A NEAR-IR SPECTRAL INVESTIGATION OF THE SCHILLER-SCHICKARD REGION OF THE MOON; D.T. Blewett, B.R. Hawke, P.G. Lucey, James F. Bell III, Jeffrey F. Bell, G.J. Taylor, C.A. Peterson, Planetary Geosciences/SOEST, Univ. of Hawaii, 2525 Correa Rd., Honolulu, HI 96822; P.D. Spudis, Lunar & Planetary Inst., Houston, TX 77058

INTRODUCTION: The Schiller-Schickard region, in the southwestern portion of the lunar nearside, is an area with a complicated geologic history. It is the site of the pre-Nectarian Schiller-Zucchius Basin, has been affected by the Orientale basin-forming impact, and contains a number of interesting geologic features, including light plains deposits, mare basalt patches, and dark-haloed impact craters (DHC's). Remote-sensing studies [1, 2] have confirmed the hypothesis [3] that the DHC's formed when ancient mare basalts were excavated from beneath basin ejecta. A mantled mare deposit such as this has been referred to as a "cryptomare" [4]. Image products provided by the Galileo spacecraft's Dec. 1990 observations indicate that the area around Schiller and Schickard has a greater abundance of mafic minerals than do the surrounding highlands [4, 5]. We report here the preliminary results of further near-IR spectroscopic studies undertaken to provide additional information on the composition and origin of formations in the area and to investigate the extent of local mixing induced by the impact of Orientale primary ejecta.

DATA and ANALYSIS: Over thirty near-IR (0.6 to 2.5 µm) reflectance spectra for features in the region were obtained with the Planetary Geosciences Division InSb CVF spectrometer mounted on the University of Hawaii 2.24 m telescope at the Mauna Kea observatory [6]. In order to extract diagnostic mineralogical information, each spectrum was subjected to a quantitative analysis focussing on the "1 µm" pyroxene absorption band. The continuum slope (Δ scaled reflectance/$\Delta\lambda$) is found by fitting a straight line to the reflectance peaks on either side of the 1 µm feature. Four other spectral parameters describing the band's width, depth, asymmetry, and wavelength of reflectance minimum were calculated from the equation of a cubic polynomial fit to the band in the continuum-removed spectrum. In the present work, we concentrated on the use of the band minimum and depth for determining mineralogy. Highlands mineral assemblages dominated by low-Ca pyroxene have band minima at wavelengths <0.95 µm, while spectra of mare basalts possess deeper bands with minima longward of 0.95 µm.

RESULTS and DISCUSSION: A brief summary of findings concerning a variety of surface units within the Schiller-Schickard region follows.

In the immediate vicinity of Schickard crater (227 km diam.), the mare and highlands endmember compositions were observed, along with areas which consist of mixtures of the two. The regional highlands material is exemplified by Schickard X, a fresh crater on the rim of Schickard. Its band minimum (0.92 µm) and relatively shallow depth indicate a noritic anorthosite composition. The spectral characteristics of the mare deposits in the area are revealed by spectra obtained for mature and immature mare surfaces in and around Schickard, as well as DHC material. These spectra have deep bands, with minima between 0.97 and 1.00 µm. Spectra of the light plains unit on the floor of Schickard have relatively strong bands with minima of the order 0.96 µm, intermediate between those of the mare and highlands units. This indicates a major mare basalt component in the plains. The most likely explanation is that local mixing [7] incorporated variable amounts of pre-existing mare basalt into the highlands-rich layer deposited as a result of the Orientale impact event. The level surface of the ancient mare provided a favorable location for the deposition of smooth light plains by the action of the debris surge generated by Orientale secondary crater-forming projectiles.

The Schiller plains lie to the southwest of Schiller crater. This area has been previously mapped as light plains [8, 9] though it is relatively dark, exhibits mare-type ridges, and appears to embay the adjacent terrain. Our spectra for spots on the Schiller plains show that they are composed of mare basalt with a minor admixture of highlands material. Therefore, we interpret the plains as a post-Orientale mare deposit which has been somewhat contaminated by highlands material from nearby impacts. The Copernican age crater Zucchius is located about 250 km to the southwest, and Zucchius rays and secondaries are abundant on the Schiller plains. Hence, Zucchius is the likely source for most of the highlands contamination. This confirms earlier suggestions of a volcanic origin for the Schiller plains [1].

Another unusual feature of the Schiller-Schickard region is the crater Wargentin. This 94 km-diameter crater has a flat floor above the level of the surrounding terrain, and a mare-type wrinkle ridge crosses the interior. The floor has a moderately high albedo, and a DHC is present in the southern portion. Previous workers have proposed that Wargentin was flooded by a phase of pre-Orientale mare volcanism, then covered by a veneer of higher-albedo debris that was emplaced as a result of the Orientale basin-forming event [2]. Our analysis of a spectrum of the DHC strongly supports this interpretation. The DHC spectrum has a band minimum of 0.99 μm, clearly indicating that mare basalt was excavated from beneath a higher-albedo surface layer.

This work has produced several important results for understanding the complex geologic history of the Schiller-Schickard region. First, we have demonstrated that the light plains on the floor of Schickard contain a major mare basalt component. This lends support to the local mixing hypothesis, which predicts that significant amounts of local material are excavated by impact basin secondary-forming projectiles and incorporated into the resulting deposit. We have also confirmed the presence of mare basalts in the Schiller plains. Apparently, much of this mare unit was emplaced after the Orientale impact event and was subsequently contaminated by varying amounts of highlands debris ejected from Zucchius and other impact craters. In addition, mare basalts occur beneath the light plains deposit within Wargentin crater. These results strongly demonstrate that mare volcanism was widespread throughout the Schiller-Schickard region. Much of this volcanism occurred prior to the formation of the Orientale basin.

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