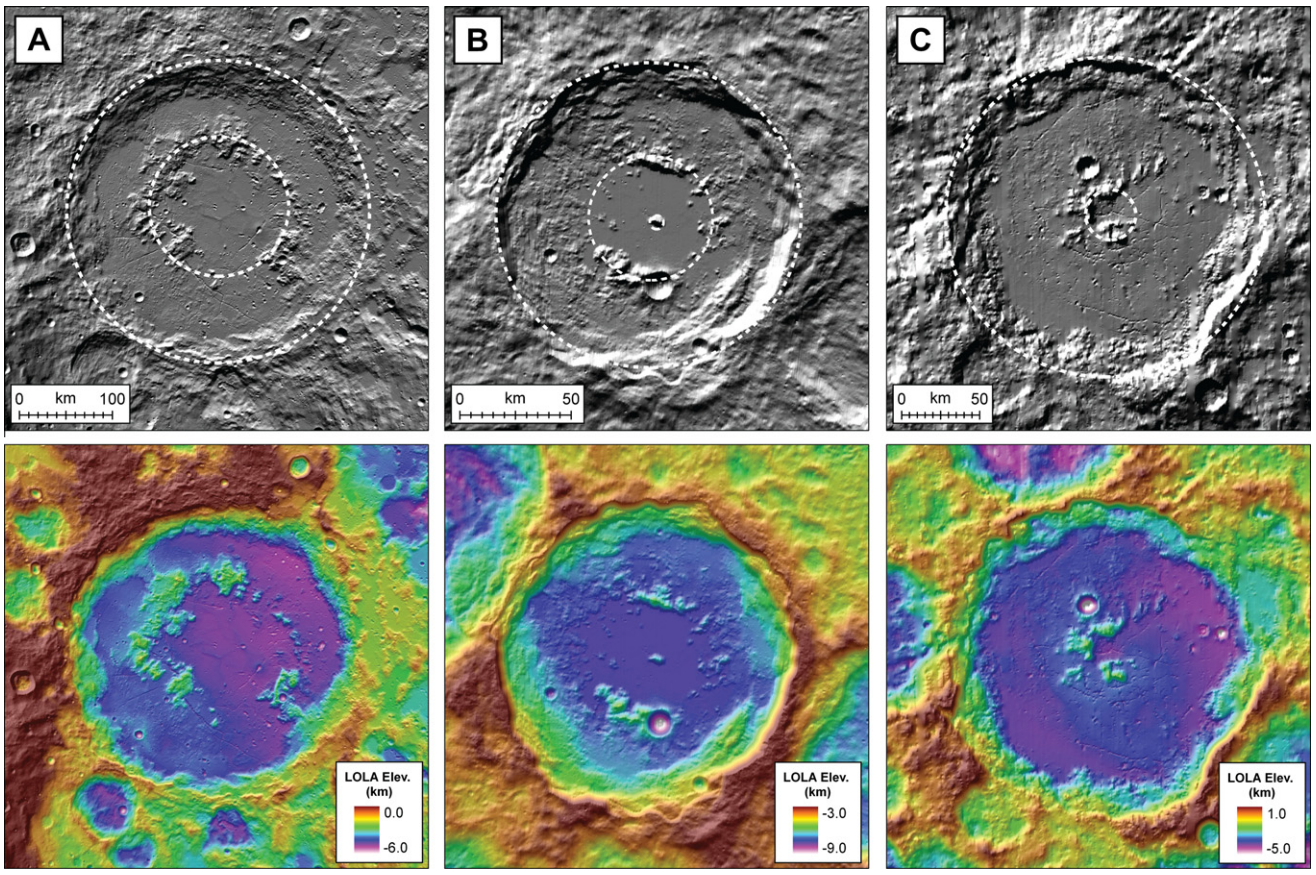

Fig. 1. Examples of a peak-ring basin (A), protobasin (B), and ringed peak-cluster basin (C) on the Moon. Top panels show outlines of circle fits to the basin rim crest and interior ring (dashed lines) on LOLA hillshade gridded topography. Bottom panels show LOLA colored gridded topography at 128 pixel/degree on LOLA hillshade gridded topography. (A) Schrödinger (326 km; 133.53°E, 74.90°S), a peak-ring basin, exhibits a nearly continuous interior ring of peaks with no central peak. (B) Antoniadi (137 km; 187.04°E, 69.35°S), a protobasin, has a less prominent peak ring surrounding a small central peak. (C) Humboldt (205 km; 81.06°E, 27.12°S) is a ringed peak-cluster basin with an incomplete, diminutive ring of central peak elements.

multi-ring basins where some ring designations were most uncertain (Pike and Spudis, 1987).

The diameters of basin features, including rim crests, rings, and central peaks, were measured (where present) by visually fitting circles to the features using the CraterTools extension in ArcGIS (Kneissl et al., 2010). Circle-fits were carefully selected to best approximate the mean diameter value for the features (Baker et al., 2011) (Fig. 1). For example, peak rings were fit by a circle intermediate between circles that inscribe and circumscribe the peak ring. Fits to rim crests were defined by the most prominent topographic divides along the crater rim crest. Central peaks were the most difficult to measure due to their irregular outlines. For those irregular central peaks, we chose circular fits that approximated a diameter that is intermediate between the maximum and minimum areal dimensions of the feature (Baker et al., 2011) (Fig. 1). As in previous catalogs, our confidence in the identification and measurement of peak rings is presented as a scale from 1 (lowest) to 3 (highest) (Tables A1–A3). Most basins are cataloged with the highest confidence, however, three peak-ring basins remain more speculative due to incomplete preservation of interior morphologies or possible mis-interpretation of interior features as primary basin structure. The continuity of observable peak rings are also designated as being greater than or less than 180° of arc (Tables A1–A3).

4. The basin catalog

Our catalog is a refinement of earlier catalogs of peak-ring basins and protobasins on the Moon. We have excluded some ambiguous basins and have re-classified several other basins, particularly those near the transition diameters between peak-ring basins and protobasins and peak-ring basins and multi-ring basins. These re-classifications largely reflect our improved ability to recognize genuine basin ring and central peak structures from new LOLA topographic and image data. Our refined catalog includes 17 peak-ring basins (Table A1), 3 protobasins (Table A2), and 1 ringed peak-cluster basin (Table A3). LOLA gridded topography images of each basin in Tables A1–A3 are also included as online supplementary material. Twenty-two craters exhibiting ring-like arrangements of central peak elements are also cataloged (Table A3), but are not classified as ringed peak-cluster basins due to their small (<114 km) rim-crest diameters that fall below the transitional rim-crest diameter range between complex craters and peak-ring basins (see discussion in Section 6.1). All of the peak-ring basins and protobasins cataloged in this study have appeared in earlier catalogs, but have been variously classified as one or multiple basin types based on the available data at the time the catalogs were generated.

Our peak-ring basin catalog includes five basins that have been previously classified as multi-ring basins by Pike and Spudis (1987): Apollo, Moscoviense, Grimaldi, Coulomb–Sarton, and Korolev. Our catalog also includes Freundlich–Sharonov, which was recognized as a candidate multi-ring basin but with only one 600-km diameter ring identified (Wilhelms et al., 1987; Spudis, 1993). Upon careful examination of LOLA topographic data (Fig. 3), we find that all of these basins are fit best by no more than two topographic rings. For example, a possible ring exterior to Apollo (Fig. 3A) appears to be associated with the rim structure of South