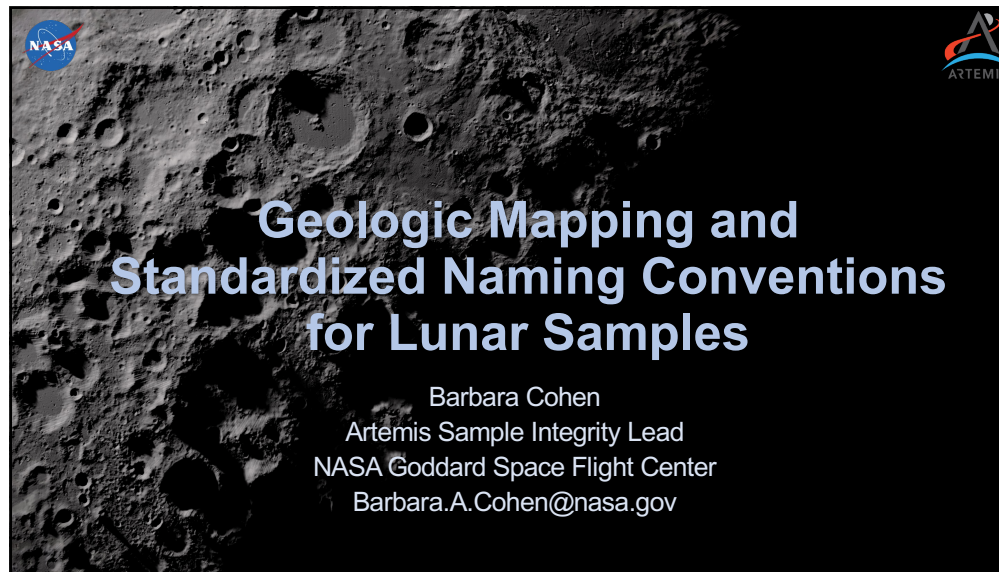




1

Maps provide context for samples

- Kelsey discussed how geologic maps support strategic sample planning pre-mission and support changing sampling abilities/locations during missions
- Map products provide geologic context for samples in the syn- and post-mission phases of operations
- The intent for this talk is to discuss standardized naming conventions and curation practices that leverage information from, and integrate with, various map products.
- Another way of looking at it is, what are the possible associations scientists might make with samples?
 - Samples collected at a specific site (What are all the samples from Station 8)
 - Samples collected near a feature at different locations or dates (What samples came from the Dakota Bench)
 - Samples of a specific type (e.g., all soil samples)
 - Sample features (color, friability, angularity, etc.)
 - Samples that have compositional similarities in the lab (Mg-suite samples)
 - Supporting data – images to determine orientation, spectra created on a date, data over some linear distance

2

 **Quiz!** 

Create four groups of four related words

Wright	Crash	Passport	Warner
Sonic	Canopy	Jonas	Mario
Trundle	Pilot	Marx	Civic
Link	Accord	Bunk	Murphy

Connections (NYT) <https://www.nytimes.com/games/connections>
 Only Connect (BBC) <https://www.bbc.co.uk/programmes/b00lshg>

3

 **Quiz!** 

BEDS BUNK, CANOPY, MURPHY, TRUNDLE
FAMOUS BROTHERS JONAS, MARX, WARNER, WRIGHT
HONDAS ACCORD, CIVIC, PASSPORT, PILOT
VIDEO GAME CHARACTERS CRASH, LINK, MARIO, SONIC

4



Option 1: Plain language



- Choose plain language names for each feature. Typically we would generate a list of candidate names around a theme, that the team would then choose from to name features as needed.
- Pros:
 - Unique alphabetic identifiers for each feature
 - Interpretation can evolve without any need to revisit the name
 - Pronounceable words can be clearly enunciated over voice comms
 - Teams enjoy choosing names
 - Opportunity to honor and boost engagement on a chosen theme, person, etc.
- Cons:
 - Limited ability to associate names with meaningful attributes, such as location, sample type, etc.
 - Many “themes” are culturally or linguistically specific - may not convey association to people outside the team
 - Many persons, places, themes, etc. can have both positive and negative attributes
- Consider these pros and cons for these sets of names:
 - Alligator, Crocodile, Caiman, Gharial
 - Subrahmanyan Chandrasekhar, Edwin Hubble, James Webb, Nancy Grace Roman
 - Gumbo, Goulash, Stew, Pudding

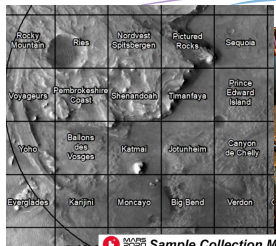
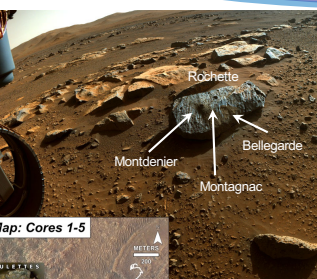
5

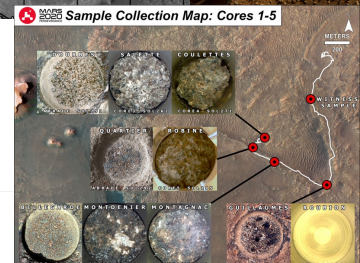


Plain language example: Perseverance



- Each quad is named after a park or natural preserve.
- In the Verdun quadrant, we encountered Rochette (rock)
- Interrogated Bellegarde (abraded patch), Montdenier (core sample), Montagnac (core sample), all on the same rock.
- These names are (to me) interchangeable with dozens of targets in the area, I have little to distinguish them as related to each other or as being designated as core samples.
- Association is via Sol # and geospatial map
<https://mars.nasa.gov/mars2020/mission/where-is-the-rover/>



6



Option 2: Encoding



- Encoded names that associate meaningful traits, such as geologic nature (rock, crater, hill, sample) and/or physical traits (lat, lon, size, etc.)
- Pros:
 - Unique alphanumeric identifiers for each feature
 - Similar parts of the encoding can be readily associated both geospatially and temporally
 - Can provide rich contextual information that aids both the team and outsiders in associating features along different traits
- Cons:
 - Numerical encoding is non-intuitive when applied to map features
 - Difficult to pronounce in oral comms
 - If you encode interpretive information, it may need to change based on evolved understanding
- Consider these pros and cons for these sets of names:
 - Station 4, Station 5, Station 6
 - 60053, 60503, 60603, 62243, 65703
 - 2P126471340EDN0000P2303L2M1.JPG, 2P126471340EDN0000P2303L5M1.JPG, 2P126471340EDN0000P2303L7M1.JPG,

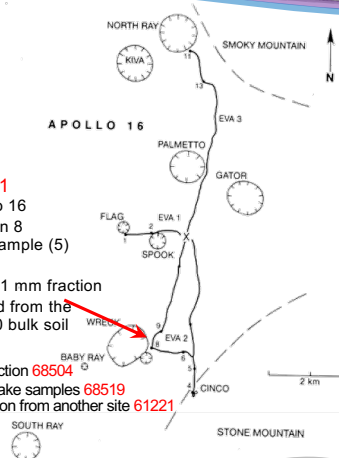
7



Encoding Example: Apollo



- Stations were numbered and executed approximately in order
- Sample numbers were assigned after return and encoded the best available information:
- **vwxyz**
- V = mission designation
- W = Station
- X was used for
 - 0-4 for drill stems, drive tubes, and special samples (surface samplers), with an omitted number to separate drive tube or drill stem strings
 - 5-9 Paired soil and rake samples for each sampling area
- Y associated contents of each documented bag. For example DB 11 contained soil, numbered 62280 - 62284, and 6 small rocks, numbered 62285 - 62289
- Z denotes sample size
 - Fines from a given documented bag are ascribed numbers according to:
 - 6wxy0 unsieved material (usually <1 cm)
 - 6wxy1 <1 mm
 - 6wxy2 1-2 mm
 - 6wxy3 2-4 mm
 - 6wxy4 4-10 mm
 - Rocks from a documented bag were numbered 6wxy5 - 6wxy9



68501
 Apollo 16
 Station 8
 Soil sample (5)
 Bag 0
 The <1 mm fraction
 sieved from the
 68500 bulk soil

4-10 mm fraction **68504**
 associated rake samples **68519**
 <1 mm fraction from another site **61221**

8



Blended models



- We are looking for something in the middle, where there is ease for the real-time users but also legacy for those who weren't directly involved to understand the campaign and data.
- One possibility is a **Feature_target** scheme for field observations
 - Features** are mapped geologic units that you can pick out before landing, like craters, massifs, rilles, boulders, vegetation clusters, plains, etc. Generate feature names and assign them on the map before the mission starts. During an EVA, a feature might also be a Station (for example, EVA 1 station 6).
 - Targets** are geologic units investigated during a mission, like outcrops, rocks, small craters, rille branches, regolith, etc. Commonly, targets are associated with mapped features (or, traverses between features).
- A more fully encoded scheme for data products and samples could be assigned after return, using additional information from the map and from the samples

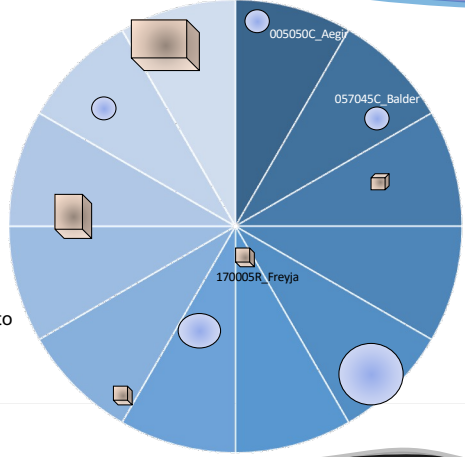
9



Blended example: Heimdall

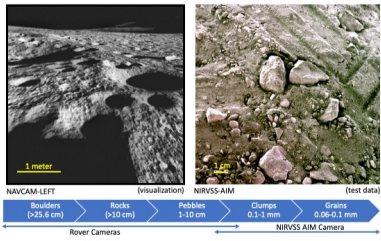


- A code that provides Az, distance, type
 - Az – 3 digits (nearest degree? Nearest 10 degrees?)
 - Distance – 3 digits (nearest meter)
 - Type – R for rock, C for crater?
- Examples:
 - 005050C_Aegir
 - 057045C_Balder
 - 170005R_Freyja
- Gives instant recognition to Az, distance, feature type based on code
- Can use any names informally if you also have a LUT to tie them to mission name
- Mission code and LUT might need to be revised as understanding changes



10

Blended example: VIPER



- VIPER must quickly identify natural features, and the capture process must allow for easy designation of feature details (location, size, etc.)
- All features will have a VIPER ID (aka "serial number") – a two-letter code for its type (e.g., CR for crater, BO for boulder, SR for Shadowed Region) followed by an integer in its order of discovery
- Some may also have names. Names may be formal (IAU approved) or informal (team use only). Names and VIPER IDs are associated via look-up table (LUT)

- >100 m feature names need to be IAU approved
 - VIPER (team poll) chose multi-cultural human names related to Moon; crowd-sourced working list of 78
 - Prior to Launch: Name craters and features along traverse path (chose from subset of names - easiest to write/pronounce)
 - During Mission: When a >100 m crater is of sufficient interest to receive a name (in addition to a VIPER ID) a name would be selected from the first-name list at random and then that name will be added to the Natural Feature database so that the name is now associated with the appropriate crater and always connected to the original VIPER ID number.
- <100 m natural features (craters, rocks, persistently shadowed areas, patches of regolith) will be informally named by the VIPER team during the mission in addition to their VIPER ID

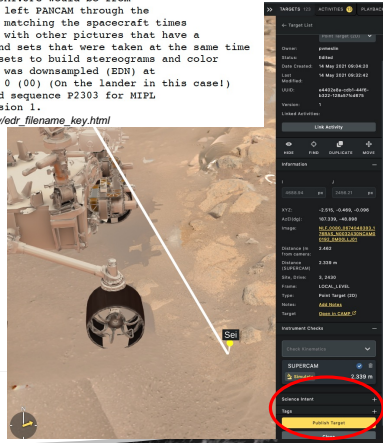
11

Also needed: contextual data products!

- Data Products** are images, spectra, samples, etc. of a feature, target, or something else (like the sky or hardware).
- Data products are what we use to search for things like "vesicular rocks" or "different views of that boulder from different locations".
- We need to have additional discussion with the software developers to establish how to associate meaningful descriptions and observations, gleaned from the community of users, for each data product.
 - Encode details in the file name like MER
 - Encode details in operations software like Mars 2020, if it is searchable after the mission
 - Encode details in shift logs or notes via hashtag, if they are searchable after the mission

Example:

A photo with the file name 2P126471340EDN0000P2303L5M1.JPG would be from Spirit (2), taken by the left PANCAM through the 535nm (green) filter. By matching the spacecraft times (in this case 126471340) with other pictures that have a similar time, you can find sets that were taken at the same time of the day. Use similar sets to build stereograms and color composites. This picture was downsampled (EDR) at site 0 (00) and position 0 (00) (on the lander in this case!). It was taken with command sequence P2303 for MIPL (OPGS) at JPL and is version 1.
https://mars.nasa.gov/marigallery/edr_filename_key.html



12




Recommendations, of sorts

- **Naming links map features to samples to data products. Develop them together, iteratively!**
 - Ensure that operations are easily and logically visualized and names are wieldy for the team during tactical operations
 - Correlating samples, data products, and activities, time, location, from the mission outside the team and after the fact
 - Numbers and codes are difficult for people to use in the moment but are readily associated and mined later
 - **Geospatial tools** can be powerful new ways of associating and mining products, but need to be useable forever by everyone
 - Are lookup tables inevitable?
- **Naming is powerful.** It provides historical legacy to a mission, inclusion and purpose to the team
 - Reconsider naming for people – can be a tool to lift underconsidered contributors up, but people and their historical context are complex
 - Reconsider naming with words that require specific cultural awareness and association
- **What should we use for the Artemis missions?** My feeling is we start with the Apollo nomenclature for Mission, Station, and Samples, BUT
 - Formal and informal names for large features, what about impromptu crew designations?
 - Sample numbering needs to be expanded to accommodate double-digit Missions and Stations, and maybe for additional samples, will this make sample numbers unwieldy?
 - How to ensure that geospatial tools, notes, images, etc. are all accessible and mineable? “Artemis in Real Time” is under development
 - We are developing some different naming schemes for Artemis in the JETT tests! *Your ideas and discussion are very welcome!!*