APOLLO-SOYUZ OBSERVATIONS OF DESERT ENVIRONMENTS

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Experience gained from the Gemini, Apollo and Skylab missions proved that orbiting astronauts could provide valuable data in the form of visual observations and photographs of the Earth. Based on this experience, an experiment was planned on the first international space mission, the Apollo-Soyuz Test Project (ASTP) of July, 1975. One major objective of the experiment was to study parts of the world deserts (El-Baz and Mitchell, 1976). The astronauts concentrated on the description of eolian landforms as well as the effects of the process of desertification. Because color is an important factor in the study of deserts, the experiment included: (1) visual comparisons by the astronauts of terrain color with a "color wheel" composed of 54 Munsell chips; and (2) color photography using specially manufactured film that was processed under controlled conditions for good photographic color balance (El-Baz, 1977).

Most ASTP photographs were taken with a bracket-mounted 70mm Hasselblad camera equipped with a reseau plate. Both 60mm and 100mm Zeiss lenses were used along with an intervalometer for 60% overlap between successive frames. This permitted stereo viewing and the production of controlled photomosaics. A similar 70mm Hasselblad reflex camera was handheld by the astronauts to acquire photographs of selected targets. Both 50mm and 250mm Zeiss lenses were used with this camera. Excellent photographs were obtained of deserts in North Africa, the Arabian Peninsula, Australia, and Argentina. (These photographs are available from the EROS Data Center, Sioux Falls, S. D.) The photography of North Africa is extensive and includes areas of Algeria, Chad, Libya, and Egypt (Figure 1).

Figure 1. Photographic coverage of desert regions on the Apollo-Soyuz mission. Those of the Peruvian Desert, the Monte-Patagonian Desert, and part of the Australian Desert were taken with the handheld camera. All other strips were taken with the bracket-mounted camera. The author is willing to provide frame numbers of photographs covering specific areas.
ASTP observations indicate that the color of desert surfaces, as seen from orbit, is indicative of soil composition. For example, photographs of the Sturt and Simpson Deserts of Australia show that the sand becomes redder as the distance from the source increases. Field investigations have shown that reddening is caused by a thin iron-oxide coating on individual sand grains (Norris and Norris, 1961; Norris, 1969; Folk, 1976, among others). This reddening may be used to map relative-age zones of photographed areas, particularly in Australia.

Another example of the utility of ASTP color photographs in characterizing desert surfaces is that of distinct color zones in the Western (Libyan) Desert of Egypt. In one photograph (AST-16-1256) taken just west of the Nile Delta, three nearby parallel color zones have been correlated in the field with: (1) arable soil composed of quartz sand, clay and calcium carbonate particles; (2) active sand with or without vegetation; and (3) relatively inactive sand mixed with dark (desert-varnished) pebbles (El-Baz, 1978). The youngest yellow sands in this region are in the form of longitudinal dunes, which are migrating to the S-SE along the prevailing wind direction. Identification from orbit of this desert process is significant considering that some of these dunes are encroaching on the western boundary of the fertile Nile Valley. This example shows the importance of these color photographs in identifying both land that is threatened by dune encroachment as well as areas that can be reclaimed from the desert.

These and other examples of Apollo-Soyuz orbital observations strengthen the case for desert study from Earth orbit. Visual observations by well-trained astronauts should be supported by stereo, color and high-resolution photographs on future space missions. The Space Shuttle will allow more detailed study and repeated monitoring of the desert environments in the early 1980’s by the use of the 305mm "Large Format Camera".

REFERENCES CITED


