# MRD 138- Global Regolith Geology Map

**Data Product Overview**

This is a map of the global distribution of deposits or patches of loose material (regolith) on the surface of Bennu, along with evidence for mass movement of regolith. Here, regolith will be defined as particles < 20 centimeters (or smallest resolvable) in shortest dimension. Supplementary information could include any relevant properties of the regolith (i.e. depth, color, thermal properties, mineralogy). The production of this map will be done in two phases, where early in the mission a "regolith feature map" will be produced indicating locations of crater material and material associated with linear features. As a long-term science product, a "global regolith geology map" will be produced that includes geologic interpretation of all observed regolith features.

**Overview**

Data type:

- ShapeFile format

What does it measure at what scale?

- Globally, it measures regions of regolith (regions) as small as 1m.
- Material related to craters and related to linear features.

**Observational Requirements**

MRD-138 requires that regolith regions as small as 1-m across are mapped across 80% of the surface of Bennu. The fundamental observing requirement is resolution superior to 1m (4px) over 80% of Bennu. For example, if MRD-121 is achieved (21cm resolution over 80% of Bennu), then the necessary observations exist to map regolith regions.

When in the DRM are the observations that make the data product scheduled to be taken?

- Starting at the Preliminary Survey phase, ending during Detailed Survey.

How long does it take to produce the data product?

- The map of features - crater material and linear feature material - can be generated in a few weeks, completed at the end of Detailed Survey.
- The long-term science product, the Global Regolith Geology Map, will take months.

Is this product used for sample site selection, science value, or long-term science?

- The rapidly produced feature map - crater and linear feature material - is used for sample site selection as an input to Global Science Value Geologic Feature Map (MRD-114). The long-term Regolith Geology Map is and for long-term science as an input to the Global Geology Map (MRD-195a).

**Data Product Structure and Organization**

What is the structure of the data product?

- ShapeFile format

How is the product organized?

- ShapeFile format details information for each individual mapped feature, which are separate pieces of data.

Data Format Descriptions

- Header information (metadata) included with data product.
- Start/End time of observations that make up data product
- Lat/lon or other geometric parameters
- Map scale/ resolution
- Map projection
- Instrument parameters or housekeeping data needed to process data
- Calibration files used in processing

Detailed Description of data format

- ShapeFile format

**Data Product Generation**

How and by whom is the product generated?

- John Marshall, Co-I, within RDWG

What are the input products needed to produce the product?

Global Regolith Feature Map (map of crater material and linear feature material):

  - Global Mosaic @ 21cm resolution (MRD-121)
  - Global Topographic Map (MRD-122)

Global Regolith Geology Map (long-term science):

- Global Slope Map (MRD-126)
- Global Space Weathering Map (MRD-542)
- Global Mineral and Chemical Maps (MRD-140)
- Global Bond Albedo Map (MRD-154)
- Global Reflectance Factor Maps (MRD-154)
- Global Thermal Inertia Maps (MRD-155)

Are there format expectations for the input products?

- All input data will be either co-registered map-projections or ShapeModel+Ancillary format.

What algorithms and/or calibration data is used to generate products?

- Mapping of crater and linear feature material relies on access to the crater feature map and linear feature map - knowing the locations of craters and linear features. With this information, correlations and similarities in material in and around the features can be used to map related material. The Regolith Geology Map relies on more information, including compositional and thermal information.

Has a specific Science Team Member been assigned to produce this product?

- John Marshall

Will multiple versions of the product be generated?

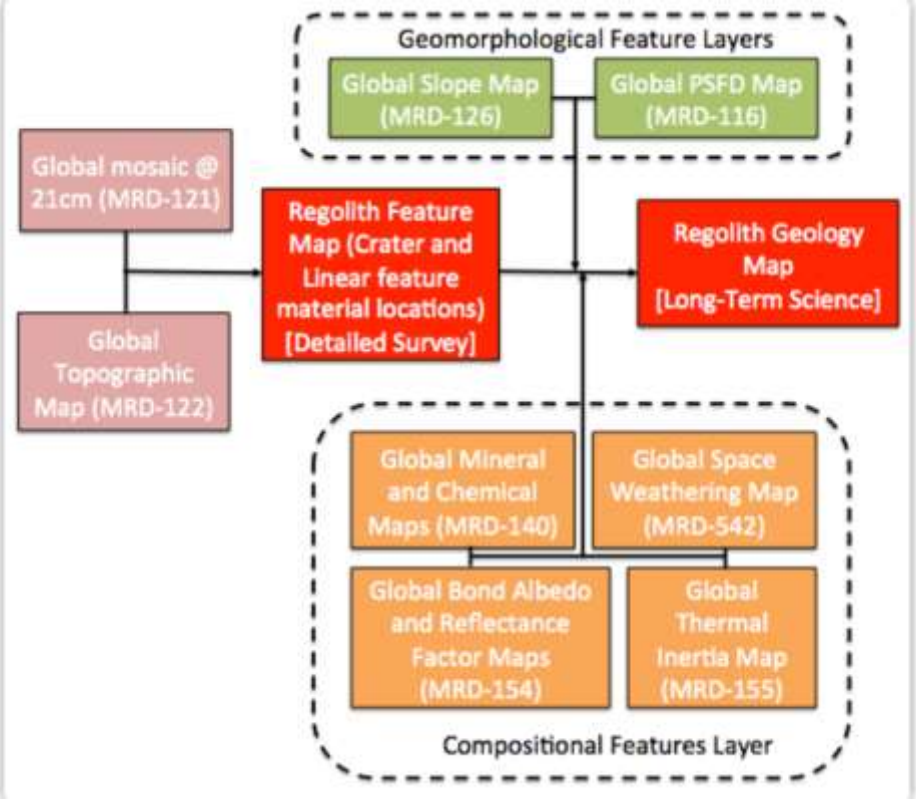
- Yes. An intermediate "Feature Map" will be produced at the end of Detailed Survey that maps the locations of crater material and linear feature material. A final "Regolith Geologic Map" will be completed on a longer timescale and include geologic interpretation and analysis considering more input data.

**Data Product Validation**

How will the product be vetted to ensure contents and format are correct?

- Validation of the feature map - crater and linear feature material locations - will be vetted by RDWG and formats will be tested by visual inspection upon loading in jAsteroid. Vetting of the long-term science product will occur later via peer-review during publication.

Data Flow




Describe the sources, destinations, and transfer procedures for data products. State the size of an individual data product and the total size of all the data products generated over the course of each mission phase.

- A ShapeFile document is a series of files that records the location and some physical properties of each feature that is mapped. A published crater database contains about 5,000 craters per Mb of file size. Thus, while we don't know how many features that will be mapped, we can estimate with a total surface area of around 1 million square meters, that even if each square meter of the surface were an individual feature the data file would only be on order 200Mb. A more practical estimate for 100s of craters and linear features would require less than 1Mb of storage for the Regolith Feature Map produced during Detailed Survey. The long-term science Regolith Geology Map will necessarily be less than the ~200Mb maximum but may map geologic units across the entire surface and reach a larger size than the feature map.

**Standards used to generate data product**

Time (e.g. times are all converted to UTC)

- Either spacecraft time or UTC.

Coordinate System

Asteroid coordinate system (MRD-125)

Data Storage Conventions (i.e. byte order, compression, machine dependence)

- Little Endian with either PackBits or LZW compression