

**Extraterrestrial Materials
Analysis Group (ExMAG)**



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PAC meeting, July 2024

Philipp Heck, Chair
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<https://www.lpi.usra.edu/exmag/>

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ExMAG STEERING COMMITTEE

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NASA HQ Liaison
Katie Robinson

NASA HQ Chief Scientist
for Astromaterials Curation
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Vice Chair:

Yang Liu (NASA JPL)

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Kate Burgess (NRL)

Zack Gainsforth (UC Berkeley)

Daniel Glavin (NASA GSFC)

Pierre Haenecour (U Arizona)

Lydia Hallis (U Glasgow)

Manavi Jadhav

Rhiannon Mayne (TCU)

Molly McCanta (UT)

Peng Ni (UCLA)

Devin Schrader (ASU)

Alice Stephant (INAF, Rome)

Lunar Sample Subcommittee
Jessica Barnes

Mars Sample Subcommittee
Lydia Hallis and Yang Liu (acting)

Microparticles & Genesis Subcommittee
Zack Gainsforth

Asteroid Subcommittee
Daniel Glavin

Meteorite Subcommittee
Devin Schrader

Facilities and Informatics Subcommittee
Pierre Haenecour and Rhiannon Mayne

Equity, Diversity, Inclusion, Accessibility
Kate Burgess and Manavi Jadhav

At Large
Peng Ni and Alice Stephant

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Recent Accomplishments and Upcoming Events

- ExMAG Special Poster Session at LPSC on Sample Science Facilities and Collections
 - 15+ presentations
- ExMAG Annual Public Meeting May 13-15 at LPI and virtually
 - Focused on curation and collections reports
 - Will include updates on curation and science of ongoing and recent sample return missions
- Joint MEPAG-ExMAG Workshop on Connecting Community Scientific Hypotheses to Mars Sample Science from April 22-23 in DC and virtually
- Joint LEAG-ExMAG SAT on Artemis Samples is ongoing, townhall for Volatile Samples and Cold Curation scheduled for LPSC



Finding 1 – Community support to facilitate Astromaterials data management

- To ensure broad accessibility, ExMAG strongly advocates for NASA to maintain and expand opportunities for the astromaterials community to receive training on how to use AstroMat.
- We appreciate NASA's ongoing commitment to facilitate the implementation of SPD-41a, including the AstroMat project, which aims to enhance open access to planetary sample data through training (see also [SBAG Finding #10](#)), tutorials, and tools to facilitate data management.
- Additionally, ExMAG encourages collaborative efforts to promote interoperability between AstroMat, Curation catalogs, SciX, and other NASA-funded databases.



Finding 2 – ANSMET

- ExMAG urges NASA to continue working with NSF or search for other options to ensure logistical support of ANSMET
 - ExMAG recognizes the importance of the ANSMET program that provides crucial samples to our community. The recent NSF decision to halt support for the 2024-2025 ANSMET season raises significant concerns, particularly with increased snowfall potentially burying critical field areas.
 - ExMAG acknowledges NASA's efforts in finding a solution. We, including with the Meteorite Subcommittee, are committed to supporting these efforts. We commit to providing NASA with compelling evidence for continuation of the program, such as highlighting the groundbreaking science derived from ANSMET samples.
 - If reengaging NSF fails, ExMAG encourages NASA to explore alternative logistic support for ANSMET, including international collaborations, to ensure ANSMET's continuity.



Finding 3 – Access to Chang’e 5 samples

- ExMAG appreciates NASA’s effort in supporting US-based scientists’ access to Chang’e-5 samples.
 - The Chang’e-5 sampling site differs from sites sampled during Apollo and its samples have proven to hold new information about the Moon’s history.
 - ExMAG applauds the remarkable achievement by NASA in finding avenues for US-based scientists to access Chang’e-5 samples.
 - While loan agreements are still being negotiated, ExMAG supports NASA's continued endeavors to find a solution.



Finding 4 – MSR

- ExMAG commends NASA's and ESA's effort in finding a viable path forward for MSR and urges NASA to continue to support the next generation of scientists and the upcoming MMX mission.
 - Martian rocks collected by Mars 2020, unlike any in our meteorite collections, hold unique geological context thanks to detailed orbital and lander measurements. This context is crucial for understanding Martian evolution. Studying these samples, including their ages and compositions (e.g., impactites), will unlock new discoveries about Mars and the Solar System, benefiting the broader scientific community.
 - ExMAG recognizes the technical complexity and cost challenges of MSR. We commend NASA's efforts to find a viable path forward and strongly encourage continued support for MSR within its future plans.
 - The potential delay of MSR underscores the importance of training the next generation of scientists.
 - Furthermore, ExMAG advocates for continued support of the upcoming Martian Moons Exploration (MMX), which presents the first chance to potentially return Martian samples.



Finding 5 – Training Workshops

- ExMAG urges NASA to expand its support for training opportunities in sample handling and analysis, particularly for early career researchers (graduate students, postdocs, and early-career faculty).
 - **The high demand for LPI's training programs underscores the critical need for such inclusive opportunities.** To ensure inclusivity and address oversubscription, ExMAG proposes exploring additional avenues and increase support for existing opportunities. This could involve partnering with new institutions, expanding the range of training topics, and considering alternative delivery methods.
 - Given the successful record of sample handling workshops, ExMAG encourages NASA to provide funding avenues that support more widespread involvement by advanced researchers to interact with early career researchers. For example, short project funding grants or workshop grants could be used to cross-pollinate ideas across our community.



Finding 6 – Lunar Gateway Dust Science

- ExMAG recognizes the unique environment of the Lunar Gateway and the opportunities it could provide for cosmic dust collection.
 - **The NASA Gateway presents a groundbreaking opportunity for collecting cosmic dust in its pristine lunar orbit. While return of collected dust awaits the Canadian robotic arm's installation in the 2030s, collection can begin much sooner.** The first Gateway element launch, targeted for 2025-2026, will enable the direct collection of dust and measurement of dust flux in an environment free of orbital debris. This would be followed by an in-situ mass spectrometry mission in the early 2030s, allowing the analysis of the composition of interstellar and interplanetary dust.
 - **By capitalizing on these initial Gateway opportunities, we can unlock its full potential for cosmic dust science and pave the way for future sample return missions.** ExMAG urges NASA leadership to prioritize these early dust collection endeavors, recognizing their high scientific value and significant return on investment.



Finding 7 – Cryogenic Samples

- ExMAG calls on NASA to prioritize research and development (R&D) efforts in cryogenic sample collection, handling, storage, and analysis
 - **The LEAG-ExMAG SAT team has identified a critical knowledge gap** in these areas, particularly for the preparation and analysis of samples collected from lunar cold traps.
 - **Understanding the origin of volatiles in the inner solar system** is a key knowledge gap identified in the decadal survey, and analyzing icy samples from these cold traps is essential for this research. However, we must invest in upgrading equipment to collect, handle, store, and analyze these cold and volatile-rich samples without compromising their scientific value.
 - **To address this technology gap and pave the way for future cold trap sampling missions**, ExMAG urges NASA to invest in R&D focused on developing cold (<20 °C) to cryogenic (<-140 °C) technologies specifically designed for the analysis of returned cold-curated and volatile-rich lunar samples.



Finding 8 – OSIRIS-REx Sample Return

- ExMAG commends NASA, the OSIRIS-REx mission team, and the Astromaterials Acquisition and Curation Office at Johnson Space Center on the successful return and distribution of samples from asteroid Bennu.
 - **The successful return and distribution of samples from asteroid Bennu to the OSIRIS-REx mission team, and opening of the first sample request to the community is highly impressive.** ExMAG thanks the curation team at ARES Johnson Space Center for cataloging and preserving these invaluable samples.
 - **ExMAG recognizes the challenges the curation team faced in opening the sample return canister,** and commends the Astromaterials Acquisition and Curation Office at Johnson Space Center on their tireless efforts and dedication to successfully preserving the integrity of the OSIRIS-REx samples.