SUBSURFACE MORPHOLOGY AND GEOARCHAEOLOGY REVEALED BY SPACEBORNE AND AIRBORNE RADAR

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The shuttle imaging radar (SIR-A) aboard the space shuttle Columbia penetrated the extremely dry deserts of the eastern Sahara, revealing previously unknown buried valleys, geologic structures, and possible Stone Age occupation sites, not detectable by Landsat. Radar responses from bedrock and gravel surfaces were also able to provide information in areas covered by very dry sand up to a depth of six meters. The enhancement of many geologic structures and the delineation of bedrock units partly mantled by sand, make the SIR-A radar a valuable adjunct to conventional geologic mapping tools. In some cases the signatures on the radar images show structural depressions and the probable buried intrusives, as well as infiltration of bedrock crevices by windblown sand and colluvium which results in a dark response to SIR-A that enhances the patterns of these structures on radar images.

The use of radar imaging to determine the subsurface fluvial features in southern Egypt and Sudan is compared with the detection of subsurface stream canals in the tropical terrain of Guatemala-Belize. These data were obtained by Shuttle Imaging Radar (SIR-A) in 1981, and NASA's CV 990 in 1978 and 1980. The data sets were acquired through a different range of incident angles. Perception by low order SAR of subdued linear stream channels and canals is influenced also by the orientation of the channel relative to the illumination direction.

Radar penetration of tropical vegetation and soil varies with the wavelength of the incident signals (24 cm for SIR-A and SIR-B systems). Subsurface features with potential tectonic or geomorphic significance may also be revealed in other orbital radar. CV 990 imaging of tropical terrain detected the presence of an extensive canal drainage network beneath the jungle cover of Guatemala, providing the specific geologic locations of landforms which have been sites of episodic human habitation.

Radar imagery represents a large-scale perspective of providing extensive information improving both the quality and quantity of subsurface morphology and geoarchaeology targets through penetration of foliage, silt, and root cover to map ancient man-made roads, causeways, and natural signatures disclosing the larger environmental design.