SPACE SHUTTLE RADAR IMAGES: CONNOLLY BASIN IMPACT SITE, WESTERN AUSTRALIA.

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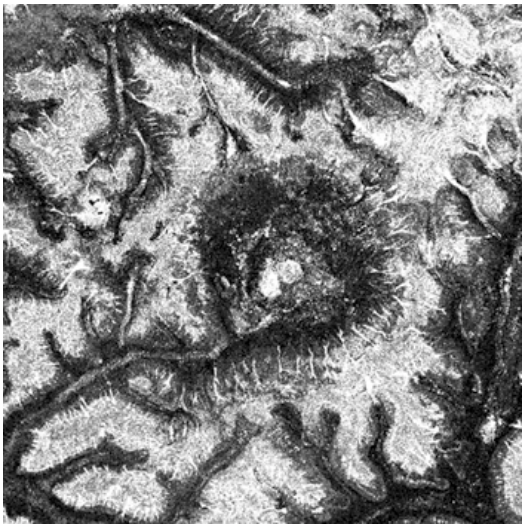
Introduction: The highly successful Spaceborne Radar Laboratory flew aboard two separate Space Shuttle missions in 1994 [1]. The objective of these experiments was to generate high-resolution images of previously selected ground features using synthetic aperture radars. Several terrestrial impact structures were covered and have been reported [2]. In addition to intentional target sites, a vast amount of additional image data were acquired, partially processed, and archived. These archived data sets are still being processed and studied. One radar path designed to image Wolf Creek crater inadvertently covered also the Connolly Basin Impact Structure in Western Australia [3].

Connolly Basin Impact Structure: Gene and Caroline Shoemaker first suggested that a 9 km diameter rimmed depression which they detected on the Australia 1:250,000 Morris topographic sheet was a meteoritic impact scar. Their later field studies confirmed an impact origin, and the site is now formally known as Connolly Basin Impact Structure [4,5,6]. The feature lies in the Gibson Desert of Western Australia (latitude 23.53 S; longitude 124.75 E) within an area covered by laterites of probable Tertiary age. A subdued outer topographic rim confines a central playa and rises 25-40 meters above surrounding lateritic plains. The oldest exposed rocks occur within the central playa as a 1 km wide zone of chaotically uplifted Permian sandstone blocks and fragments. Detailed field mapping of the central uplift indicates a system of imbricated (listric?) faults reminiscent of the Spider Impact Structure, possibly resulting from an oblique projectile trajectory during the impact event [7]. Between the outer rim and central uplift lies a discontinuous annulus of probable Cretaceous-to-Tertiary sandstone beds.

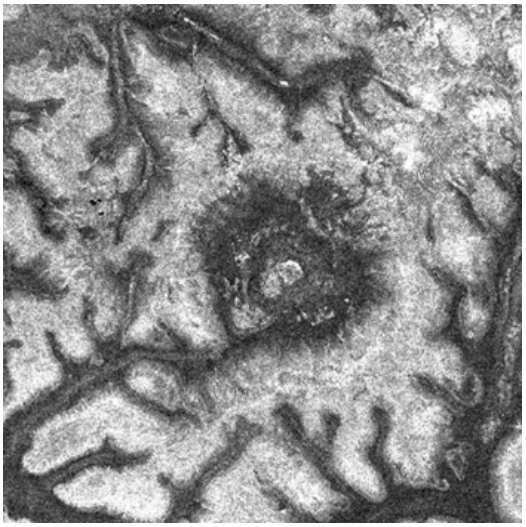
Radar Images: Connolly Basin was fortuitously imaged during acquisition of a ground track (Datatake 117.51) intended to cover Wolf Creek Crater in north-central Western Australia. Radar images were simultaneously acquired by two separate instruments utilizing three distinct radar wavelengths. The German/Italian X-Band data (3 cm) were processed for single-polarity VV (vertically transmited/recieved) imagery. American C-Band (6 cm) and L-Band (24 cm) data were processed for HH (horizontally transmitted/received) and HV (horizontally transmitted/vertically received) imagery. In general terms, smooth flat surfaces reflect impinging radar energy away from their slanted source resulting in radar-dark zones on a final image. In addition, longer wavelengths tend to penetrate dry desert sediments and become absorbed, producing radar-dark tones, while shorter wavelengths tend to scatter more readily from gravel or vegetation, producing radar-bright signals.

The entire impact structure is a rather subtle feature on topographic maps and in aerial photographs. To casual ground observers in the field it appears nearly featureless. However, in radar its size and structure are prominently displayed regardless of wavelength or polarization (Fig. 1). Radar-dark tones mark fine-grained sediments in the inner crater and in a network of outer drainage systems. Brighter radar patterns mark fragmented crater rocks and the surrounding lateritic gravels. The result is an accurate radar map of the size and general structure of Connolly Basin Impact Crater.

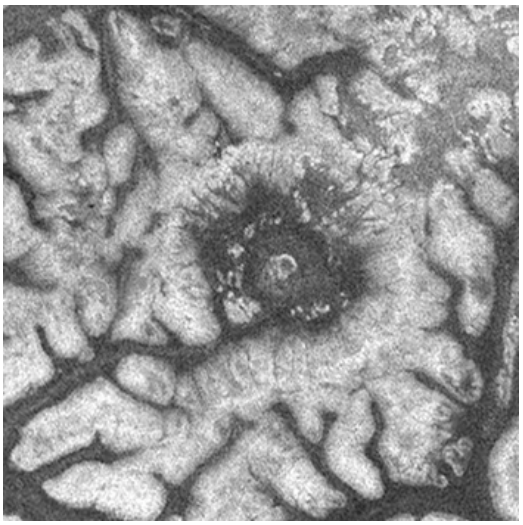
References: [1] E.R. Stofan et al. (1995) *IEEE Trans. Geosciences and Remote Sensing*, *33*, 817-828. [2] D.G. Blumberg et al. (1995) *LPSC XXVI*, 139-140. [3] J.F. McHone et al. (2000) *Met. and Planet Sci., 35*, A106. [4] E.M. Shoemaker and C.S. Shoemaker (1985) *Meteoritics*, *20*, 754-756. [5] E.M. Shoemaker and C.S. Shoemaker (1989) *LPSC XX*, 1008-1009. [6] E.M. Shoemaker et al. (1989) *LPSC XX*, 1010-1011. [7] E.M. Shoemaker and C.S. Shoemaker (1985*) Geol. Soc. Am Abst. w/ prog* 20/7, 147.



L-hh



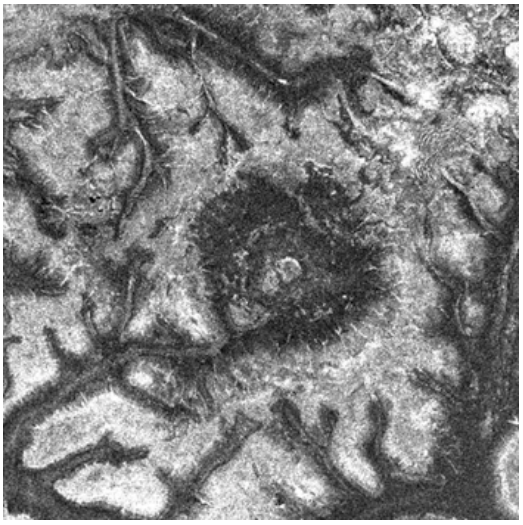
C-hh



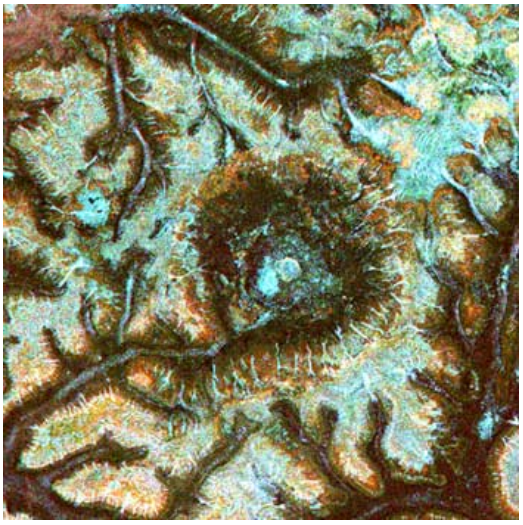
X-vv

Fig. 1. Radar images of Connolly Basin acquired during the 1994 SIR-C/X-SAR mission.

L-hv



C-hv



R=C-hv; G=L-hh; B=Lhv