GEOLOGIC MAP AND POTENTIAL ROVER TRAVERSES FOR HUMAN-ASSISTED SAMPLE RETURN MISSIONS TO THE SCHRÖDINGER BASIN, LUNAR FARSIDE. B. E. Farrant[1], S. K. Bell[1], E. C. Czaplinski[2], E. M. Harrington[3], G. D. Tolometti[3], V. T. Bickel[4,5], C. I. Honniball[6], S. N. Martinez[7], A. Rogaski[8], H. M. Sargeant[9], D. A. Kring[10,11]. [1]University of Manchester, United Kingdom (Email: Benjamin.farrant@manchester.ac.uk), [2]University of Arkansas, United States, [3]University of Western Ontario, Canada, [4]Max Planck Institute for Solar System Research, Germany, [5]Swiss Federal Institute of Technology, Switzerland, [6]University of Hawai'i, United States, [7]Tulane University, United States, [8]South Dakota School of Mines & Technology, United States, [9]The Open University, United Kingdom, [10]Lunar and Planetary Institute, Universities Space Research Association, United States,[11]NASA Solar System Exploration Research Virtual Institute, United States.

Introduction: The 320 km diameter Schrödinger basin, on the Moon's south polar farside, contains a 150 km diameter peak ring with lithologies uplifted from 15 - 26 km depth [1]. Peak-ring structures and lithologies can be used to address questions about the lunar interior as outlined in the 2007 report by the National Research Council (NRC) [2]. Previous Schrödinger basin maps covering areas of the peak ring are coarse [3] or cover a small extent [1]. This study mapped an area of Schrödinger's southwest peak ring (SWPR) spanning ~4500 km^2 at a scale of ~0.5 m/pixel. Using that map, several traverse routes were planned in the SWPR area. These traverses focus on sampling contacts between peak-ring lithologies not targeted in previous Schrödinger basin traverse plans [4,5].

SWPR area: Previous mapping of Schrödinger basin identified the SWPR area as structurally complex [1]. The area is lithologically diverse, containing anorthositic, pyroxene-bearing anorthositic, noritic, and troctolitic lithologies [1]. This study examines the complexity and diversity of a larger portion of the SWPR. Main objectives were to investigate structural features and to determine if contacts between lithologies were fault-bounded or magmatic.

Mapping Method: A geologic map was produced using Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera (NAC) & Wide Angle Camera (WAC) images and Moon Mineralogy Mapper (M^3) spectral data. Images were analyzed and processed using Isis3, the LROC Quickmap program, Moon Trek, and JMARS. Features such as outcrops, craters, ejecta, and faults were mapped. All mapped features, combined datasets, and images were processed and analyzed using ArcGIS 10.3.1.

Geologic Map: A geologic map produced for the SWPR area of Schrödinger basin is presented in Figure 1. Peak-ring lithologies were individually mapped as part of this study, while basin floor lithologies were taken from [3]. Both structural and magmatic contacts between peak-ring lithologies were mapped. Contacts were inferred magmatic if there was no change in topography between two M3 lithologies or were inferred structural where there was a change in topography. Magmatic contacts provide information about the lunar crust and interior as well as magmatic processes operating during its formation [6]. Structural contacts provide information on peak-ring formation and the forces involved with uplifting material from depth within the lunar crust [1]. Therefore, this area is an attractive scientific target for any future lunar exploration as these

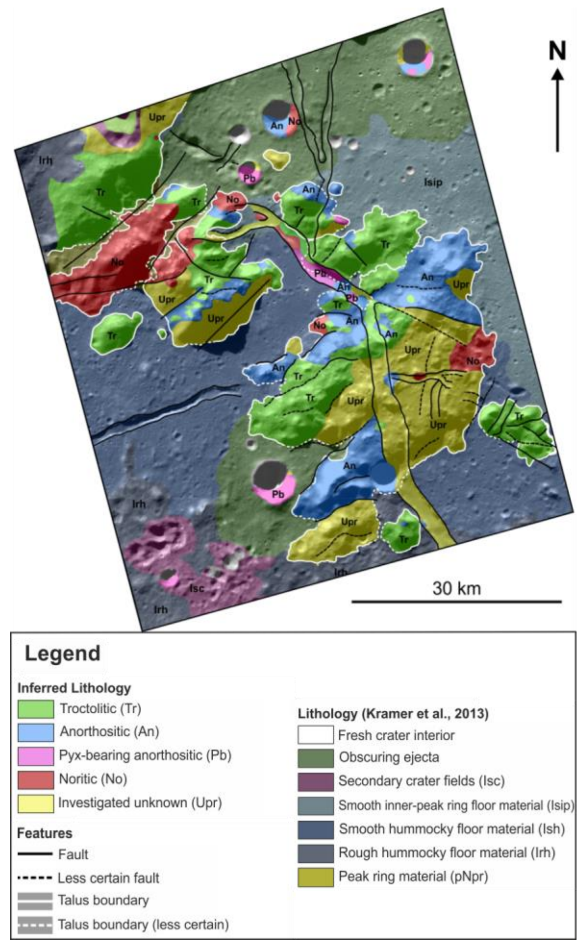


Fig. 1. Geologic map in the SWPR area of Schrödinger basin produced in this study.

contacts could provide an opportunity to address many NRC (2007) [2] science concepts and goals.

Faults within the SWPR area unexpectedly show a dominantly radial orientation with respect to the center of the basin. This suggests a complex rotation of fault blocks may have occurred during peak ring formation, possibly due to interactions with the underlying Amundsen–Ganswindt basin. However, the main graben in the SWPR, trending N-S across the mapping area, is concentrically oriented with respect to the basin center. It cross-cuts many of the radially-oriented faults, suggesting the graben post-dates radial faulting.

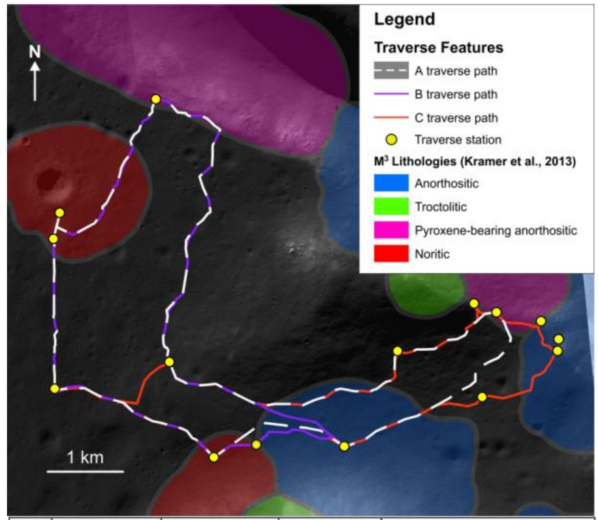
SWPR Traverses: Mapping of the SWPR area showed that it is an attractive scientific target for future lunar exploration. Traverses planned in this area would be carried out by a tele-operated rover utilizing a communications asset in the L2 orbital position. Traverses were designed to collect recommended minimum sampling masses of 15 - 20 kg [7] over a 14 day mission timeline. The rovers would utilize an instrument payload driven by sampling requirements.

Traverse Method: The geologic map constructed (Fig. 1) was used in traverse planning along with similar remote sensing datasets as mentioned above. Features of interest were noted within an assigned segment and on accessible slopes from 0 to 16˚. Notional traverse areas were then selected to provide *in situ* observations and samples from the most geologically interesting sites within a 14-day traverse. The preferred traverse area is located between two massifs, southwest of a graben through peak-ring material (Fig. 2). This area is geologically interesting, due to its proximity to the peak ring, graben, and a relatively fresh ~500 m crater. The region also contains outcrops of all four noritic, troctolitic, anorthositic, and pyroxene-bearing anorthositic lithologies identified with M^3 data [3]. Here, three traverses across the area are presented with a common landing site at Lat: -75.54˚, Long: 126.72˚.

Traverses A, B & C: Traverse A (Fig. 2) maximizes the diversity of samples and science goals addressed [2]. This route enables sampling of Schrödinger impact melt and all peak-ring lithologies, plus imaging of structural features within the graben.

Traverse B (Fig. 2) also presents an opportunity to sample Schrödinger impact melt and all peak-ring lithologies except the troctolitic unit. This traverse provides an opportunity to study a graben and a fresh crater with *in situ* analyses and, thus, may require a larger instrument suite.

Traverse C (Fig. 2) samples all peak-ring lithologies, but may not provide access to a sample of Schrödinger impact melt except as clasts within regolith covering other units. This traverse is focused on contacts



	Distance (km)	Sampling Mass (kg)	# Stations	Payload Requirements
A	25.0	16.5	9	Sampling
B	18.6	17.5	8	In-Situ & Sampling
C	12.2	16.5	11	Sampling

Fig. 2. Upper – Planned traverses A, B, and C in the SWPR area of Schrödinger basin. Lower – Individual planned traverse details.

between peak-ring lithologies to better understand magmatic relationships and to provide ground truth for M^3 data.

Summary: Geologic mapping of the SWPR area of the Schrödinger basin suggests magmatic and structural contacts between peak-ring lithologies. Fault orientations within the area indicate a complicated structural history during and directly after peak ring emplacement. Using the produced map, three traverse routes were developed within the SWPR that focus on sampling and investigating the contacts between peak-ring lithologies. Investigation of the features of the SWPR area during future lunar exploration could help address outstanding high priority NRC goals regarding the lunar interior and basin forming events [2].

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