

PHOTOGRAPHIC ARCHIVE DIGITIZATION OF THE EARTH ANALOG SITE, AMBOY CRATER.

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Introduction: The NASA Regional Planetary Information Facilities (RPIFs) are a network of 16 facilities (nine US and seven international), that archive maps, images, and supporting literature from past planetary missions. Although the RPIFs maintain similar products, each contain one or more unique datasets, often from research that was performed at the host institution.

Historically, the RPIFs were founded in the 1970s to serve two primary functions: 1) to archive photographs and literature from active and completed planetary missions, and 2) to provide researchers and the public access to the archive for scientific research and future mission planning [1]. Now, in the 21st century, a further goal is to digitize the unique collections and make them available online to the public.

Like other RPIFs, the Ronald Greeley Center for Planetary Studies (RGCPs), located at Arizona State University (ASU), in Tempe, AZ, contains unique collections within its archives. One of these collections consists of aerial and field photographs taken of Amboy Crater, which is located in the Mojave Desert of southeast California and has been a favored terrestrial analog site for studying basaltic volcanism and aeolian processes in close association.

In this abstract, we describe the digitization of this archive, how the images have been scanned, documented, reviewed by the Planetary Data System (PDS), and hosted for the first time online.

The RGCPs: During its 40 years of operation, the RGCPs has accumulated over a quarter-million products in its archive, of which over 30,000 are unique. The unique products include: photos of field and laboratory work, aerial photos, site studies (field maps, notes, and photographs), 35 mm slides and films of wind tunnel experiments, VHS tapes of presentations and conferences, and “gray literature” publications and reports.

Archive Digitization: In 2014, we were awarded funding to digitize part of our unique collection through the Planetary Data Archiving, Restoration, and Tools (PDART) program. The goal is to distribute these planetary resources so that they can be better utilized by the whole planetary community for future research. To facilitate this distribution, we are making the datasets compliant to NASA’s PDS. For this project, we have outlined four tasks: *Task 1*) digitization of our aerial photographic archive; *Task 2*) digitization of field (Earth analog) research photographs; *Task 3*) digitization of photographs and films of laboratory experiments; and *Task 4*) scanning of NASA special publications (https://rpif.asu.edu/index.php/nasa_pubs) [2].

Amboy Crater: For the pilot study in the digitization of the RGCPs archives, we chose the Earth analog site, Amboy Crater.

Amboy Crater is an extinct cinder cone, located in the Mojave Desert of eastern San Bernardino County, California (34.545°N, 115.791°W). The structure is about 76 m (250’) high and sits 290 m (250’) above sea level. It formed approximately 80,000 years ago, during the Late Pleistocene, and last erupted about 10,000 years ago. Heavily eroded, vesicular pahoehoe flows surround Amboy Crater, which have been modified with numerous sand-filled depressions. A few plateau-like structures can be found within the flows, along which are arcuate rifts or fractures, and small pressure domes and circular craters are located on the flat surfaces. Trending to the southeast from the cinder cone and superposing the flows is a dark (low sediment) wind streaks.

The purpose of the research was to depict volcanic features on the Earth that “may be analogous to some of the small volcanic surface features observed on the Moon and Mars.” [3]. At this same location, a two-month field experiment involving several 50-foot meteorology towers was performed at this site by Greeley, Iversen, and their associates for aeolian processes related to the Mars-like aeolian crater streak.

Image Archive: This photographic archive is a collection of 266 images, compiled from field research of the study site. About half of the photographs are b/w, 69 of which are 8” x 10” and 62 are 3 ½” x 5”, and 135 are color (3 3/8” x 5”).

The photographs were taken in Feb. 1976 by Drs. Ronald Greeley and James Iversen during field research at Amboy Crater. The photographs were acquired using hand-held cameras, taken at low altitude from a fixed-wing aircraft of the volcanic outcrops, and on the ground of flows for close up views of the surface textures.

Image Digitization: Each of the photographs received an initial assessment to review its physical condition and was placed in the correct sequence within the collection. The photos are lightly cleaned then scanned (600 dpi for images 5” x 7” or larger and 1200 dpi for smaller) on a flatbed scanner without image correction, and are saved as TIFF files. Damaged photos, or those deemed irrelevant to the study, might be scanned but not included with the PDS archive. The complete image set are then rectified and/or cropped using Adobe Photoshop [4], then saved in the lossless PNG format to reduce image volume size.

File Naming Convention: The file names given to each of the scanned images include: identification of the type of image, the regional location, site name, and number within the sequence.

The first variable identifies either aerial or field subject type. In the case of the Amboy Crater image set, “f” is used to indicate “field”, whereas an “a” would be used for high altitude “aerial” photographs. The regional location code was obtained from the Library of Congress’s MACHine Readable Cataloging (MARC) Code List for Countries; this metadata standard encompasses both states and countries [5]. For California, USA, the value “cau” was used. The site name is simply the abbreviation of Amboy Crater, or “ac”. The file name ends with a 3-number suffix, assigned from the order of images within the physical collection, beginning with 001. Finally, each name is given the file type suffix, in this case “.png”. Thus, the first image in the collection is assigned the name: fcau_ac_001.png

Metadata Compilation: Information for the images is sparse and we included feature interpretation, physical and digital maps, field notes, print materials on geomorphology, and publications by Dr. Greeley and his colleagues (where available) as part of the metadata. This info was collected in a spreadsheet and includes the following field types: Product ID, Date Taken, Location, Description, Named Feature, Feature Type, Purpose Photo Taken, Scale, Source/Photographer, Instrument, and Related Publications.

PDS Archive: Once all digitized documents were collected and reviewed by RGCPS staff, the project was compiled into a directory structure and supplemented with supporting XML documents, as described by the conventions outlined in the PDS4 Data Provider’s Handbook [6].

By the PDS terminology, Amboy Crater is a single Collection, which included all image files, spreadsheets,

and supporting documents for this particular subject. Each of the documents (regardless of the type) within the Collection is referred to as a Product. The Collection itself is contained within the larger Bundle of other similar collections (which will include scanned field photographs of other Earth analog sites).

The Amboy Crater Collection has been peer reviewed and approved by the PDS as of September of 2018 (Figure 1). It is currently hosted at the PDS Geosciences Node at: <http://pds-geosciences.wustl.edu/missions/amboycrater/index.htm>

and concurrently on the RGCPS website:

https://rpif.asu.edu/index.php/fieldings_amboy_crater/

Continuing Work: The Amboy Crater project was the first in the digitization of the unique field images in the RGCPS archive. There are over 30 different sites in the archive and a total of 6557 photographs. A large number of these images have already been scanned and processed and are being prepared for PDS review. The sites are primarily in the US, but also include sites in Iceland, Bolivia, Peru, and Italy.

The implementation of this digitization project required the development of a cataloging procedure that could standardize the sometimes sparse documentation, while providing users with enough information to identify specific image archive products.

References: [1] <http://www.lpi.usra.edu/library/RPIF/> [2] Nelson, D.M., et al., 2018, LPSC XVIX, Abs #2680 [3] Greeley, R., et al., 1978, Features of Southern California: A Comparative Planetary Geology Guidebook. NASA report, pp. 264. [4] Adobe: <http://www.adobe.com> [5] <http://www.loc.gov/marc/> [6] https://pds.jpl.nasa.gov/pds4/doc/dph/current/PDS4_DataProvidersHandbook_1.9.0.pdf (2017)



Figure 1. Scaled examples of field photos of Amboy Crater, which is located in the Mojave Desert of southeast California. Left: the cinder cone at ground level (fcau_ac_008.png). Center: the cinder cone from low altitude (fcau_ac_079.png). Right: eroded and incised volcanic flow from low altitude (fcau_ac_230.png).