Geology of the Lunar Moscoviense Basin

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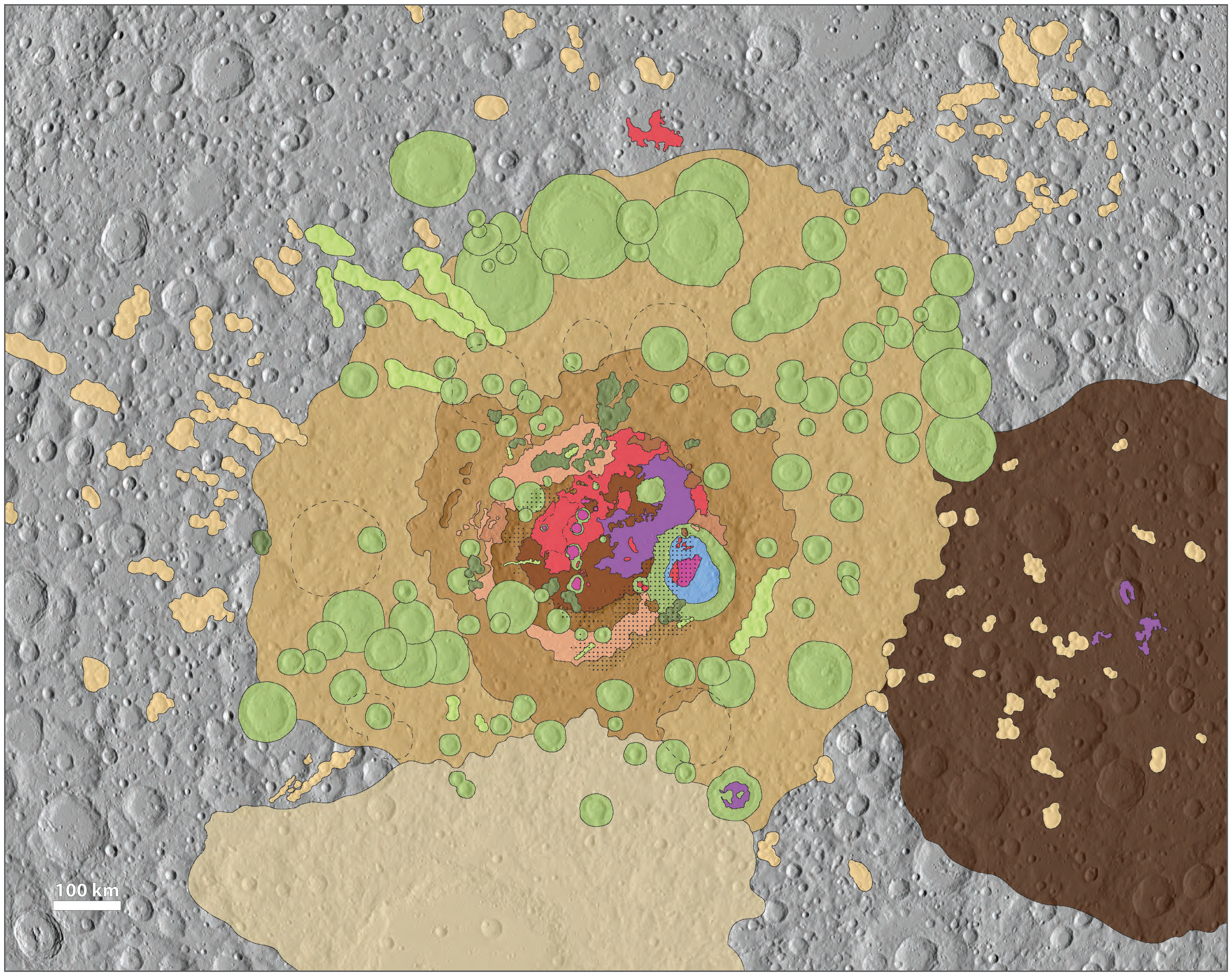
INTRODUCTION

Moscoviense is a 640 km-diameter, Nectarian-age, multi-ring impact basin on the lunar far side, centered at 26°N, 147°E. Although it has previously been mapped [1], new high resolution data from recent missions permit maps to be made in greater spatial detail with consideration of observed surface composition. The purpose of this project was to use these new data to compile an updated geologic map of the Moscoviense basin and its ejecta deposits (Fig. 1, 2).

METHODS

Mapping was completed in ArcMap 10.3.1 using geologic mapping methods outlined by [2] applied to several orthographically projected data sets. These included a mosaic of Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera (WAC) images, the Global Lunar DTM 100m topographic model (GLD100), and the Clementine Ultraviolet/Visible (UVVIS) color ratio map. Additional data including LRO Narrow Angle Camera (NAC) images were viewed in the online LRO QuickMap tool [3].



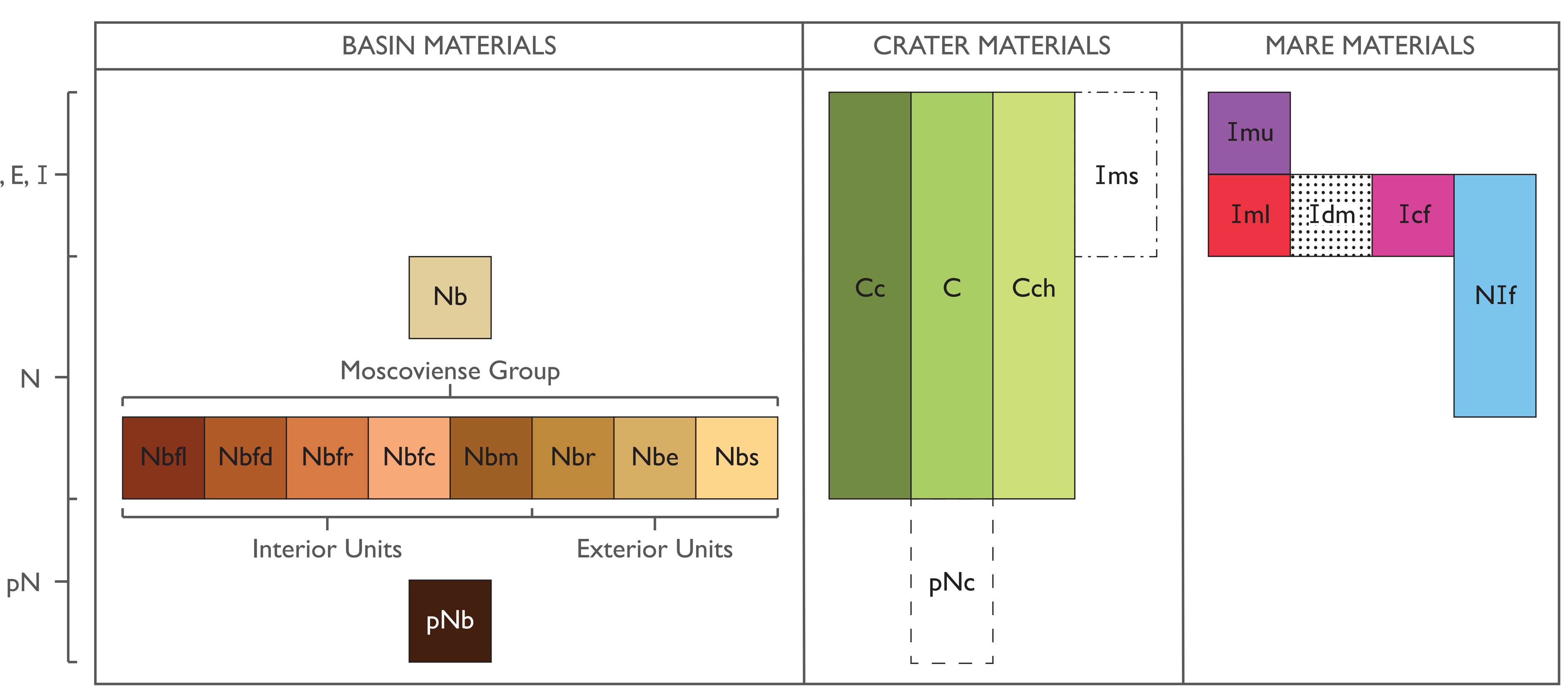


Figure 1 (above). Geologic map of the Moscoviense basin. Orthographic projection centered on 26°N, 147°E with north at the top.

Figure 2 (left). Correlation chart of mapped units. Timescale: Copernican (C), Eratosthenian (E), Imbrian (I), Nectarian (N), pre-Nectarian (pN). Key units: Freundlich-Sharonov Deposits (pNb), Dark Cratered Basin Floor (Nbfl), Draped Basin Floor (Nbfd), Rough Basin Floor (Nbfr), Cratered Basin Floor (Nbfc), Basin Massifs (Nbm), Basin Rim (Nbr), Basin Ejecta (Nbe), Basin Secondaries (Nbs), Mendeleev Deposits (Nb), Fractured Highlands (NIf), Fractured Crater Floor (Icf), Pyroclastics (Idm), Lower and Upper Maria (Iml, Imu).

FINDINGS

Impact Origin

The apparent offset of the ring structure of Moscoviense has been attributed to either a single oblique impact [4] or the overlap of two unrelated impact basins [5]. The new mapping supports an oblique impact origin for Moscoviense through documentation of scoured topography to the northeast, a linear offset of the ring structure (Fig. 3), and a compositional asymmetry of the ejecta deposit (Nbe).

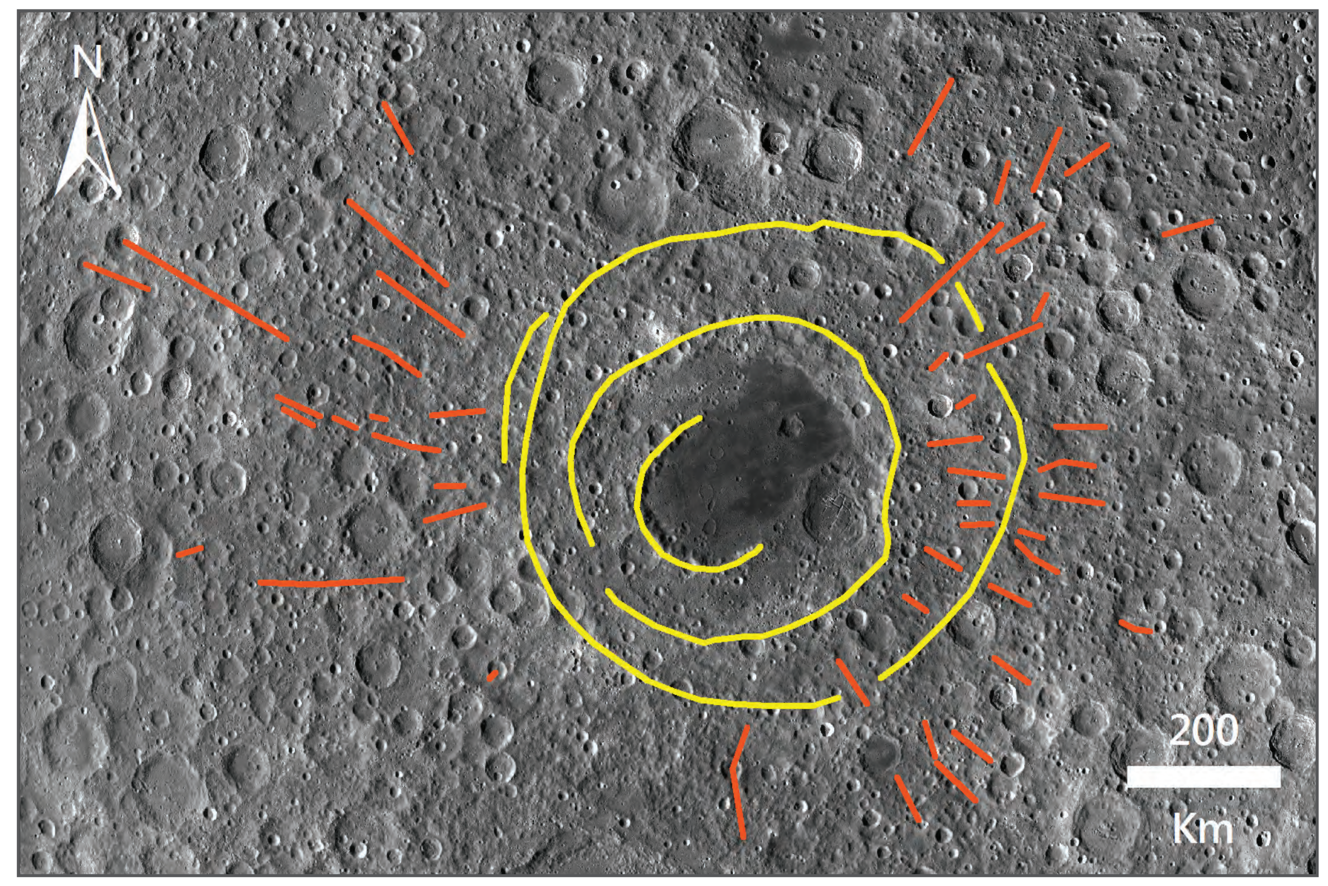


Figure 3. Structural map of Moscoviense basin showing ring structures in yellow and topographic troughs in orange over an LRO WAC mosaic.

Compositional Analysis

Higher-than-expected FeO and TiO_2 contents in the dark cratered (Nbfl) and draped (Nbfd) basin floor materials indicates a more mafic composition for the basin melt sheet than suggested by the composition of basin ejecta [6] and may be attributed to post-basin craters excavating mafic material at depth.

Elevated FeO content can be seen to the east and northeast of the basin within the basin ejecta (Nbe) and rim (Nbr) deposits (Fig. 4). The crater Steno Q appears to have excavated deep enough (~1.7 km [3]) to eject highly anorthositic material from beneath this relatively mafic basin ejecta.

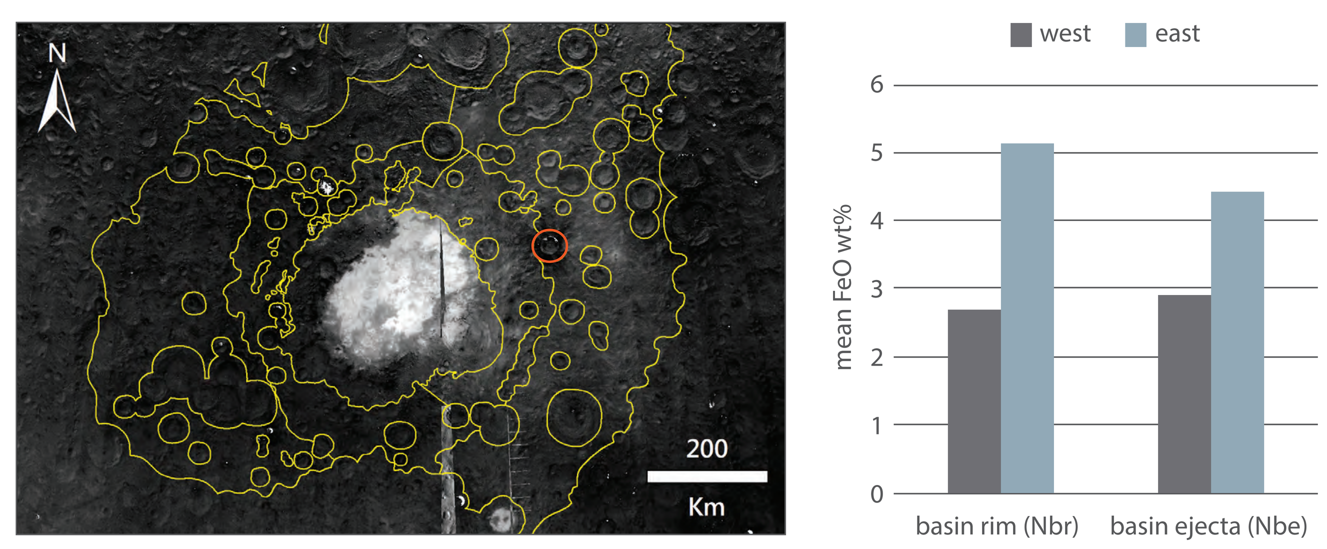


Figure 4. Clementine FeO mosaic overlain with yellow outlines of divided basin rim (Nbr) and basin ejecta (Nbe) units. Crater Steno Q is outlined in orange. Lighter areas have higher FeO content than darker areas. Results of zonal statistics calculations of mean FeO weight percent for the eastern and western portions of each unit are presented on the right.

REFERENCES

[1] Stuart-Alexander D.E. (1978) USGS Map **I-1047**. [2] Wilhelms D.E. (1972) USGS IR **55**, 47 pp. [3] http://target.lroc.asu.edu/q3/# [4] Schultz P.H. and Stickle A.M. (2011) *LPSC* **XLII**, 2611. [5] Ishihara Y. et al. (2011) *LPSC* **XLII**, 1124. [6] Spudis, P.D. and M.U. Sliz (2017) *Geophys. Res. Lett.* **44**, 1260.