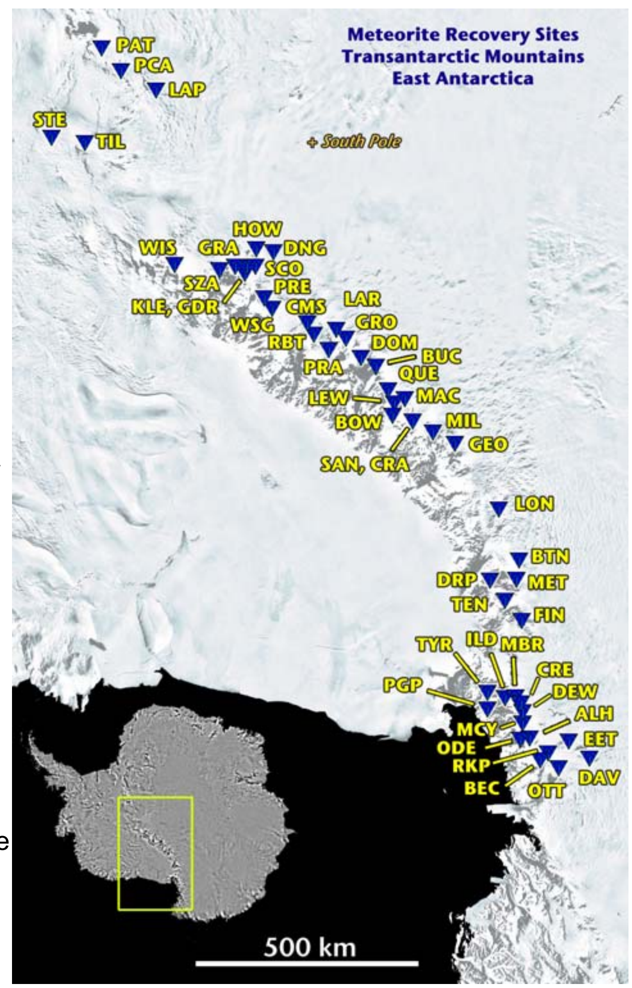
Meteorite descriptions contained in this issue were contributed by the following individuals:

Mitchell Haller, Roger Harrington and Cecilia Satterwhite
Antarctic Meteorite Laborabory
NASA Johnson Space Center
Houston, Texas

Cari Corrigan, and Tim McCoy
Department of Mineral Sciences
U.S. National Museum of Natural History - Smithsonian Institution
Washington, D.C.

## Antarctic Meteorite Locations

ALH — Allan Hills
BEC — Beckett Nunatak
BOW — Bowden Neve
BTN — Bates Nunataks
BUC — Buckley Island
CMS — Cumulus Hills
CRA — Mt.Cranfield Ice Field
CRE — Mt. Crean
DAV — David Glacier
DEW — Mt. DeWitt
DNG — D'Angelo Bluff
DOM — Dominion Range
DRP — Derrick Peak
EET — Elephant Moraine
FIN — Finger Ridge
GDR — Gardner Ridge
GEO — Geologists Range
GRA — Graves Nunataks
GRO — Grosvenor Mountains
HOW — Mt. Howe
ILD — Inland Forts
KLE — Klein Ice Field
LAP — LaPaz Ice Field
LAR — Larkman Nunatak
LEW — Lewis Cliff
LON — Lonewolf Nunataks
MAC — MacAlpine Hills
MBR — Mount Baldr
MCY — MacKay Glacier
MET — Meteorite Hills
MIL — Miller Range
ODE — Odell Glacier
OTT — Outpost Nunatak
PAT — Patuxent Range
PCA — Pecora Escarpment
PGP — Purgatory Peak
PRA — Mt. Pratt
PRE — Mt. Prestrud
QUE — Queen Alexandra Range
RBT — Roberts Massif
RKP — Reckling Peak
SAN — Sandford Cliffs
SCO — Scott Glacier
STE — Stewart Hills
SZA — Szabo Bluff
TEN — Tentacle Ridge
TIL — Thiel Mountains
TYR — Taylor Glacier
WIS — Wisconsin Range
WSG — Mt. Wisting



# Table 1
# Newly Classified Antarctic Meteorites

| Sample Number | Weight(g) | Classification | Weathering | Fracturing | %Fa | %Fs |
|---|---|---|---|---|---|---|
| GRA 12501 | 89.2 | H5 CHONDRITE | B | A/B | 18 | 16 |
| GRA 12510 | 4.4 | WINONAITE | B | A/B | 1-3 | 1-4 |
| GRA 12511 | 4.0 | H6 CHONDRITE | B | A/B | 19 | 16 |
| | | | | | | |
| LAR 12034 | 930.6 | LL3.8 CHONDRITE | A/B | B | 25-34 | 12-24 |
| LAR 12075 | 21.0 | LL3.8 CHONDRITE | A | A | 19-32 | 13-34 |
| LAR 12078 | 30.2 | LL3.8 CHONDRITE | A | A | 8-36 | 22 |
| LAR 12082 | 13.4 | H4 CHONDRITE | B | A | 18 | 16 |
| LAR 12163 | 25.1 | H4 CHONDRITE | B/CE | A/B | 18 | 16 |
| LAR 12164 | 43.7 | H4 CHONDRITE | BE | A/B | 18 | 16 |
| LAR 12169 | 35.4 | H6 CHONDRITE | B/C | A/B | 18 | 16 |
| LAR 12176 | 5.7 | H4 CHONDRITE | A/B | A/B | 17 | 15 |
| LAR 12180 | 20.1 | LL3.8 CHONDRITE | B/C | A/B | 4-27 | 19 |
| LAR 12182 | 13.4 | L5 CHONDRITE | B/C | A/B | 24 | 20 |
| LAR 12203 | 28.0 | LL3.8 CHONDRITE | BE | A | 12-34 | 18-26 |
| LAR 12283 | 26.2 | UREILITE | B/CE | A/B | 3-21 | |
| LAR 12288 | 14.0 | L4 CHONDRITE | B/C | A/B | 25 | 21 |
| LAR 12289 | 14.2 | LL6 CHONDRITE | A/B | A | 30 | 25 |
| LAR 12301 | 22.2 | L5 CHONDRITE | A/B | A | 22 | |
| LAR 12302 | 2.9 | H5 CHONDRITE | B/C | A/B | 21 | |
| LAR 12303 | 6.0 | LL5 CHONDRITE | B/C | A/B | 28 | |
| LAR 12304 | 8.6 | LL5 CHONDRITE | B/C | A | 28 | |
| LAR 12305 | 10.2 | LL5 CHONDRITE | B/C | A | 29 | |
| LAR 12306 | 7.5 | LL5 CHONDRITE | B/C | A/B | 28 | |
| LAR 12307 | 3.2 | H5 CHONDRITE | B/C | A | 21 | |
| LAR 12308 | 14.5 | LL5 CHONDRITE | A/B | A/B | 28 | |
| LAR 12309 | 2.7 | LL5 CHONDRITE | B/C | A/B | 28 | |
| LAR 12310 | 8.5 | LL5 CHONDRITE | B/C | A/B | 28 | |
| | | | | | | |
| SCO 12530 | 113.7 | H5 CHONDRITE | A | A | 18 | 16 |
| | | | | | | |
| SZA 12441 | 11.8 | L5 CHONDRITE | A/B | A | 24 | 21 |
| SZA 12444 | 0.6 | EH4 CHONDRITE | B/CE | A | | 0-1 |
| | | | | | | |
| MIL 13004 | 1804.3 | AUBRITE | A/B | B | 0 | 0 |
| MIL 13005 | 192.7 | CM1/2 CHONDRITE | AE | B/C | 0-23 | |
| MIL 13019 | 67.5 | EUCRITE (UNBRECCIATED) | A/B | A/B | | 25-60 |
| MIL 13062 | 15.5 | CK5 CHONDRITE | A/B | B | 34-38 | |
| MIL 13079 | 11.6 | EUCRITE (BRECCIATED) | A | A/B | | 24-62 |
| MIL 13116 | 33.5 | LL6 CHONDRITE | A | A | 28 | 23 |
| MIL 13119 | 2.6 | CM2 CHONDRITE | A/B | B/C | 0-19 | |
| MIL 13139 | 2.9 | CM2 CHONDRITE | B | A/B | 0-28 | |
| MIL 13317 | 32.2 | LUNAR-ANORTH. BRECCIA | B | A/B | | 28-49 |
| MIL 13318 | 13.2 | LL4 CHONDRITE | B | A/B | 28 | 16-24 |
| MIL 13319 | 10.6 | LL4 CHONDRITE | A/B | A/B | 28 | 21 |
| MIL 13328 | 69.0 | CV3 CHONDRITE | A/B | A/B | 1-14 | 1 |
| MIL 13329 | 2.9 | CM2 CHONDRITE | B | A/B | 0-28 | |
| MIL 13330 | 11.1 | CM2 CHONDRITE | A | B | 0-37 | |
| MIL 13331 | 2.4 | CK5 CHONDRITE | A | B/C | 33 | |
| MIL 13332 | 36.2 | H5 CHONDRITE | C | B | 18 | 16 |

# Table 2
# Newly Classified Meteorites Listed by Type

## Achondrites

| Sample Number | Weight(g) | Classification | Weathering | Fracturing | %Fa | %Fs |
|---|---|---|---|---|---|---|
| MIL 13004 | 1804.3 | AUBRITE | A/B | B | 0 | 0 |
| MIL 13079 | 11.6 | EUCRITE (BRECCIATED) | A | A/B | | 24-62 |
| MIL 13019 | 67.5 | EUCRITE (UNBRECCIATED) | A/B | A/B | | 25-60 |
| MIL 13317 | 32.2 | LUNAR-ANORTH. BRECCIA | B | A/B | | 28-49 |
| LAR 12283 | 26.2 | UREILITE | B/CE | A/B | 3-21 | |
| GRA 12510 | 4.4 | WINONAITE | B | A/B | 1-3 | 1-4 |

## Carbonaceous Chondrites

| Sample Number | Weight(g) | Classification | Weathering | Fracturing | %Fa | %Fs |
|---|---|---|---|---|---|---|
| MIL 13062 | 15.5 | CK5 CHONDRITE | A/B | B | 34-38 | |
| MIL 13331 | 2.4 | CK5 CHONDRITE | A | B/C | 33 | |
| MIL 13005 | 192.7 | CM1/2 CHONDRITE | AE | B/C | 0-23 | |
| MIL 13119 | 2.6 | CM2 CHONDRITE | A/B | B/C | 0-19 | |
| MIL 13139 | 2.9 | CM2 CHONDRITE | B | A/B | 0-28 | |
| MIL 13329 | 2.9 | CM2 CHONDRITE | B | A/B | 0-28 | |
| MIL 13330 | 11.1 | CM2 CHONDRITE | A | B | 0-37 | |
| MIL 13328 | 69.0 | CV3 CHONDRITE | A/B | A/B | 1-14 | 1 |

## Chondrites - Type 3

| Sample Number | Weight(g) | Classification | Weathering | Fracturing | %Fa | %Fs |
|---|---|---|---|---|---|---|
| LAR 12034 | 930.6 | LL3.8 CHONDRITE | A/B | B | 25-34 | 12-24 |
| LAR 12075 | 21.0 | LL3.8 CHONDRITE | A | A | 19-32 | 13-34 |
| LAR 12078 | 30.2 | LL3.8 CHONDRITE | A | A | 8-36 | 22 |
| LAR 12180 | 20.1 | LL3.8 CHONDRITE | B/C | A/B | 4-27 | 19 |
| LAR 12203 | 28.0 | LL3.8 CHONDRITE | BE | A | 12-34 | 18-26 |

## E Chondrites

| Sample Number | Weight(g) | Classification | Weathering | Fracturing | %Fa | %Fs |
|---|---|---|---|---|---|---|
| SZA 12444 | 0.6 | EH4 CHONDRITE | B/CE | A | | 0-1 |

## **Notes to Tables 1 and 2:

**“Weathering” Categories:**

A: Minor rustiness; rust haloes on metal particles and rust stains along fractures are minor.
B: Moderate rustiness; large rust haloes occur on metal particles and rust stains on internal fractures are extensive.
C: Severe rustiness; metal particles have been mostly stained by rust throughout.
E: Evaporite minerals visible to the naked eye.

**“Fracturing” Categories:**

A: Minor cracks; few or no cracks are conspicuous to the naked eye and no cracks penetrate the entire specimen.
B: Moderate cracks; several cracks extend across exterior surfaces and the specimen can be readily broken along the cracks.
C: Severe cracks; specimen readily crumbles along cracks that are both extensive and abundant.

The ~ indicates classification by optical methods. This can include macroscopic assignment to one of several well-characterized, large pairing groups (e.g., the QUE LL5 chondrites), as well as classification based on oil immersion of several olivine grains to determine the approximate index of refraction for grouping into H, L or LL chondrites. Petrologic types in this method are determined by the distinctiveness of chondrules boundaries on broken surfaces of a 1-3 g chip. While this technique is suitable for general characterization and delineation of equilibrated ordinary chondrites, those undertaking detailed study of any meteorite classified by optical methods alone should use caution. It is recommended that a polished thin section be requested to accompany any chip and appropriate steps for a more detailed characterization should be undertaken by the user. (Tim McCoy, Smithsonian Institution)

# Petrographic Descriptions

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **GRA 12510** | Graves Nunataks | 24348 | 2.0 x 1.7 x 0.7 | 4.410 | Winonaite |

Macroscopic Description: Cecilia Satterwhite
80% of the exterior is covered with black/brown fusion crust that is rusty in some areas. The interior is rusty orange with metal and has a coarse grained texture.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section is composed of subequal amounts of iron-nickel metal with troilite and silicate grains, up to 0.5 mm. Metal grains include rare graphite and schreibersite. The silicates include olivine ($Fa_{1-3}$), orthopyroxene ($Fs_{1-4}Wo_{1-2}$), clinopyroxene ($Fs_{1-5}Wo_{45-49}$) and feldspar. The combination of graphite-bearing metal and low-FeO mafics suggests this meteorite is a winonaite and closely related to the silicate-bearing IAB irons.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **LAR 12034** | Larkman Nunatak | 23905 | 14.2 x 9.0 x 4.0 | 930.600 | LL3.8 Chondrite |

Macroscopic Description: Mitchell Haller
The exterior has 90% black/brown fusion crust with weathered pits and 2-3 large fractures penetrating the surface. The interior is a gray matrix with white, gray, tan and weathered clasts. A large white clast is visible on the broken edge.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section exhibits numerous well-defined chondrules (up to 2 mm) in a matrix of fine-grained silicates, metal and troilite. Polysynthetically twinned pyroxene is abundant. The meteorite is modestly stained with hydrated iron oxides of terrestrial origin. Silicates are unequilibrated; olivines range from $Fa_{25-34}$ and pyroxene is $Fs_{12-24}$. The meteorite is an LL3 chondrite (estimated subtype 3.8).

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **LAR 12075** | Larkman Nunatak | 22609 | 3.2 x 2.1 x 1.4 | 20.961 | LL3.8 Chondrite |

Macroscopic Description: Mitchell Haller
Glossy black fusion crust covers 90% of the exterior surface. Yellow colored chondrules/inclusions are visible. The interior is a black matrix with mm sized white and gray chondrules/inclusions.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section exhibits numerous small, well-defined chondrules (up to 1 mm) in a matrix of fine-grained silicates, metal and troilite. Polysynthetically twinned pyroxene is abundant. The meteorite is extensively weathered. Silicates are unequilibrated; olivines range from $Fa_{19-32}$ and pyroxenes from $Fs_{13-34}$. The meteorite is an LL3 chondrite (estimated subtype 3.8).

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **LAR 12078** | Larkman Nunatak | 22642 | 3.0 x 2.6 x 2.0 | 30.200 | LL3.8 Chondrite |

Macroscopic Description: Mitchell Haller
Glossy black fusion crust covers 90% of the exterior surface. Yellow colored chondrules/inclusions are visible. The interior is a black matrix with mm sized white and gray chondrules/inclusions.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section exhibits numerous well-defined chondrules (up to 1 mm) in a matrix of fine-grained silicates, metal and troilite. Polysynthetically twinned pyroxene is abundant. The meteorite is modestly stained with hydrated iron oxides of terrestrial origin. Silicates are unequilibrated; olivines range from $Fa_{8-36}$ and a pyroxene is $Fs_{22}$. The meteorite is an LL3 chondrite (estimated subtype 3.8).

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| LAR 12180 | Larkman Nunatak | 23131 | 3.1 x 2.7 x 1.2 | 20.070 | LL3.8 Chondrite |

Macroscopic Description: Cecilia Satterwhite

The exterior is covered with 80% black fusion crust. Some areas are weathered brown with visible chondrules. The interior is heavily weathered with some dark gray to black matrix visible. The visible chondrules/inclusions are weathered.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy

The section exhibits numerous well-defined chondrules (up to 1 mm) in a matrix of fine-grained silicates, metal and troilite. Polysynthetically twinned pyroxene is abundant. The meteorite is modestly stained with hydrated iron oxides of terrestrial origin. Silicates are unequilibrated; olivines range from $Fa_{4-27}$ and a pyroxene is $Fs_{19}$. The meteorite is an LL3 chondrite (estimated subtype 3.8).

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| LAR 12203 | Larkman Nunatak | 23171 | 4.0 x 2.5 x 1.6 | 28.040 | LL3.8 Chondrite |

Macroscopic Description: Cecilia Satterwhite

The exterior has black fusion crust with some evaporites. Exposed interior shows a gray matrix with weathered areas. The interior is a dark gray to black matrix with heavy oxidation.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy

The section exhibits numerous well-defined chondrules (up to 2 mm) in a matrix of fine-grained silicates, metal and troilite. Polysynthetically twinned pyroxene is abundant. The meteorite is modestly stained with hydrated iron oxides of terrestrial origin. Silicates are unequilibrated; olivines range from $Fa_{12-34}$ and pyroxene is $Fs_{18-26}$. The meteorite is an LL3 chondrite (estimated subtype 3.8).

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| LAR 12283 | Larkman Nunatak | 23943 | 4.0 x 2.6 x 2.0 | 26.330 | Ureilite |

Macroscopic Description: Cecilia Satterwhite

The rough pebbly textured exterior has 25% black fusion crust. The interior is a black matrix with metal and brown oxidation. It has a platy texture with crystal faces visible.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy

The section consists of an aggregate of large olivine grains up to 2 mm across. Individual olivine grains are rimmed by carbon-rich material containing traces of metal. Olivines have cores of $Fa_{21}$, with rims reduced to $Fa_3$. The meteorite is a ureilite.

| **Sample No.** | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **SZA 12444** | Szabo Bluff | 24361 | 1.0 x 0.7 x 0.3 | 0.57 | EH4 Chondrite |

Macroscopic Description: Cecilia Satterwhite

The exterior has black fusion crust with some evaporites. The interior is black with visible metal grains. A few chondrules are also visible.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy

The section shows an aggregate of chondrules (up to 1 mm), chondrule fragments, and pyroxene grains in a matrix of about 30% metal and sulfide. Weathering is modest, with staining of some enstatite grains and minor alteration of metal and sulfides. Microprobe analyses show the pyroxene is $Fs_{0-1}$. Metal contains ~2.5 wt. % silicon. The meteorite is an EH4 chondrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13004** | Miller Range | 24381 | 15.0 x 10.0 x 8.5 | 1804.3 | Aubrite |

Macroscopic Description: Mitchell Haller
Exterior has black patches of fusion crust. The rest of the exterior shows black matrix with white, black, and gray clasts. The exterior shows moderate fracturing and numerous clasts, the largest is 5.5 mm. Some minimal brown oxidation is visible on one exterior surface. The interior is has a black/gray matrix similar to the exterior but lighter. Black/gray/white inclusions and silvery metal faces are visible.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of coarsely comminuted pyroxene grains up to 0.7 mm with rare olivine present. Coarse pyroxene clasts are extensively shocked, with undulose extinction and shock darkening, and are set in a matrix of finely-comminuted grains. Pyroxenes and olivine are essentially FeO-free ($Fs_0$; $Fa_0$). The meteorite is an aubrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13005** | Miller Range | 22292 | 7.2 x 6.5 x 5.5 | 192.736 | CM1/2 Chondrite |

Macroscopic Description: Mitchell Haller
Matte black exterior with patchy steel coat fusion crust on 10% of surface. Some evaporites are visible. This carbonaceous chondrite has a black matrix.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of a few small remnant chondrules (up to 0.5 mm) and mineral grains are set in a black matrix; rare metal and sulfide grains are present. Olivine compositions are $Fa_{0\text{-}23}$. Aqueous alteration of the matrix and chondrules is substantial, with chondrules largely replaced. The meteorite is a CM1/2 chondrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13019** | Miller Range | 22666 | 4.3 x 3.0 x 4.0 | 67.514 | Eucrite (Unbrecciated) |

Macroscopic Description: Mitchell Haller
50% of the exterior has glossy jet black fusion crust with gray weathered areas and minor fractures. The interior is a white/gray matrix with fracture lines throughout. Some inclusions/clasts are visible.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The meteorite is unbrecciated, but with extensive shock veining cross cutting the sample. Shock veins form a network with widths of 1mm. Shock effects are extensive throughout the sample. Mineral compositions are homogeneous with orthopyroxene ($Fs_{60}Wo_2$), with lamellae of augite ($Fs_{25}Wo_{44}$), and plagioclase ($An_{87}Or_{0.5}$). The Fe/Mn ratio of the pyroxene is ~28. The meteorite is a eucrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13062** | Miller Range | 22687 | 3.2 x 2.8 x 1.2 | 15.514 | CK5 Chondrite |

Macroscopic Description: Mitchell Haller
Black fusion crust covers 60% of the exterior, some areas are porous. The top has a moss -like texture, while the bottom is smooth and porous. Areas without fusion crust show a dark gray matrix. Some fractures penetrate the surface. The interior is a dark gray matrix with shiny metal and small brown spots, 1-2 mm rusty and weathered.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of rare chondrules, large sulfides (up to 0.3 mm) and magnetite. The meteorite is little weathered, but extensively shock blackened. Silicates are homogeneous. Olivine is $Fa_{34\text{-}38.}$ The meteorite appears to be a CK5 chondrite, although the silicates are slightly richer in FeO than typical for CK chondrites ($Fa_{29\text{-}33}$).

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13079** | Miller Range | 21106 | 3.6 x 2.2 x 1.0 | 11.574 | Eucrite (Brecciated) |

Macroscopic Description: Mitchell Haller
70% of the exterior has glossy jet black fusion crust and minor fractures. Areas without fusion crust are gray with some oxidation. The interior is gray matrix with black and white inclusions and minor weathering.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of a coarsely comminuted pyroxenes (up to 1 mm) and feldspar (up to 0.5) mm set in a fine-grained matrix. Polymineralic clasts are scarce, with most fragments being monomineralic. Mineral compositions are homogeneous with orthopyroxene ($Fs_{62}Wo_2$), with lamellae of augite ($Fs_{24}Wo_{47}$), and plagioclase ($An_{88}Or_{0.5}$). The Fe/Mn ratio of the pyroxene is ~28. The meteorite is a brecciated eucrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13119** | Miller Range | 22487 | 1.8 x 1.3 x 0.9 | 2.581 | CM2 Chondrite |

Macroscopic Description: Mitchell Haller
85% of the exterior has black fusion crust with some fractures. Areas without fusion crust have a green tint. The interior has black matrix in the center and gray matrix around the edges.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of a few small chondrules (up to 0.5 mm), mineral grains and CAIs set in a black matrix; rare metal and sulfide grains are present. Olivine compositions are $Fa_{0-19}$. Aqueous alteration of the matrix is substantial and the chondrules are moderately altered. The meteorite is a CM2 chondrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13139** | Miller Range | 22244 | 1.7 x 1.2 x 1.0 | 2.94 | CM2 Chondrite |

Macroscopic Description: Mitchell Haller
A patch of black fusion crust covers 5% of the exterior. Areas without fusion crust have a porous greenish tint with minor fractures. The interior is a black matrix with gray inclusions/chondrules. Greenish color is visible around the edges near the exterior.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of a few small chondrules (up to 0.5 mm), mineral grains and CAIs set in a black matrix; rare metal and sulfide grains are present. Olivine compositions are $Fa_{0-28}$. Aqueous alteration of the matrix and chondrules is substantial. The meteorite is a CM2 chondrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13317** | Miller Range | 22275 | 3.3 x 3.1 x 2.0 | 32.247 | Lunar Anorth. Breccia |

Macroscopic Description: Mitchell Haller
A patch of glossy black fusion crust covers 25% of the exterior. Areas without fusion crust have a greenish tint with large inclusions visible. The interior is a light to dark gray breccia with white inclusions and numerous clasts ranging in size from 1 mm to 1 cm.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
This meteorite is a breccia comprised of coarse- and fine-grained clasts up to 8 mm in maximum dimension, set in a comminuted matrix. The clasts are heavily shocked to impact melted. Pyroxenes range from $Fs_{28}Wo_{11}$ to $Fs_{49}Wo_{35}$ with a nearly continuous range of intermediate compositions. The Fe/Mn ratio of the pyroxene is ~60. Plagioclase is $An_{80-98}Or_{0-1}$. The meteorite is lunar.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13328** | Miller Range | 21722 | 5.9 x 3.8 x 1.6 | 69.008 | CV3 Chondrite |

Macroscopic Description: Mitchell Haller
40% of the exterior has black fusion crust with minor fractures. Areas without fusion crust are gray colored with yellow and white inclusions and chondrules. The interior is a dark gray matrix with yellow and white inclusions/chondrules.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section exhibits large chondrules (up to 2 mm), CAIs and AOAs in a dark matrix. Olivines range from $Fa_{1-14}$, with most $Fa_{1-2}$, and pyroxenes of $Fs_1$. The meteorite is an unequilibrated carbonaceous chondrite, probably a CV3.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13329** | Miller Range | 21745 | 1.9 x 0.8 x 1.6 | 2.851 | CM2 Chondrite |

Macroscopic Description: Mitchell Haller
A patch of black fusion crust covers 5% of the exterior. Areas without fusion crust have a porous greenish tint with minor fractures. The interior is a black matrix with gray inclusions/chondrules. The edges near the exterior are a greenish color.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of a few small chondrules (up to 0.5 mm), mineral grains and CAIs set in a black matrix; rare metal and sulfide grains are present. Olivine compositions are $Fa_{0-33}$. Aqueous alteration of the matrix and chondrules is substantial. The meteorite is a CM2 chondrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13330** | Miller Range | 22273 | 2.3 x 2.1 x 2.0 | 11.135 | CM2 Chondrite |

Macroscopic Description: Mitchell Haller
There is a patch of porous black fusion crust on the exterior with moderate fractures. Areas without fusion crust are black/gray/greenish and smooth texture. Some small inclusions are visible. The black matrix has small white inclusions and chondrules.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of a few small chondrules (up to 0.5 mm), mineral grains and CAIs set in a black matrix; rare metal and sulfide grains are present. Olivine compositions are $Fa_{0-37}$. Aqueous alteration of the matrix and chondrules is substantial. The meteorite is a CM2 chondrite.

| Sample No. | Location | Field No. | Dimensions (cm) | Weight (g) | Classification |
|---|---|---|---|---|---|
| **MIL 13331** | Miller Range | 22480 | 1.3 x 1.1 x 1.0 | 2.436 | CK5 Chondrite |

Macroscopic Description: Mitchell Haller
Black/brown fusion crust covers 50% of the exterior with some gray matrix visible on non-fusion crust surface. Some brown rust/oxidation is present and the sample is brittle. The matrix is light gray with darker inclusions/chondrules.

Thin Section (,2) Description: Cari Corrigan, Tim McCoy
The section consists of large (up to 1 mm), poorly-defined chondrules in a matrix of finer-grained silicates, sulfides and very abundant magnetite. The meteorite is little weathered, but extensively shock blackened. Silicates are homogeneous. Olivine is $Fa_{33}$ and clinopyroxene is $Fs_{9-11}Wo_{46}$. The meteorite is a CK5 chondrite.

# Sample Request Guidelines

The Meteorite Working Group (MWG), is a peer-review committee which meets twice a year to guide the collection, curation, allocation, and distribution of the U.S. collection of Antarctic meteorites. The deadline for submitting a request is 2 weeks prior to the scheduled meeting.

Requests that are received by the MWG secretary by **Sept. 10, 2015 deadline** will be reviewed at the MWG meeting on **Sept. 24-25, 2015 in Washington, D.C.** Requests that are received after the deadline may be delayed for review until MWG meets again in the Spring of 2016. Please submit your requests on time. Questions pertaining to sample requests can be directed to the MWG secretary by e-mail, fax or phone.

Requests for samples are welcomed from research scientists of all countries, regardless of their current state of funding for meteorite studies. Graduate student requests should have a supervising scientist listed to confirm access to facilities for analysis. All sample requests will be reviewed in a timely manner. Sample requests that do not meet the curatorial allocation guidelines will be reviewed by the Meteorite Working Group (MWG). Issuance of samples does not imply a commitment by any agency to fund the proposed research. Requests for financial support must be submitted separately to an appropriate funding agency. As a matter of policy, U.S. Antarctic meteorites are the property of the National Science Foundation, and all allocations are subject to recall.

Samples can be requested from any meteorite that has been made available through announcement in any issue of the ***Antarctic Meteorite Newsletter*** (beginning with 1(1) in June, 1978). Many of the meteorites have also been described in five *Smithsonian Contributions to the Earth Sciences*: Nos. 23, 24, 26, 28, and 30. Tables containing all classified meteorites as of August 2006 have been published in the Meteoritical Bulletins and *Meteoritics* and *Meteoritics and Planetary Science.*

They are also available online at:

http://www.meteoriticalsociety.org/simple_template.cfm?code=pub_bulletin

The most current listing is found online at:

http://curator.jsc.nasa.gov/antmet/us_clctn.cfm

All sample requests should be made electronically using the form at:

**http://curator.jsc.nasa.gov/antmet/requests.cfm**

The purpose of the sample request form is to obtain all information MWG needs prior to their deliberations to make an informed decision on the request. Please use this form if possible.

The preferred method of request transmittal is via e-mail. Please send requests and attachments to:

**JSC-ARES-MeteoriteRequest@nasa.gov**

Type **MWG Request** in the e-mail subject line. Please note that the form has signature blocks. The signature blocks should only be used if the form is sent via Fax or mail.

Each request should accurately refer to meteorite samples by their respective identification numbers and should provide detailed scientific justification for proposed research. Specific requirements for samples, such as sizes or weights, particular locations (if applicable) within individual specimens, or special handling or shipping procedures should be explained in each request. Some meteorites are small, of rare type, or are considered special because of unusual properties. Therefore, it is very important that all requests specify both the optimum amount of material needed for the study and the minimum amount of material that can be used. Requests for thin sections that will be used in destructive procedures such as ion probe, laser ablation, etch, or repolishing must be stated explicitly.

Consortium requests should list the members in the consortium. All necessary information should be typed on the electronic form, although informative attachments (reprints of publication that explain rationale, flow diagrams for analyses, etc.) are welcome.

## Antarctic Meteorite Laboratory Contact Numbers

Please submit request to: **JSC-ARES-MeteoriteRequest@nasa.gov**

**Kevin Righter**
**Curator**
Mail code X12
NASA Johnson Space Center
Houston, Texas 77058
(281) 483-5125
kevin.righter-1@nasa.gov

**Cecilia Satterwhite**
**Lab Manager/MWG Secretary**
Mail code X12
NASA Johnson Space Center
Houston, Texas 77058
(281) 483-6776
cecilia.e.satterwhite@nasa.gov

**FAX: 281-483-5347**

## *Meteorites On-Line*

Several meteorite web sites are available to provide information on meteorites from Antarctica and elsewhere in the world. Some specialize in information on martian meteorites and on possible life on Mars. Here is a general listing of ones we have found. We have not included sites focused on selling meteorites even though some of them have general information. Please contribute information on other sites so we can update the list.

| | |
|---|---|
| **JSC Curator, Antarctic meteorites** | http://curator.jsc.nasa.gov/antmet/ |
| **JSC Curator, HED Compendium** | http://curator.jsc.nasa.gov/antmet/hed/ |
| **JSC Curator, Lunar Meteorite Compendium** | http://curator.jsc.nasa.gov/antmet/lmc/ |
| **JSC Curator, Mars Meteorite Compendium** | http://curator.jsc.nasa.gov/antmet/mmc/ |
| **ANSMET** | http://caslabs.case.edu/ansmet/ |
| **Smithsonian Institution** | http://mineralsciences.si.edu/ |
| **Lunar Planetary Institute** | http://www.lpi.usra.edu |
| **NIPR Antarctic meteorites** | http://www.nipr.ac.jp/ |
| **Meteoritical Bulletin online Database** | http://www.lpi.usra.edu/meteor/metbull.php |
| **Museo Nazionale dell'Antartide** | http://www.mna.it/collezioni/catalogo-meteoriti-sede-di-siena |
| **BMNH general meteorites** | http://www.nhm.ac.uk/our-science/departments-and-staff/earth-sciences/mineral-and-planetary-sciences.html |
| **Chinese Antarctic meteorite collection** | http://birds.chinare.org.cn/en/resourceList/ |
| **UHI planetary science discoveries** | http://www.psrd.hawaii.edu/index.html |
| **Meteoritical Society** | http://www.meteoriticalsociety.org/ |
| **Meteoritics and Planetary Science** | http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1945-5100 |
| **Meteorite! Magazine** | http://www.meteoritemag.org/ |
| **Geochemical Society** | http://www.geochemsoc.org |
| **Washington Univ. Lunar Meteorite** | http://meteorites.wustl.edu/lunar/moon_meteorites.htm |
| **Washington Univ. "meteor-wrong"** | http://meteorites.wustl.edu/meteorwrongs/meteorwrongs.htm |
| **Portland State Univ. Meteorite Lab** | http://meteorites.pdx.edu/ |
| **Northern Arizona University** | http://www4.nau.edu/meteorite/ |
| **Martian Meteorites** | http://www.imca.cc/mars/martian-meteorites.htm |

### Other Websites of Interest

| | |
|---|---|
| **OSIRIS-REx** | http://osiris-rex.lpl.arizona.edu/ |
| **Mars Exploration** | http://mars.jpl.nasa.gov |
| **Rovers** | http://marsrovers.jpl.nasa.gov/home/ |
| **Near Earth Asteroid Rendezvous** | http://near.jhuapl.edu/ |
| **Stardust Mission** | http://stardust.jpl.nasa.gov |
| **Genesis Mission** | http://genesismission.jpl.nasa.gov |
| **ARES** | http://ares.jsc.nasa.gov/ |
| **Astromaterials Curation** | http://curator.jsc.nasa.gov/ |