MARS SAMPLE RETURN: THREE FORKS DEPOT SAMPLE RECORD INVENTORY. J. R. Christian[1], T. C. Stein[1], and G. Bowen[1], [1]McDonnell Center for the Space Sciences, Dept. of Earth, Environmental, and Planetary Sciences, Washington University in St. Louis, 1 Brookings Drive, CB 1169, St. Louis, MO 63130; jchristian@wustl.edu.

Introduction: As part of the Mars Sample Return program, the Earth and Planetary Remote Sensing Laboratory at Washington University in St. Louis is preparing a set of archives to organize and make available scientific, operational, and ancillary data relating to the various samples collected by Mars 2020 *Perseverance* for return to Earth. The first of these archives, the Three Forks Depot Sample Record Inventory, will contain data relating to the Three Forks Depot, a cache of 10 sample tubes constructed from December 2022 to January 2023 to serve as a contingency set of samples [1,2] for return to Earth. These data products are intended both to allow for a full reconstruction of the environmental conditions experienced by each sample tube during depot creation and to provide sufficient localization and contextual information to model post-drop environmental conditions at the depot site.

Data Products: Several types of data products will be archived:

Sample Drop Events: These products are intended to capture details of each individual sample drop event. They include:

- Sols on which tube drops and documentation imaging occurred.
- Timestamps of events during tube drop, as the sample moved through the Sample Caching System from long-term storage inside the rover to deposition on the surface.
- Temperature records from sensors within the Sample Caching System.

Localization: Details of rover and sample tube locations and orientations will be captured in several planned localization products. These products include:

- Latitude, longitude, elevation, and orientation of each sample tube.
- Latitude, longitude, elevation, and orientation of Perseverance at all times recorded during depot creation.
- Pre-drop 3D meshes generated from stereo images, as used to plan tube drop events.
- Post-drop digital elevation models showing each tube on the surface.

Images: Identifiers of all image products acquired by Perseverance during depot construction showing sample tubes will be recorded, along with the pixel coordinates and name of each sample tube in each image (where applicable). Browse versions of images specifically acquired as sample tube documentation (CacheCam, WATSON sealing station images, WATSON post-drop images, and post-drive Front Hazcam, Navcam, and Mastcam-Z images) will be included in the archive; full versions of these products can be found in each instrument's archive bundle at the PDS Imaging Node. Examples of these browse products are shown in Figures 1 and 2; Figure 1 shows a scenario where multiple sample tubes are visible in the same image; pixel coordinates for both will be recorded in this archive.

For most sample tubes, additional images were acquired beyond those specifically collected for documentation; identifiers for these images will also be recorded in this archive, but additional browse versions are not currently planned to be included. An approximate breakdown of the number of images available for each tube is given in Table 1.

Documentation: Several additional products that provide contextual information on the Three Forks Depot will be archived, including:

- Identifiers and serial numbers of each sample tube, seal, seal ferrule, and drop zone within the Three Forks Depot.
- High-level overview of all other science products collected by Perseverance during depot creation and scouting campaigns.
- High-level summaries of all anomalies encountered during depot creation.
- Documents describing cached samples, sample management, and the Three Forks Depot, including the Science Community Workshop report [3] and several others still being written.

Archive and Data Access: Data products and documentation comprising the Three Forks Depot Sample Record Inventory will be archived with the PDS Geosciences Node (https://pds-geosciences.wustl.edu) [4]. In addition, they will be incorporated into the PDS Analyst's Notebook for Mars 2020 (https://an.rsl.wustl.edu) in the sample science section, which contains initial reports for collected samples cross-linked with relevant metadata and images, activity plans, mission lead and documentarian reports, and pre-release collection reports [5].

Summary: The Three Forks Depot Sample Record Inventory, planned to record all available data related to

the creation and current known state of the Three Forks Depot, is expected to be made publicly available in 2024. This archive is intended to complement an upcoming Sample Dossier Archive, still being designed, which will record all available information relating to the individual samples collected by Perseverance.

References: [1] Czaja, A. D. et al. (2023), *LPSC LIV*, Abstract #2523. [2] Herd, C. D. K. et al. (2023), *LPSC LIV*, Abstract #2185. [3] MSR Campaign Science Group (2023) *Meteoritics & Planet. Sci.*, DOI: 10.1111/maps.13981. [4] Stein, T. C. and F. Zhou (2023) *LPSC LIV*, Abstract #2194. [5] Ward, J. G. et al. (2023), *LPSC LIV*, Abstract #1533.

	CacheCam	WATSON	Navcam	Front Hazcam	Rear Hazcam	Mastcam-Z
Malay* M2020-337-8	8	18 (14)	364 (11)	35 (4)	1 (0)	8 (1)
Mageik* M2020-579-17	8	16 (14)	261 (11)	30 (4)	3 (0)	7 (1)
Crosswind Lake* M2020-639-21	8	17 (15)	220 (9)	25 (4)	3 (0)	7 (1)
Roubion M2020-164-2	8	8 (4)	232 (11)	25 (4)	1 (0)	6 (1)
Coulettes M2020-271-6	8	6 (4)	183 (8)	20 (4)	2 (0)	6 (1)
Montdenier* M2020-190-3	8	28 (24)	181 (8)	20 (4)	2 (0)	6 (1)
Bearwallow* M2020-516-15	8	16 (14)	184 (11)	16 (4)	1 (0)	5 (1)
Skyland M2020-495-12	8	5 (4)	147 (13)	15 (4)	-	4 (1)
Atsah M2020-374-10	8	6 (4)	78 (11)	11 (4)	-	4 (1)
Amalik (witness) M2020-586-18 WB3	8	4 (4)	9 (9)	4 (4)	-	2 (0)

Table 1: Approximate number of images (single frames, stereo pairs, or mosaics) available for each sample tube collected during depot creation. * indicates samples for which WATSON images of the sample tube in the Sealing Station were collected; for other samples, WATSON images were obtained only on the surface. Numbers in parentheses indicate how many images were collected as planned documentation for each sample tube; any other images that happen to show each sample tube are included in the full count.

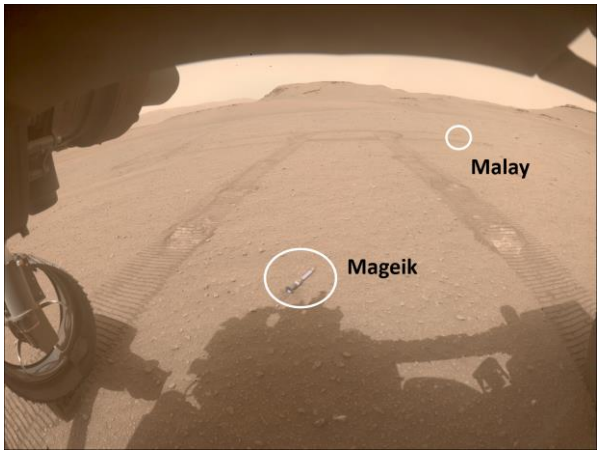

Figure 1: Front Hazcam image FLF_0658_0725352317_817RAD_N0320262FHAZ08111_0A0295J01, acquired on sol 658 as a planned documentation image of the Mageik sample tube. The Malay sample tube is also visible in the background. Pixel coordinates of both Malay and Mageik in this image will be included in the archive to make it possible to identify every image acquired of every sample tube during depot creation.

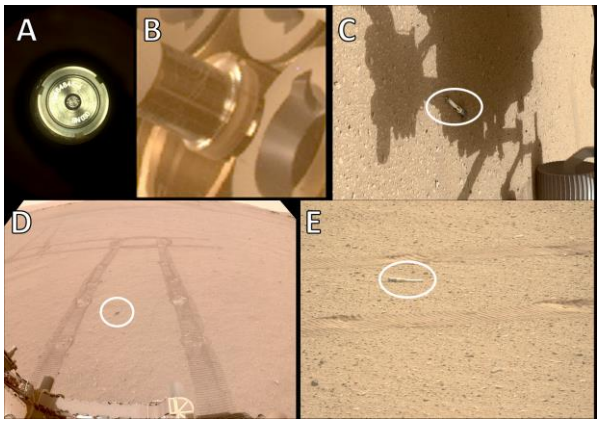

Figure 2: Sample browse versions of images acquired as planned documentation of the Mageik sample tube (circled on the ground, parts C-E). **A.** CacheCam image CCF_0655_0725088926_550RAD_N0320250CACH00202_0A0295J02. **B.** WATSON image SIF_0655_0725089596_671RAD_N0320250SRLC07057_0000LMJ02 showing the sample tube in the Sealing Station. **C.** WATSON image SIF_0655_0725092075_902RAD_N0320250SRLC08040_0000LMJ02. **D.** Navcam image NLF_0658_0725353173_848RAD_N0320274NCAM08111_0A0295J01. **E.** Mastcam-Z image ZL0_0663_0725801909_928EBY_N0320378ZCAM08657_1100LMJ01.