SPECTRAL STUDIES OF THE HIGHLANDS AROUND THE NECTARIS BASIN: PRELIMINARY RESULTS; B.R. Hawke, P.G. Lucey, J.F. Bell, and P.D. Owensby, Planetary Geosciences Div., Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI 96822; P.D. Spudis and P.A. Davis, U.S. Geological Survey, Flagstaff, AZ 86001.

INTRODUCTION: Valuable insight concerning lateral and vertical changes in the composition of the lunar crust can be provided by studies of materials exposed by the lunar impact basins. These impacts have excavated material from a variety of depths and deposited this ejecta in a systematic manner. We have recently presented the results of remote sensing studies of the interior and exterior deposits of Imbrium and Orientale basins[1-3]. The purpose of this paper is to present the preliminary results of spectral studies of the highlands units associated with Nectaris basin. While the primary purpose of this work is to understand the pre-impact stratigraphy of the nectaris target site, other objectives include the following: 1) to better understand the composition and origin of the geologic units in the vicinity of the Apollo 16 site, 2) to determine the provenance of the Apollo 16 samples, 3) to investigate the nature of geochemical and spectral anomalies in the Nectaris region, and 4) to search for evidence of both pre- and post-basin volcanism in the highlands of the region.

METHOD: Forty near-infrared spectra (0.6-2.5μm) were recently (September 1984) obtained at the Mauna Kea Observatory 2.24-m telescope using the Planetary Geosciences Division indium antimonide spectrometer. Extinction corrections were made using the techniques described by McCord and Clark[4]. Analyses of absorption bands and continuum slopes were made using the methods presented by McCord et al.[5].

RESULTS AND DISCUSSION: A preliminary survey of the spectra obtained for fresh craters, massifs, and mature surfaces in the highlands around Nectaris suggests that the bulk of the material is not radically different from that exposed in the vicinity of the Apollo 16 site. The highland rocks have abundant Fe-bearing plagioclase feldspar and Ca-poor pyroxene. Generally, anorthositic norites and noritic anorthosites appear to dominate the region. However, unusual compositions have been identified. Bohnenberger F is a fresh 10 km impact crater (14.7°S, 39.6°E) located on an elongated highland massif (Bohnenberger eta) which is inside the Montes Pyrenaeus ring of the Nectaris basin. The spectrum of Bohnenberger F exhibits no well-defined "1μm" absorption feature as do other fresh highlands craters which expose pyroxene-bearing material[6]. Continuum removal and band analysis, however, reveal the presence of a shallow (3%) band centered at approximately 1.2μm. We attribute this band to plagioclase feldspar. Pyroxene can be present in amounts less than 4%. Hence, Bohnenberger F appears to have exposed a deposit of nearby pure anorthosite. An even more unequivocal example exists on the east wall of Kant crater (D=33 km). Kant (10.6°S, 20.1° E) is located on the main Nectaris ring and is on the eastern portion of the Kant plateau. The east wall spectrum exhibits a shallow orthopyroxene absorption feature centered at 0.87μm and a well-defined feldspar band centered at 1.27μm. Based on the laboratory spectra for various pyroxene-plagioclase mixtures presented by Nash and Conel[7], we estimate that the pyroxene abundance is between 2 and 4%. We conclude that anorthosite deposit was exposed by the Kant impact event. To the best of our knowledge, this is the first report of the detection of unshocked lunar anorthosites by spectral reflectance techniques. However, there have been recent reports of shocked anorthosites in the inner Rook ring of Orientale basin and the central peaks of certain craters[1,2,6].

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Spectral Studies of Nectaris Basin

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Andre and Strain[8] recently identified a mafic geochemical anomaly in the terra north of Nectaris. The Mg/Al concentration ratios are only 21% less than those determined for mare soil samples in central Fecunditatis. These anomalous values are generally associated with a hummocky unit interpreted as Nectaris basin ejecta or Imbrium secondary ejecta by Wilhelms[9]. However, Andre and Strain[8] attributed the geochemical anomaly to volcanic resurfacing of the hummocky material. To further investigate this problem, three spectra were obtained for the region. One spectrum was collected for the approximate location of a local Mg/Al high west of Gutenberg eta. Two spectra were obtained for dark portions of the hummocky unit north of the Apollo 16 groundtrack. While the three spectra are somewhat different from those of the Apollo 16 site, preliminary analyses indicate that all three have similar spectral parameters and represent highlands material. All exhibit 4-5% pyroxene bands centered at 0.92-0.93μm and continuum slopes of about 0.7. There is no evidence for the presence of any mare basalt or pyroclastic glass. A mature noritic highlands composition is indicated. These preliminary results support the basin ejecta interpretation of Wilhelms[9]. More spectra are needed for the immediate area of the geochemical anomaly in order to fully resolve this question.

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