

# The Planetary Shared Sample Library

*A New Tool for Planetary Science*

**The University of Leicester's Space Research Centre has begun to assemble a database for use by all planetary scientists and engineers in the analysis of rocky planets, moons, and asteroids.**

**Barry E. DiGregorio**

One of the goals of planetary researchers, who send spacecrafts to other planets, moons, and asteroids, is to gather enough information from the on-board scientific instruments to confidently say what these celestial bodies are composed of. Although this may seem like a straightforward task, in reality, it is very difficult to do. Why? There are several reasons. In the case of a spacecraft lander equipped with imaging devices, spectrometers, and sample acquisition tools, a single in situ sample is examined for various properties in hope that the combined information will lead to the correct interpretation of the sample. Therefore, it is extremely important that each scientific instrument is tested on Earth against a wide range of analogous rock and soil samples, which it might encounter on a planetary neighbor.

However, to date, most terrestrial sample inventories have been biased toward a specific scientific instrument, rather than the entire payload, and, as a result, may not provide the desired cross-correlation between instruments. Take, for example, the in situ examination of Martian rocks by NASA's *Viking* and *Mars Pathfinder* spacecrafts. Although the various on-board scientific instruments have yielded clues about what the rocks are composed of, researchers still cannot say with absolute confidence what they are made of. This is largely due to coatings and dust covering the rocks.

Conversely, orbiting spacecraft usually obtain only low-resolution spectroscopic data over a wide area, thereby necessitating the need for coordinated in situ ground-truth data from past, present, or future landers. Unfortunately, combined orbiter/lander missions, such as *Viking*, are becoming rare because of the enormous costs associated with them.

The Planetary Shared Sample Library (PSSL) is being created to assist planetary researchers by collecting a large database of terrestrial samples representing planetary analogues and exotics to compare against any samples studied in situ on the surface of other rocky worlds.

The main objective of the PSSL is to share samples and data that conform to a standard of sample preparation and analytical practice. Besides being of enormous value to interdisciplinary planetary scientists, the PSSL will help engineers in developing better in situ instruments and tools.

The PSSL is the idea of Derek Pullan, instrument manager for the British-built *Beagle 2 Mars Lander* (1). Pullan and his colleagues at the University of Leicester (United Kingdom) have been cataloging geological samples and spectral data for the PSSL from donations made by scientists, research centers, and universities from around the world. "We would like to expand the database as much as possible before *Beagle 2* lands on Mars in January 2004, and any university or scientist wishing to donate samples to the PSSL database can do so by contacting us here at the Space Research Centre (Derek Pullan, Space Research Centre, Physics and Astronomy Department, University of Leicester, Leicester LE1 7RH, United Kingdom). The need for analog Mars samples

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and terrestrial igneous types would be especially appreciated. Whole rock specimens, thin sections, or images taken with infrared filters and scanning electron photomicrographs would be excellent as well," Pullan said. Any rock or soil samples that are donated to the PSSL need to be professionally described and documented (for example, petrology and mineralogy) along with any spectral data.

## FORMAT HIERARCHY

In its generic form, the sample collection is based on a logical and hierarchical set of sample formats and governing rules. Although some formats conform to routine laboratory practice, these have been deliberately constrained. Standardizing sample sizes, for example, enables sharing of resources between several instruments and test facilities. Some degree of flexibility is provided, but the emphasis is generally on

simplicity. The defined formats include hand specimens (maintaining natural features, form, and texture; that is, field-representative), rock slabs (geometrically constrained but otherwise mineralogically/petrologically intact), and powders (homogenized material either loose, compressed, or vitrified).

Samples designated as terrestrial types, planetary analogues, and exotics (such as meteorites) are incorporated into the collection in sufficient quantity to satisfy the format requirements described above. Where possible, specimens already contained in the collections of participating members should be included, even if quantities are small and not all formats are available. Adopting this philosophy takes advantage of established heritage and expertise where they exist and avoids excessive effort in acquiring and preparing duplicate samples, especially during the initial buildup of the resource. Samples are made available to participating members either permanently (if sufficient quantities allow), or on a loan-and-return basis. Irrespective of sample ownership, all data obtained from experiments involving any sample in the collection are subsequently stored in a central database and made available to the participating members.

The diversity of the *Beagle 2* and *Mars Express* payloads presents an ideal trial opportunity for the PSSL concept during the flight/flight spare instrument calibration and characterization programs, a period of activity that runs through to actual mission operations on Mars in 2004. Once proven by the *Beagle 2/Mars Express* model, there is no limit to the expansion of the physical sample and data resource established during the trial. Additional collaborations, including future payloads destined for other planetary missions, will both benefit from and contribute to the overall resource, thereby expanding the potential for further spin-off research. ■

## Reference

1. B.E. DiGregorio, *Spectroscopy* 15(12), 28–29 (2000). ■

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