



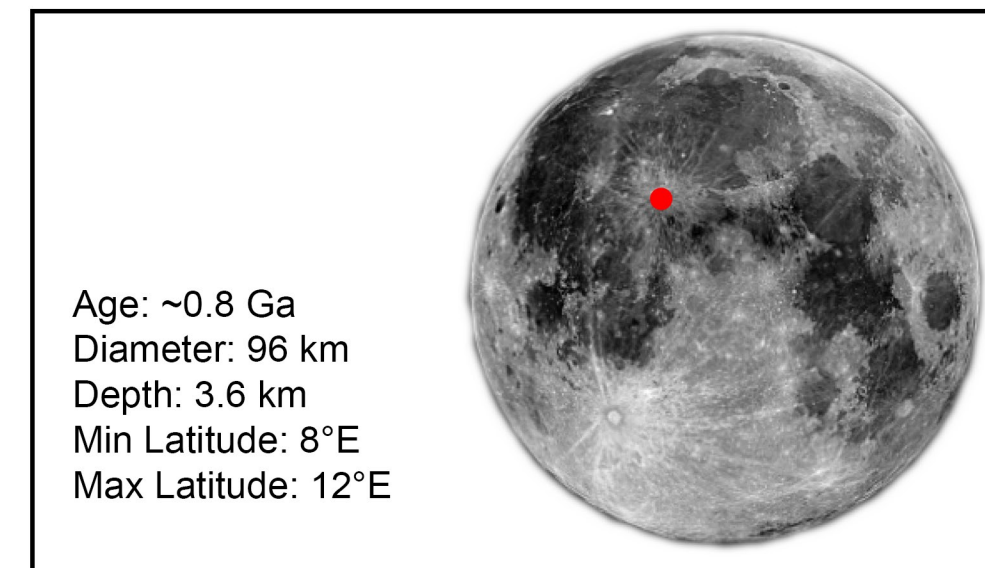
# Geologic evolution and map of Copernicus Crater interior (Moon)

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Scale 1:150,000

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Age: ~0.8 Ga  
Diameter: 96 km  
Depth: 3.6 km  
Min Latitude: 8°E  
Max Latitude: 12°E

## LEGEND

### GEOLOGICAL UNITS

#### Crater floor units

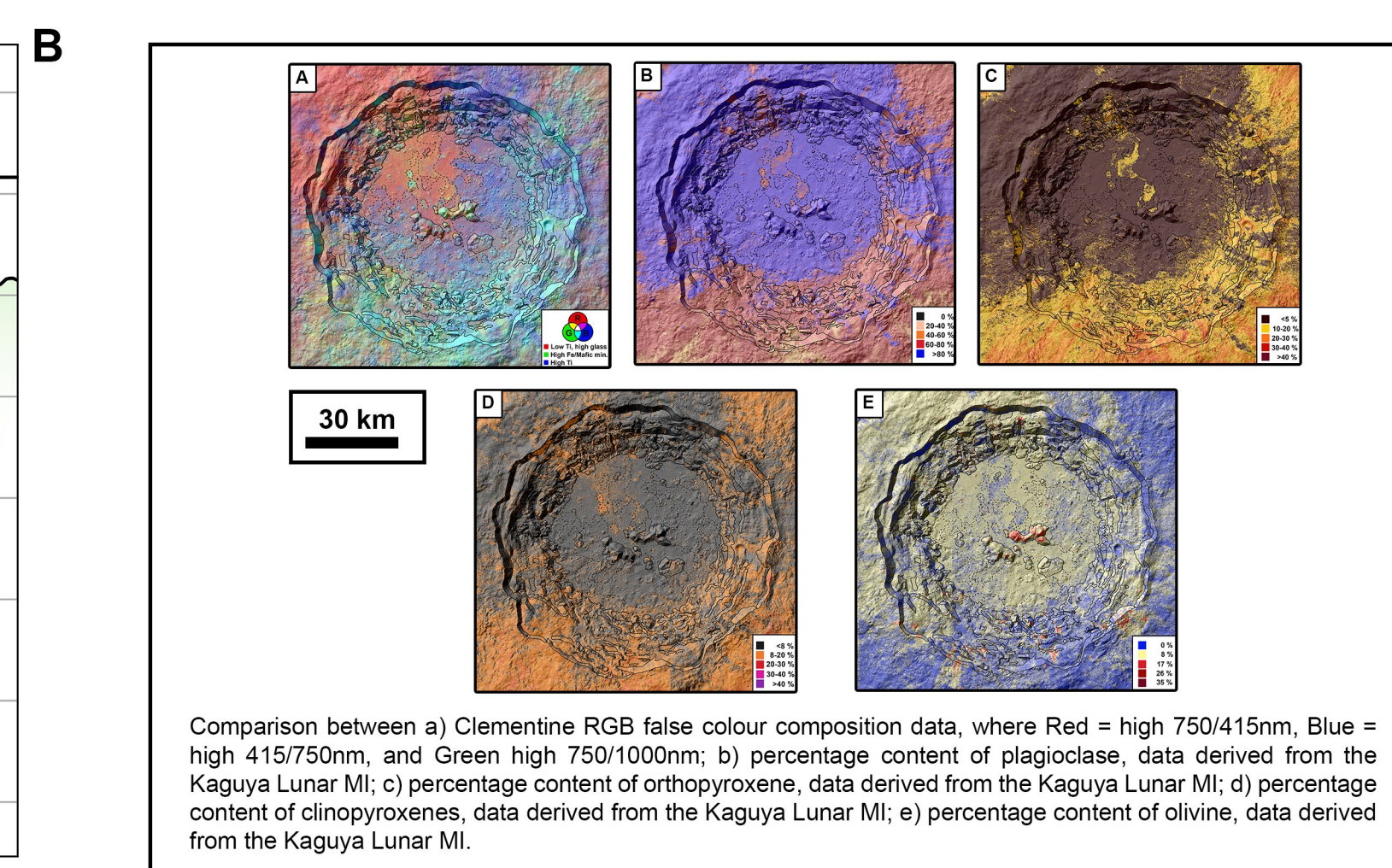
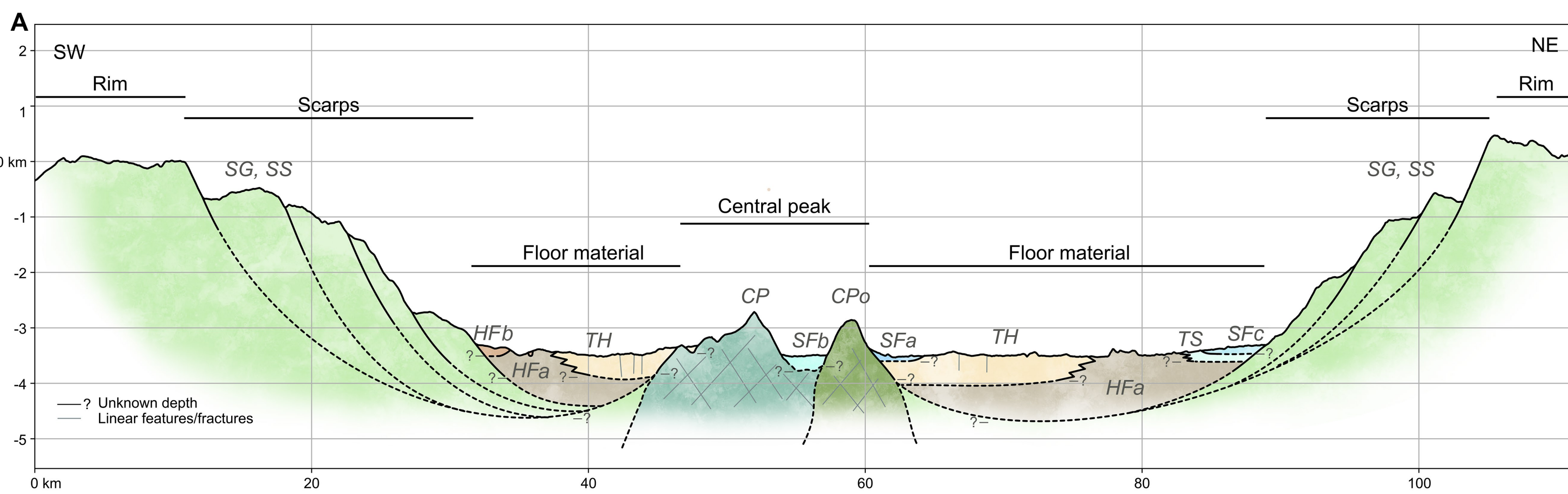
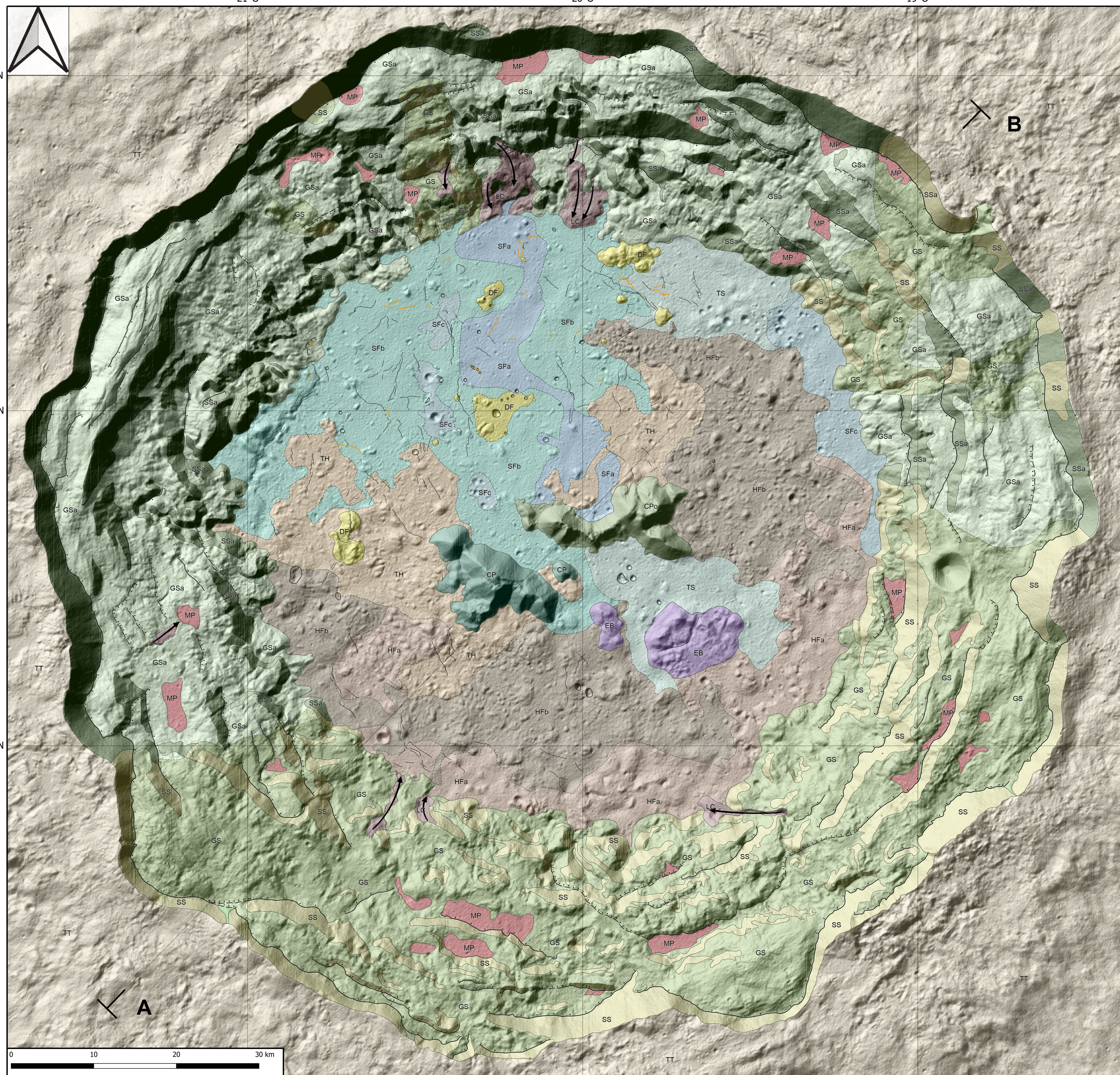
- Degassing features and related deposits (DF):** degassing vents and related ejecta deposits possibly derived from vugs and pockets of volatiles within impact melts of the smooth floor and the hummocky materials.
- Smooth floor material (SF):** smooth unit on the crater floor displaying a very low amount of blocks and mounds. Despite its morphological uniformity, this unit shows spectral variations visible both on Clementine and Kaguya MI data, allowing the distinction of 3 subunits in stratigraphic sequence.
  - Smooth floor material a (SFa):** smooth floor subunit with sinuous boundaries. In Kaguya MI spectral maps the unit appears enriched in Mg-rich orthopyroxene (15% + 40%) and with a lower content of plagioclase (73% + 78%) with respect to the surroundings. Clementine data suggests the presence of mafic minerals mixed with glass content.
  - Smooth floor material b (SFb):** subunit characterised by a low roughness and very rare blocks and mounds. A high Clementine 750/415nm ratio indicates a TiO2 and/or a high glass content. Kaguya MI maps highlight a very high content in plagioclase (88% + 93%), a very low content in clinopyroxene (~0% + 15%) and a possible small amount in olivine (~8%).
  - Smooth floor material c (SFc):** smooth crater floor subunit, which in Kaguya MI spectral maps shows a clear enrichment in orthopyroxene (15% + 40%), a decrease in plagioclase content (60% + 77%) and a slight increase in clinopyroxene (5% + 30%) with respect to SFa and SFb.
- Transitional smooth material (TS):** unit of morphological and spectral (Clementine data) transition between SF and HF units, although with a prevalence of the SF component. The surface is indeed characterised by a mid-low roughness due to dispersed blocks and mounds and a mid-high Clementine 750/415 nm ratio (more reddish colour on Clementine RGB).
- Transitional hummocky material (TH):** unit of morphological and spectral (Clementine data) mixture between HF and SF units, although with a prevalence of HF. The surface is indeed characterised by a mid-high roughness due to a higher amount of blocks and mounds with respect to TS, and a mid-high Clementine 415/750 nm ratio (more bluish colour on Clementine RGB).
- Hummocky floor material (HF):** unit with the highest roughness among the crater floor units, it shows abundant blocks and mounds. Despite its uniform morphology, it can be subdivided into two distinct subunits with different spectral characters on Clementine and Kaguya MI data.
  - Hummocky floor material a (HFa):** floor material with the highest roughness and abundant blocks and mounds. The high ratio 415/750 nm on Clementine data indicates high TiO2 content and/or a shortage of glass content. Kaguya MI data show a high orthopyroxene (~10%) and clinopyroxene content (~0% + 15%), and a low plagioclase amount (80% + 86%).
  - Hummocky floor material b (HFb):** subunit of hummocky floor material, showing in Kaguya MI spectral data a higher value of orthopyroxene (15% + 30%) and a lower content in plagioclase (55% + 77%) than HFa.
- Central peak material (CP):** southernmost central peak characterised by scree or talus at its base. No particular spectral signature in Clementine and Kaguya spectral data has been detected, except for a very high value of plagioclase (85% + 92%).
- Olivine-rich central peak material (CPO):** northernmost central peak showing on Kaguya spectral maps, a massive enrichment in olivine (~20%) and on Clementine data a 750/1000 nm high ratio, indicating high values of Fe and mafic minerals (likely ferrosilicic olivine). Kaguya Multiband Imager spectral maps also show a slightly lower plagioclase content with respect to the CP unit (80% + 90%).

#### Crater wall units

- Lobate flow and channel material (LC):** lobes and channels probably due to downhill flows of viscous molten material. Those features show a textured morphology composed of sub-parallel corrugations and ponds, often terminating with a melt pool at their base.
- Terrace and gentle scarp (GS):** terraces and scarps with a relatively slight slope (8° - 43%). Kaguya MI evidence a content of 50 + 75% in plagioclase, 15 + 45% in orthopyroxene, and ~15% in clinopyroxene. This mineralogical composition is mostly in the southern part of the wall and is in line with the composition of the surface surrounding the Copernicus crater at a regional scale.
- Terrace and gentle scarp a (GSA):** subunit of GS, located mostly in the northern-western sector, where terraces and gentle scarps are covered by ejecta extremely rich in plagioclase (88 + 93%) and glass (red colour on Clementine RGB), and putative absence of orthopyroxene.
- Steep scarp (SS):** scarps with relatively high slope (over 43°). Kaguya MI evidence a content of 50 + 75% in plagioclase, 15 + 45% in orthopyroxene, and ~15% in clinopyroxene. This mineralogical composition is mostly in the southern part of the wall and is in line with the composition of the surface.
- Steep scarp a (SSa):** subunit of SS, located mostly in the northern-western sector, where steep scarps are covered by ejecta extremely rich in plagioclase (88 + 93%) and glass (red colour on Clementine RGB), and putative absence of orthopyroxene.
- Melt pool (MP):** small smooth and flat morphologies located within rough and steep areas. No particular spectral evidences are recognizable in Clementine's data.

### LANDFORMS

- Open fracture:** irregular cracks of the floor in places potentially associated with degassing features.
- Pit chain:** chains of open pits present on the floor, probably associated with degassing features and fractures.
- Open pit:** crater characterised by not-raised rim depression. Probably generated by circular collapses of the floor into cavities formed by degassing events or evacuation of still-molten fallback. Some of them show degassing deposits inside.
- Flow channel:** downhill flow of unit LC. Locally leveed channels and lobate protrusion are present.
- Rim and wall fault:** typical sliding surfaces and faults formed during the inward mass movements during the crater modification stage. They are subdivided into certain and inferred. The inferred ones are in shadowed areas and/or due to bad data quality.
- Megablock ejecta (EB):** groups of large and fractured ejecta blocks, with a variable colour in Clementine RGB data.
- Surrounding terrain (TT):** unmapped areas, mainly composed of Copernicus' continuous ejecta.



Comparison between a) Clementine RGB false colour composition data, where Red = high 750/415nm, Blue = high 415/750nm, and Green high 750/1000nm; b) percentage content of plagioclase, data derived from the Kaguya Lunar MI; c) percentage content of orthopyroxene, data derived from the Kaguya Lunar MI; d) percentage content of clinopyroxenes, data derived from the Kaguya Lunar MI; e) percentage content of olivine, data derived from the Kaguya Lunar MI.