DIVERSITY OF EXPLOSIVE VOLCANIC FEATURES IN SCHRODINGER BASIN ON THE MOON.

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Methods: An M3 mosaic of Schrödinger was constructed with bounds 110-155ºE and 82-67ºN in an orthographic projection with six spectral images (Fig 2), using the methods described in [9,10]. M3 observations of Schrödinger have a resolution of 280 m/pixel in 86 spectral channels [11] with data obtained in optical period 2C [12]. Because of these less ideal observation conditions, spectra extracted from M3 images in Schrödinger tend to exhibit significant noise.

Spectral diversity maps were created by parameterizing the 1- and 2-μm absorption bands in the M3 mosaic. In this study, spectral variability was assessed using two types of spectral parameters: (1) spectral indices using simple arithmetic (e.g., Glass spectral parameter detects the wings of the glass iron absorption based on the average band depth below the continuum at 1.15, 1.18, and 1.20 μm.) and (2) 1 and 2 μm band position, area, and shape parameters derived from our continuum removed mosaic.

Results: We completed the first hyperspectral map of the Schrödinger basin with M3 data (Fig 1).

The volcanic deposits are spectrally distinct units. RGB composite images are shown in Figs 1-2), which highlights the mineralogical diversity of Schrödinger. The subtle horizontal striping across the M3 frames in (Figs 1-2) maps is due to slight resolution and detector sensitivity changes. Analysis of these data reveals that the volcanic terrains of the cone and the inner-peak ring pyroclastic deposits are spectrally distinct from impact features as well as the inner-peak ring floor.

Spectra collected from Schrödinger are shown in Fig 3. The large conical edifice has bands centered near 0.98-1.10 and 1.85-2.00 μm and strong shoulders to long wavelengths on the 1 μm band, consistent with a mixture of glass and pyroxene and supporting an explosive origin (Fig 3) [9,13]. Olivine is unlikely to be a major contributor based on the band center positions, a 2μm band, and the 1μm band asymmetry.

The inner peak-ring lobate mafic unit exhibits bands near 0.95-1.05 μm and 1.8-2.0 μm, and the 1 μm band is narrow without any additional absorption that could be attributed to olivine or glass (Fig 3). Integrating the spectral map and the LROC imagery with the morphology of the lobate mafic unit leads to the first possible identification of small secondary vents or cones in Schrödinger (Fig 2e,f). Two C-shaped topographic rises resemble breached cones with diameters of 1.5 and 3.0 km and are consistent with detections in the glass parameter map (Fig 2f). Spectra of the cones (Fig 3) are
difficult to extract due to their size, but an average spectrum taken from both cones shows band centers near 1.03-1.05 μm and 1.80-1.90 μm, with a broad 1 μm band that may be consistent with glass.

The linear ridge unit is a thin lenticular unit isolated within the inner-peak ring basin (Fig 2c). The distinct linear ridge on the floor exhibit bands centered near 0.97 μm and 1.9-2.0 μm (Fig 3), attributed to the influence of CPX. The 1μm band is wider than expected for CPX alone and exhibits additional absorption at long wavelengths, suggesting a contribution from glass.

**Discussions:** Schrödinger cone has spectral signatures consistent with a mixture of pyroxene and significant glass, indicating an explosive emplacement as previously theorized [7,14]. The spectral differences in the west and east sides of the volcanic vent (Fig 2b) can be attributed to the covering of the volcanic deposits by ejecta from more recent impacts.

The lobate mafic unit within the peak ring is spectrally distinct from the other volcanic units in Schrödinger. Previously, the lobate mafic unit was considered a mare unit that has erupted effusively instead of explosively [5–7]. However, we have also identified possible glass signatures on the flow associated with small edifices that appear to be small cinder cones. We hypothesize that the unit first erupted explosively, building an edifice like a terrestrial cinder cone, and then erupted the flow component to create the lobate morphology of the margins.

M3 spectra from the linear ridge could be attributed to the increased influence of CPX and potentially with a limited contribution from glass relative to the basin floor. This detection corroborates the volcanic origin hypothesis because CPX and glass both likely represent juvenile magmatic material, similar to the lobate mafic unit. The presence of juvenile material with the location separated from the radial fractures leads us to believe that this was a magmatic intrusion that erupted through a fissure that created a thin layer of material that cooled quickly, overlaying the inner-peak ring floor.

**Conclusions:** We made the first hyperspectral mapping of the Schrödinger inner basin with M3 data. Three distinct volcanic units were identified within the inner-peak ring basin, the large cone, the lobate mafic unit, and the ridge unit, which are spectrally distinct from the inner-peak ring floor and have similar FeO abundances, potentially indicating a single magmatic source. Glass signatures in M3 spectra support a pyroclastic origin of the cone potentially originating from a Strombolian or fire-fountaining eruption possibly related to its location along the large radial graben. Smaller cones with potentially glassy spectral signatures have been identified within the lobate mafic units, suggesting an initial explosive pyroclastic eruption that later transitioned to an effusive component where coalesced pyroclasts flowed to create the lobed flow margins and a rough flow surface in radar images. The linear ridge unit exhibits spectra consistent with CPX and possible glass, which is unlike the basin floor but similar to the lobate mafic unit, thus confirming a volcanic origin over a tectonic feature.

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**References:**