Introduction: The Rima Hyginus region contains numerous enigmatic deposits and features. The nature and origin of these are of high interest in lunar science. The Rima Hyginus region occupies a broad structural trough concentric to the Imbrium basin, which has played an important role in controlling the geology of the area. Hyginus crater (9 km in diameter) is located just south of Mare Vaporum at the juncture of the two branches of the Hyginus linear rille. The crater is characterized by the absence of a raised rim and numerous domical hills on the crater floor and is surrounded by a smooth, low-albedo unit of uncertain origin. The two branches of the linear rille trend northwest and east, respectively. These linear grabens are characterized by associated chains of low-rimmed craters of endogenic origin. Light plains deposits of the Cayley Formation dominate the surficial geology of the Rima Hyginus region. Portions of the Fra Mauro Formation and of a regional dark mantle deposit occur in the northern part of the region (see Pike, 1976).

Several excellent geologic studies of the Rima Hyginus region have been conducted. The area was included in the geologic map of the Mare Vaporum Quadrangle made by Wilhelms (1968). Schultz conducted an intensive photogeologic analysis of Rima Hyginus using Lunar Orbiter photographs. Pike produced a very detailed geologic map (scale = 1:250,000) for the Rima Hyginus region using Apollo, Lunar Orbiter, and Earth-based photography. The results of these studies provided answers to many important geologic questions. Still, many major problems remain unresolved. These include the following: 1) the nature and composition of the dark material around Hyginus crater, 2) the processes responsible for the formation of Hyginus crater, 3) the composition and origin of the Cayley plains in the region; and 4) the composition of the regional dark mantling material exposed in the northeastern portion of the Rima Hyginus region.

The purpose of this study was to use a variety of existing and new remote sensing data to attempt to answer these questions. The preliminary results of this effort are presented here.

RESULTS AND DISCUSSION: Both multispectral imagery and color difference photography exist for the Rima Hyginus region. Both the dark unit around Hyginus crater and the regional dark mantling deposit northeast of Hyginus exhibit high values on the 0.95/0.56 μm multispectral ratio image. High 0.95/0.56 μm values are generally attributed to shallow 1μm bands and/or steep continuum slopes. These spectral characteristics have also been found to be associated with regional pyroclastic deposits elsewhere on the Moon. Unfortunately, no 0.40/0.56 μm images exist for this region. However, it is included in the color difference photograph presented by Whitaker. Both the regional dark mantling deposit and dark unit surrounding Hyginus appear dark (high UV/VIS ratio values or "blue") in this image. While this spectral characteristic is consistent with a pyroclastic composition for the dark unit around Hyginus crater, it does not rule out a high- or medium-Ti mare basalt deposit. In fact, several apparent mare basalt ponds in the region also exhibit high UV/VIS values ("blue").

High-resolution 3.8-cm radar backscatter data has been presented for this region by Zisk and co-workers. It was pointed out that the proposed Apollo landing site (just north of Hyginus crater) was located on a small area of low radar backscatter and hence apparently has a smooth, rock-free
The area with low radar values correlates with the dark unit around Hyginus crater. The "blue" mare basalt ponds in the region do not exhibit low radar values. A pyroclastic origin for the dark unit surrounding Hyginus crater is suggested. It seems unlikely that this dark unit is a mare basalt deposit which was emplaced in a broad topographic low prior to the formation of the crater or rille as has been suggested.

Zisk et al. noted that the Rima Hyginus region exhibited numerous radar anomalies. Chief among these are the rille walls and their associated chains of endogenic craters. Shorthill reported high thermal values associated with the rille and crater chains. These observations suggest the presence of immature surfaces with a relatively high abundance of rocks. The 3.8-cm radar images do not show low radar returns from the deposits around the endogenic craters. This observation, plus the absence of albedo and spectral anomalies associated with the units around these crater chains, indicate that these endogenic features are not volcanic vents. The subsidence or collapse model proposed by Pike for the origin of these craters is supported.

Radar and spectral data for the regional dark mantling deposit north and northeast of Rima Hyginus were presented by Pieters et al. The received depolarized radar signal level for most of this unit was nearly zero. An unusually rock-free surface was indicated. The spectrum (0.3 - 1.1) obtained for the deposits exhibited the same distinctive spectral characteristics as other dark mantling deposits for which spectra were available; i.e., it was very blue in the visible region and relatively bright into the infrared. These workers and others have interpreted this unit to be a rock-free pyroclastic deposit composed of glass-rich basaltic debris. We have recently obtained new near-infrared spectra (0.6-2.5 μm) for several areas within this unit. Analysis of this data should provide additional compositional information.

McCord et al. presented fine spectra (0.3-1.1μm) for the Rima Hyginus region. The spectra obtained for the dark unit around Hyginus crater exhibit relatively high reflectivity in the ultraviolet and the near-infrared. These are the same spectral characteristics that are exhibited by lunar dark mantle deposits of probable pyroclastic origin. A similar origin is implied for the dark unit surrounding Hyginus crater. This pyroclastic interpretation is supported by a near-infrared spectrum that we obtained in October, 1984 for this dark unit. Additional near-infrared spectra were collected in October, 1986 for geologic units in the region. Analysis and interpretation of these new spectral data should provide further insight concerning the composition and origin of these units.