PhD student: Gloria Tognon Supervisor: Prof. Matteo Massironi Co-supervisor: Prof. Giampiero Naletto



Large-scale mapping

mapping

Mercury

Large-scale mapping



1:3M regional geological maps





H9 Eminescu quadrangle (22.5°N - 22.5°S, 72°E - 144°E)



1:3M regional geological maps





H9 Eminescu quadrangle (22.5°N - 22.5°S, 72°E - 144°E)

Datasets



Mercury

USGS Mercury MESSENGER Global DEM (Becker et al. 2016)

MONOCHROME BASEMAPS:

Basemap reduced Data Record (BDR) High-Incidence angle from East (HIE) High-Incidence angle from West (HIW) LOw-Incidence angle (LOI)

COLOR BASEMAP:

Enhanced-color mosaic 3-Color map-projected Multispectral reduced Data Record (MD3) horizontal resolution ~ 665 m/px

resolution ~ 166 m/px resolution ~ 166 m/px resolution ~ 166 m/px resolution ~ 166 m/px

$S_m = R_r \times 2000$ $S_m =$ mapping scale $R_r =$ raster resolution *(Tobler, 1987)*

Geological mapping $S_m = 1:332.000$

resolution ~ 665 m/px

resolution ~ 665 m/px

Spectral mapping $S_m = 1:1.330.000$

Mercury

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies

Crater rims mapping

---- crest of crater rim 5km<D<20km

---- crest of crater rim D>20km

---- crest of degraded or buried crater





Geological mapping

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies

undefined contact

--- contact, approximate

— contact, certain



Mercury

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies

Structural mapping

- undefined structure



Mercury

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies

Surface features mapping

cluster of hollows

rough ejecta

_____ secondary crater chain or cluster





Crater rims

- ---- crest of crater rim 5km<D<20km
- ----- crest of crater rim D>20km
- ---- crest of degraded or buried crater

Geological contacts

- undefined contact
- --- contact, approximate
- contact, certain

Structures

undefined structure

Surface features

cluster of hollows

rough ejecta



PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies

Output mapping









Mercury



Spectral mapping











Spectral mapping

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies



Integrated morpho-stratigraphic map

Moon

Small-scale mapping



Tsiolkovskiy crater



- Feldspathic Highlands Terrane
- Farside mare volcanism
- Oblique impact NW-SE



Tsiolkovskiy crater



(Corley et al., 2018)

- Feldspathic Highlands Terrane
- Farside mare volcanism
- Oblique impact NW-SE
- Well-preserved central peak
- Detection of olivine and purest anorthositec

Datasets



LRO-LOLA and KAGUYA-TC DEM merge

(Barker et al. 2016)

horizontal resolution ~ 59 m/px vertical resolution 3-4 m

MONOCHROME BASEMAPS:

LRO-WAC (Robinson et al., 2010) global mosaic

LRO-NAC (Robinson et al., 2010) images

LRO-NAC derived DEMs

COLOR BASEMAP:

Clementine UVVIS color ratio mosaic

(Lucey et al. 2000)

resolution ~ 100 m/px resolution ~ 0,5 m/px resolution ~ 0,5 m/px

$S_m = R_r \times 2000$ $S_m =$ mapping scale $R_r =$ raster resolution *(Tobler, 1987)*

Geomorphological mapping $S_m = 1:200.000$ High-resolution geological mapping $S_m = 1:1.000$

Spectral mapping $S_m = 1:400.000$

resolution ~ 200 m/px

Geomorphological mapping

Geological contacts

---- contact, approximate

— contact, certain

Morphologies

---- crest of crater rim D<20 km

rest of crater rim D>20 km

— mare rill

Structures

— wrinkle ridge





Geomorphological mapping



---- contact, approximate

— contact, certain

Morphologies

crest of crater rim D<20 km
crest of crater rim D>20 km
mare rill

Structures

— wrinkle ridge

Geological units







Moon

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies

Geomorphological mapping







Spectral mapping



Spectral contacts

---- contact, approximate

— contact, certain





Spectral mapping



Spectral contacts

---- contact, approximate

— contact, certain

Spectral units





Spectral mapping













High-resolution geological mapping

PLANetary MAPping at different scales: insights on atmosphere-less terrestrial bodies



High-resolution geological mapping

Geological contacts

--- contact, approximate

— contact, certain

Morphologies

---- crater diameter D>200m

— mare rill





High-resolution geological mapping

Geological contacts

--- contact, approximate

— contact, certain

Morphologies

---- crater diameter D>200m

— mare rill

Geological units

CF central peakCF smooth materialSecondary craters



High-resolution geological mapping





Boulders

- isolated boulder
- cluster of boulders
- large cluster of boulders



High-resolution geological mapping

Geological contacts

contact, approximate

contact, certain

Morphologies

crater diameter D>200m

mare rill

Geological units



Secondary craters



Boulders

- isolated boulder
- cluster of boulders
- large cluster of boulders



High-resolution geological mapping

Geological contacts

contact, approximate

contact, certain

Morphologies

crater diameter D>200m

mare rill

Geological units



Secondary craters



Boulders

- isolated boulder
- cluster of boulders
- large cluster of boulders



Future work



- ✓ Advancement of the geomorphological mapping
- Enlargement of spectral mapping area
- Chrono-stratigraphic interpretation
- ✓ Targets selection for the BepiColombo mission



- \checkmark Enlargement of the area
- ✓ Landind site and rover traverses definition
- ✓ Compositional analysis of boulders
- ✓ Radar investigation for deep structures

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