MULTISPECTRAL STUDY OF THE SCHRÖDINGER IMPACT BASIN. B. Shankar[1], G. Osinski[1], I. Antonenko[1], P. J. Stooke[2], and S. Mest[3], [1] Canadian Lunar Research Network, University of Western Ontario, Department of Earth Sciences, London, ON (bshanka2@uwo.ca), [2]Department of Geography, University of Western Ontario, London, ON, [3] Planetary Science Institute, Tucson, AZ.

Introduction: The Schrödinger impact structure (75°S, 138°E) located within the South Pole Aitken (SPA) Basin. It has been termed a peak-ring crater by some [1] and a multi-ring basin by others [2]; it is identified as the second youngest basin on the lunar surface [3-6]. With well preserved units within Schrödinger, it presents an excellent opportunity to understand modes of formation for peak-ring and multi-ring basins. We present spectral results for previously mapped Schrödinger units, using available Clementine UV-VIS data of the area, to determine the compositions of materials in these units. In addition, this allows us to determine if the SPA impact event penetrated the lower crust/mantle [1, 7]. With large craters the size of Schrödinger, it is likely for SPA floor materials were excavated and redistributed across the basin.

Background: Mapped units within Schrödinger include rough and smooth plains in the basin floor (interpreted as shock-melted materials), a pyroclastic deposit surrounding a volcanic vent, mare patches, a tectonic ridge; a well preserved peak ring, terraced basin wall, and rilles (Fig. 1) [3-6]. Schrödinger is located along the rim of the South Pole-Aitken basin which is identified as highland (plagioclase feldspar) material [7]. Mare patches and volcanic deposits are typically basalt (pyroxene- and olivine-rich) in composition. Within Schrödinger we expect to sample typical lunar materials, including highland plagioclase feldspar and basalt within the volcanic and mare areas. Any mantle materials that may have been exposed by the Schrödinger impact would also have a mafic signature (e.g. olivine and pyroxene). We can use compositional information as a tool in determining the depths of excavation for the impact event this large in scale.

Methods: Our study area consists of the Schrödinger basin and surrounding areas extending ~100km from the basin rim, to ensure we sample an area large enough to be affected by the Schrödinger impact event (Figs. 1-4). We use Clementine 5 band UV-VIS and colour composite ratio (Fig. 2) data downloaded from USGS Map-a-Planet (http://www.mapaplanet.org/explorer/moon.html). FeO maps were derived using equations defined by [8] (Fig. 3), to help in identifying iron rich areas. We used the UV-VIS data to derive 5-point spectra samples from each of the various geologic units (Fig. 4). Because fresh spectra are easier to identify than mature ones, sample spectra sites were chosen from fresh surfaces, such as the fresh ejecta and rims of recent impact craters, or other sloped surfaces. Since the maturity of surfaces can be inferred from colour composite data, these were used to help identify fresh surfaces. The low number of fresh craters in the area poses a challenge to effective sampling. Once collected, we classified the spectra as basalt (olivine, pyroxene), highland (plagioclase), or "ambiguous" and then plotted on a basemap (750nm) view of the study area to determine spectral trends (Fig. 4).

It should be noted that the large phase angle encountered due to the high-latitude location of Schrödinger can result in topography-dependent artifacts. As a result, the FeO wt % values at individual points may not be accurate; however regional trends should still provide guiding information. High phase angle artifacts will produce ambiguous spectra and therefore any good basalt and highland spectra can still be identified. Regardless, we use extreme caution in interpreting our results.

Results: Preliminary spectral analysis of the compositions of sampled geologic units within Schrödinger suggest the presence of both highland and basalt materials (Fig. 4). In general, spectra of the various units are highland in composition agreeing with studies that identify the rim of the SPA basin to be composed of highland materials in this region [7]. The composition of rough and smooth shocked units is suggestive of a highland composition indicating that the only difference between these units is textural. Spectra of the mare patches and the pyroclastic deposit indicate basalt materials, as expected. Interestingly, additional sites of basalt spectra occur on the outer flanks of the basin and in ejecta in the surrounding region. Potential explanations for these results includes: 1) compositional variation between Schrödinger units and the surrounding region; 2) the sampling of deeper subsurface materials; or 3) the sampling of South Pole-Aitken basin materials. However, these results are still preliminary and the spectral sampling density is still low, therefore the composition distribution may change with further sampling. A large percentage of sampled spectra were also identified as ambiguous. These may be due to phase angle artifact or result from spectral mixing.

Figure 3 suggests that this is a relatively FeO-poor region with a regional average of 4-6%. This is similar to low iron content sampled at the rim areas of SPA basin [7]. The FeO map also independently confirms high FeO values for the pyroclastic deposit and mare patches consistent with basaltic compositions.

Future work: We intend to continue to collect additional spectral data in this region to further constrain the compositions of mapped Schrödinger. We also intend to run spectral unmixing models to decipher the ambiguous spectra and compare our spectral data to available reference libraries (USGS UVVIS-IR, RELAB. Data from the Kaguya, Chandrayaan-1, and LRO will be incorporated into this study, when they become available.

Our early results suggest that the materials that make up Schrödinger impact basin are not completely homogeneous, and, therefore, present an opportunity to better understand the evolution of peak and multi-ring basins using multispectral datasets. In the future, we hope to use such studies to analyze the distribution of impact ejecta, impact melt, and pyroclastic deposits in the region.

References: [1] Melosh, H. J. (1989). Impact Cratering, A Geologic Process. 1-245. [2] Spudis, P. D. (1993). The geology of multi-ring impact basins: The Moon and other planets. 1-280. [3] Shoemaker, E.M. et al. (1994). *Science*. 266, 1851- 1854. [4] Wilhelms, D.E., et al. (1979). *U.S.G.S. Misc. Inves. Ser. Map* I-1162. [5] Mest, S. C. and Van Arsdall, L. E. (2008). *NLSI -I.*, Abstract # 2089. [6] Shoemaker, E. M. and M. S. Robinson. (1995). *LPSC XXVI*, 1297-1298. [7] Lucey et al. (1998). *JGR*. 103, E2, 3701-3708. [8] Lucey et al. (2000) *Journal of Geophysical Research*, 105, (E8), 20,297-20,305. [9] Shankar, B. et al. (2009) *NLSI –II*. Abstract

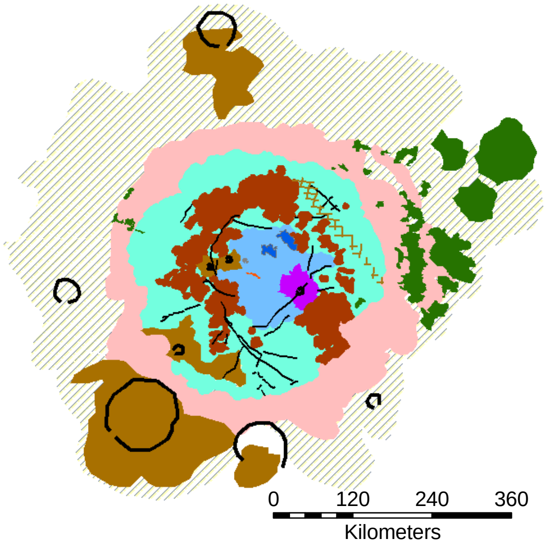

Fig. 1: Geologic map of area, combining previous work done by [3, 5, 9]. Diagonal fill = crater ejecta; pink=basin wall; brown=peak ring; dark blue=mare patch; purple=pyroclastic deposit; teal blue=rough plains; pale blue=smooth plains; green=melt ponds; orange=tectonic ridge; gold=post Schrödinger impact materials; grey=ghost crater; black=rille/crater outlines

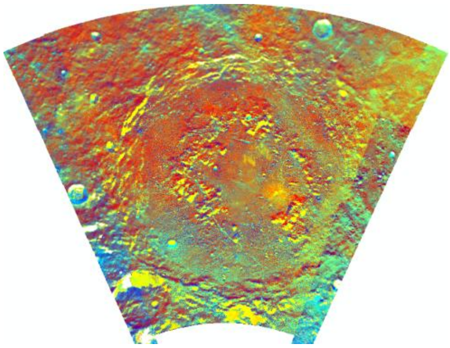

Fig. 2: Clementine UVVIS colour composite ratio map. Red areas infer mature areas, while blue/green areas are indicative of fresh materials.

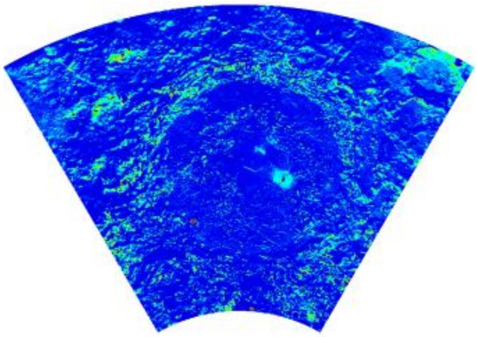

Fig. 3: FeO weight % as calculated by [8]. High FeO areas within Schrödinger correspond to mare patches and the pyroclastic deposit

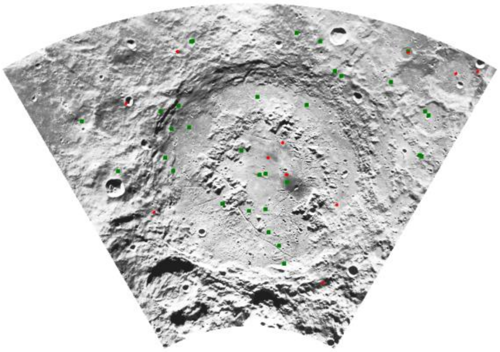

Fig. 4: Map of the Clementine 750 nm band showing the location of sampled spectra (green squares = highland, red circles = basalt units)