

## **Science Objective Summary and Science Weekly Debrief**

Orbital R insertion. Each day of the week (DOY 301–308): NavCam 1 will collect images every 2 hours for particle monitoring.

### **Science Weekly Debrief**

For slides and the WebEx recording on ODOCS, click [here](#) then follow the path: Folders \ Documents and Drawings \ OSIRIS-REx Bennu Proximity Operations \ Science Status \ Science Weekly \ 2019-10-31.

#### **Recon A updates**

- Site prioritization – Mike Nolan

As has been noted elsewhere, the Site Selection Board (SSB) decided to lean forward on Nightingale for trajectory and NFT feature development, so that we can get ahead on this process. Relatedly, the team has been asked to prioritize analysis of the larger Nightingale site ahead of Kingfisher. Note this is a prioritization for analysis and development, not a site selection. SPT continues to plan medium and low Recon passes of all four sites in parallel.

- IPWG – Dathon Golish, Carina Bennett

Nightingale has relatively good registration (compared with the more difficult Kingfisher), in some cases comparable to Sandpiper. There is about a 5-cm facet of misregistration to the ground. Nightingale sampleability images show some of the finest material imaged to date outside of DL08. The crater is redder than average; more careful color analysis is to come. The crater spectrum is similar to those of Kingfisher and Osprey. Near the Nightingale site, a bright rock face was observed with a spectrum that differs from that of the rest of the rock and the Bennu average, maybe suggesting a different exposure age. Bonus looks include a clipped view of DL08 and candidate pyroxene-bearing boulders 6 and 7.

Sandpiper rock counts have been delivered officially to RDWG for sampleability analysis. Areas in the sampleability circle that are not covered by a counted image are manually marked as hazards. Osprey rock counting is complete; the next steps are clustering and statistics. Nightingale rock counting is ongoing. Kingfisher rock counting has been suspended until Nightingale is complete, per the prioritization noted above.

- SAWG – Amy Simon

The much smaller OVIRS spot size of the Recon A data gives rise to more dramatic spectral variations than observed in Detailed Survey. Longer integration times are helping the SNR in spite of warmer detector temperatures and lower illumination. A bright spot in the DL08 area shows a relatively deep pyroxene feature (~5% band depth). The spectrum showing this feature

is slightly offset from the location of the bright spot in the OCAMS images, meaning that once the images are registered, it may be possible to use this offset to refine the OVIRS pointing. Boulder 6 shows the deepest pyroxene feature observed to date, approaching 12% band depth. Boulder 7 shows only a weak feature but was observed at an oblique angle. The 3.4-micron feature is visible over all sample sites at band depths of 2 to 3%. It has been observed elsewhere with band depths as high as 9%. More careful mapping of this feature is to come.

Processing of OTES Nightingale data was delayed because of a DSN glitch. As with other sites, complete coverage of the ellipse was achieved but not in a single pass.

SAWG will hold splinter sessions on Monday and Friday of the STM next week.

- TAWG – Josh Emery, Andy Ryan

Kingfisher shows less temperature variation than other sites analyzed so far. Its thermal inertia (TI) is comparable to those of other sites and agrees well overall with the global Bennu average and site-specific data from Detailed Survey data, but shows more variation (this analysis uses roughness information from Detailed Survey). As previously observed, darker boulders seem to have lower TI and vice versa.

The “bright” 12 o’clock rock at Osprey does not show the higher TI expected for such rocks. However, this could be explained by poor coverage; this object was never captured in the center of a spot. Further, Dani DellaGiustina noted that this rock is not actually very bright; it appears bright because of its incidence angle, but it is only about 1 or 1.5% brighter than average.

As a method of capturing roughness to disambiguate it from TI in Recon A data, OLA DTMs were compared by means of RMS slopes to the lower-resolution shape model used in thermal modeling. Roughness maps created from the RMS slopes show reasonable agreement with the topography when laid over images. The thermal analyses were re-run with these roughness inputs. The resultant absolute values of TI may or may not be trustworthy, but the relative values are thought to be reliable. For instance, the results confirm the low-TI feature in the center of the Osprey crater that smears toward the 1 o’clock position on the crater rim. The next step will be to compare the outcome of roughness input from OLA DTMs versus Detailed Survey thermally derived roughness.

- Geologic insights from Recon A data – Dante Lauretta

Boulders around the rim of the Nightingale crater show features apparently related to the crater-forming impact, such as sand-blasting, clasts embedded in a boulder face, and a boulder with a sand “skirt”. A smaller crater to the south of Nightingale is rimmed by boulders and appears to be older based on ejecta flow. The evidence generally suggests movement of loose material. Impact modelers should simulate this field area to understand the nature of the impact, the distribution of the material, and what that might tell us about the material remaining at the center of the crater.

Recon A images of Gargoyle show the “jewel” on its “shoulder” in detail; it is apparently a sheared flake and resembles a metal car part. Gargoyle exhibits two geologic contacts (grain-size transitions): a coarse unit contacts a smooth, fine-grained unit, which contacts another coarse unit on its other side. This evidence points back to layering and size-sorting processes in the parent body. The next major PI-led manuscript will focus on the aqueous alteration history and carbon chemistry of Bennu at the macroscale.

### **Upcoming meetings**

The following meetings are canceled: 7 November (for the Asteroid Science workshop), 21 November (for the SSB meeting), and 28 November (for the Thanksgiving holiday). The meeting on 14 November is thus the last one before site selection. WGs should be prepared to discuss and compare the candidate TAG sites in depth.