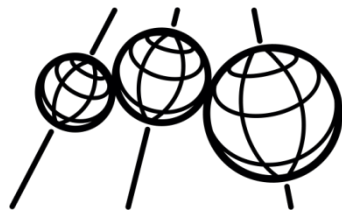


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# PLANMAP

Geologic Mapping of our Solar System

Grant Agreement	776276
Acronym	PLANMAP
Project full title	Planetary mapping

## Deliverable

### D 7.7

#### Deliverable Name

**Final release of data/code/products as VESPA compliant data**

Nature of deliverable	REPORT
Dissemination level	PU
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## Executive summary

Data and code, tools developed within the PLANMAP project were kept in the usual locations and they will be kept online after the end of the projects, using current and future projects to supports its infrastructure, such as the EPN-H2024-RI. The code and tools will also be adopted and evolve under such premises. A batch of data for the ESA Guest Storage Facility (GSF) has been provided. Upon completion of the project, the final state of the art will also be provided to the GSF. Software releases are available as Zenodo/OpenAIRE DOI-citable objects, and released on GitHub and the data portal as they were produced.



## List of Acronyms

<b>Acronym</b>	<b>Description</b>
DMP	Data Management Plan
EPN H2024-RI	Europlanet H2024 Research Infrastructure
ESA	European Space Agency
ESAC	European Space Astronomy Centre (ESA center)
ESDC	ESA Science Data Centre
GDAL	Geospatial Data Abstraction Library
GIS	Geographic Information System
GSF	Guest Storage Facility (at ESA ESAC)
OGC	Open Geospatial Consortium
PM_ID	PLANMAP IDentification (i.e. PLANMAP map short name)
VESPA	Virtual European Solar and Planetary Access
VO	Virtual Observatory
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service



## Introduction

The final delivery of PLANMAP data follows the custom of the project (see [D7.2](#), [D7.6](#)), with more peer-reviewed publications having appeared meanwhile from the exploitation of PLANMAP data and products. The data release includes: incremental updates of existing products, with previous versions still being accessible (see sections below); newly added products, related to deliverables from other WPs; data discovery enabled via the planetary VO system of Europlanet VESPA.

## Data availability and access

Data from PLANMAP are available as per previous releases (see [D7.2](#), [D7.6](#)) via the project map portal. PLANMAP map files are available individually or as compressed packages for download.

The customary points of access for data are on:

- The PLANMAP data directory - <https://data.PLANMAP.eu/>
- The PLANMAP data portal - <https://maps.PLANMAP.eu/>
- The PLANMAP Geoserver backend - <https://geoserver.PLANMAP.eu/>

Data versioning did not change since D7.6 and it continues to explicitly exclude versioning from the PM\_ID string, while keeping it in the metadata, in addition, to have earlier versions of each product, where relevant and available, on the data portal<sup>1</sup>.

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<sup>1</sup> e..g <https://data.PLANMAP.eu/pub/mars/versions/>



## Map naming

The map naming conventions are essentially the same since the start of their introduction. Additional specific Geo-spectral data have been added as (spectrally ) Integrated data, "I" (See Table 1).

Table 1: (See also [D7.4](#))

PLANMA P prefix	Target body	Type (multiple allowed in attached substrings)	String or substring	Specific substring
<b>PM</b>	<b>MER</b> Mercury	<b>S</b> = Stratigraphic	<b>&lt;Toponym&gt;</b>  e.g.  H05	e.g.
	<b>MOO</b> Moon	<b>C</b> = Compositional		<b>3cc</b> = 3 classes
	<b>MAR</b> Mars	<b>M</b> = Morphologic		<b>5cc</b> =5 classes
		<b>G</b> = Geo-structural		
		<b>I</b> = Integrated (spectral)		
		<b>D</b> = Digital Outcrop / Geologic Model-derived		

## Final data release

Data from the previous release ([D7.6](#)) include minor updates and additions of several maps. Several peer-reviewed papers have been so far accepted (e.g. Luzzi et al., 2020), based on or deriving from PLANMAP products. The final state of the art is described in Table 2.



Table 2: PLANMAP products by project end. Scientific literature linked to each product, e.g. peer-reviewed publications deriving from or describing the mapping products themselves is linked from each product's metadata page.

PLANMAP map ID	Target body	Title (location)	Category	Relevant deliverables / description	Version	Data
PM-MER-C-Beethoven	Mercury	Spectral indices map of the Beethoven basin, Mercury	Non-standard	see <a href="#">D4.3-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-C-Beethoven/">https://data.PLANMAP.eu/pub/mercury/PM-MER-C-Beethoven/</a>
PM-MER-MS-Beethoven	Mercury	Geological map of Beethoven basin, Mercury	Non-standard	see <a href="#">D3.3-public</a>	01	<a href="https://data.planmap.eu/pub/mercury/PM-MER-MS-Beethoven/">https://data.planmap.eu/pub/mercury/PM-MER-MS-Beethoven/</a>
PM-MER-MS-H05_3cc	Mercury	Hokusai Quadrangle morphostratigraphic map (3 crater classes)	Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-H05_3cc/">https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-H05_3cc/</a>
PM-MER-MS-H05_5cc	Mercury	Hokusai Quadrangle morphostratigraphic map (5 crater classes)	Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-H05_5cc/">https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-H05_5cc/</a>
PM-MER-C-H05	Mercury	Hokusai Quadrangle compositional map(s) -	Non-standard	See <a href="#">D4.1-public</a> , <a href="#">D4.2-public</a>	02	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-C-H05/">https://data.PLANMAP.eu/pub/mercury/PM-MER-C-H05/</a>

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PM-MER-C-H05_SU	Mercury	H05 Spectral units map	Non-standard	see <a href="#">D4.3-public</a>	01	<a href="https://data.planmap.eu/pub/moon/PM-MOO-C-SPAA1_SU/">https://data.planmap.eu/pub/moon/PM-MOO-C-SPAA1_SU/</a>
PM-MER-MS-H02_3cc	Mercury	Geologic Map of the Victoria Quadrangle (H02), Mercury	Non-Standard	In-kind contribution	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-H02_3cc/">https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-H02_3cc/</a>
PM-MER-MS-Rembrandt	Mercury	Rembrandt basin morphostratigraphic map	Non-Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-Rembrandt/">https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-Rembrandt/</a>
PM-MER-C-Rembrandt	Mercury	Spectral indices map of the Rembrandt basin, Mercury	Non-Standard	see <a href="#">D4.3-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-C-Rembrandt/">https://data.PLANMAP.eu/pub/mercury/PM-MER-C-Rembrandt/</a>
PM-MER-D-Rembrandt	Mercury	Geomodel of Rembrandt basin		see <a href="#">D6.3-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-D-Rembrandt/">https://data.PLANMAP.eu/pub/mercury/PM-MER-D-Rembrandt/</a>
PM-MER-MS-Lermontov	Mercury	Morphostratigraphic map of Lermontov crater, Mercury	Non-Standard	In-kind contribution	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-Lermontov/">https://data.PLANMAP.eu/pub/mercury/PM-MER-MS-Lermontov/</a>
PM-MER-MS-H10_3cc/	Mercury	Geological Map of the Derain (H10) Quadrangle, Mercury	Standard	Preliminary	01	<a href="https://data.planmap.eu/pub/mercury/PM-MER-MS-H10_3cc/">https://data.planmap.eu/pub/mercury/PM-MER-MS-H10_3cc/</a>





PM-MER-MS-H10_5cc	Mercury	Geological map of the Derain (H10) quadrangle, Mercury (5cc)	Standard	Preliminary	01	<a href="https://data.planmap.eu/pub/mercury/PM-MER-MS-H10_5cc/">https://data.planmap.eu/pub/mercury/PM-MER-MS-H10_5cc/</a>
PM-MER-MS-H14_3cc	Mercury	3 Class Geological Map of H-14 (The Debussy Quadrangle) of Mercury	Standard	Preliminary	01	<a href="https://data.planmap.eu/pub/mercury/PM-MER-MS-H14_3cc/">https://data.planmap.eu/pub/mercury/PM-MER-MS-H14_3cc/</a>
PM-MER-MS-H14_5cc	Mercury	5 Class Geological Map of H-14 (The Debussy Quadrangle) of Mercury	Standard	Preliminary	01	<a href="https://data.planmap.eu/pub/mercury/PM-MER-MS-H14_5cc/">https://data.planmap.eu/pub/mercury/PM-MER-MS-H14_5cc/</a>
PM-MAR-MS-Crommelin	Mars	Crommelin crater morphostratigraphic map	Non-Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-MS-Crommelin/">https://data.PLANMAP.eu/pub/mars/PM-MAR-MS-Crommelin/</a>
PM-MAR-C-Crommelin	Mars	Crommelin crater compositional map(s)	Non-Standard	see <a href="#">D4.1-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-C-Crommelin/">https://data.PLANMAP.eu/pub/mars/PM-MAR-C-Crommelin/</a>
PM-MAR-SI-Crommelin	Mars	Crommelin crater geostratigraphic map	Non-Standard		01	<a href="https://data.planmap.eu/pub/mars/PM-MAR-SI-Crommelin/">https://data.planmap.eu/pub/mars/PM-MAR-SI-Crommelin/</a>

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PM-MAR-C-Arsinoes	Mars	Arsinoes Chaos compositional map(s)	Non-Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-C-Arsinoes/">https://data.PLANMAP.eu/pub/mars/PM-MAR-C-Arsinoes/</a>
PM-MAR-D-Crommelin	Mars	3D geomodel of Crommelin crater	Non-standard	<a href="#">see D6.1-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-D-Crommelin/">https://data.PLANMAP.eu/pub/mars/PM-MAR-D-Crommelin/</a>
PM-MAR-GS-Crommelin	Mars	Geostructural Integrated map of Crommelin crater (subset)	Non-standard	<a href="#">see D6.3-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-SI-Crommelin/">https://data.PLANMAP.eu/pub/mars/PM-MAR-SI-Crommelin/</a>
PM-MAR-MS-Arsinoes	Mars	Arsinoes Chaos morphostratigraphic map	Non-Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-MS-Arsinoes/">https://data.PLANMAP.eu/pub/mars/PM-MAR-MS-Arsinoes/</a>
PM-MAR-D-Gale_Kimberley	Mars	3D Models of the Kimberley area		see <a href="#">D5.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/mars/PM-MAR-D-Gale_kimberley/">https://data.PLANMAP.eu/pub/mars/PM-MAR-D-Gale_kimberley/</a>
PM-MOO-C-SPAApollo	Moon	SPA Apollo Basin compositional map(s)	Non-Standard	See <a href="#">D4.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/moon/PM-MOO-C-SPAApollo/">https://data.PLANMAP.eu/pub/moon/PM-MOO-C-SPAApollo/</a>
PM-MOO-GS-SPAApollo_Detail	Moon	Detail spectromorphic map of part of Apollo basin	Non-Standard	See <a href="#">D2.4-public</a>	01	<a href="https://data.planmap.eu/pub/moon/PM-MOO-GS-SPAApollo_Detail/">https://data.planmap.eu/pub/moon/PM-MOO-GS-SPAApollo_Detail/</a>
PM-MOO-MS-SPAApollo	Moon	SPA Apollo Basin morphostratigraphic map	Non-Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/moon/PM-MOO-MS-SPAApollo/">https://data.PLANMAP.eu/pub/moon/PM-MOO-MS-SPAApollo/</a>



		tigraphic map				
PM-MOO-MS-Copernicus	Moon	Copernicus crater morphostratigraphic map	Non-Standard	see <a href="#">D2.2-public</a>	01	<a href="https://data.PLANMAP.eu/pub/moon/PM-MOO-C-SPApollo/">https://data.PLANMAP.eu/pub/moon/PM-MOO-C-SPApollo/</a>
PM-MOO-D-YutuGPR	Moon	Geological model of Yutu's GPR data on Chang'e III landing site	Non-standard	see <a href="#">D6.2 - 3D geomodels of the Moon</a>	01	<a href="https://data.PLANMAP.eu/pub/moon/PM-MOO-D-YutuGPR/">https://data.PLANMAP.eu/pub/moon/PM-MOO-D-YutuGPR/</a>
PM-MOO-MS-SPABasin	Moon	Geological map centered on South Pole-Aitken basin, Moon		See <a href="#">D3.1</a> and <a href="#">D2.3</a>	01	<a href="https://data.planmap.eu/pub/moon/PM-MOO-MS-SPABasin/">https://data.planmap.eu/pub/moon/PM-MOO-MS-SPABasin/</a>
PM-MOO-MS-Apollo11	Moon	Geological map of the Apollo 11 landing site in southwestern Mare Tranquillitatis		In kind	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MOO-MS-Apollo11/">https://data.PLANMAP.eu/pub/mercury/PM-MOO-MS-Apollo11/</a>
PM-MOO-MS-Apollo12	Moon	Geological map of the Apollo 12 landing site in Oceanus Procellarum		In kind	01	<a href="https://data.PLANMAP.eu/pub/mercury/PM-MOO-MS-Apollo12/">https://data.PLANMAP.eu/pub/mercury/PM-MOO-MS-Apollo12/</a>



## VESPA Data discovery

The entire set of PLANMAP data granules have been made discoverable via the planetary VO VESPA system<sup>2</sup>, supported by both H2020-RI and H2024-RI (figure 1).

The granularity of the system is at file-level, i.e. within a single PM\_ID, or geologic map, considered a dataset (also for ESA GSG, see the following section), includes several products, or granules, typically:

- vector file with geometries (polygons, lines) as geopackage
- raster basemaps or maps (respectively for -MS or -C maps)

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<sup>2</sup> <http://euoplanet-vespa.eu/>



The screenshot shows the GAVO ADQL Query interface. The query executed is: `select * from planmap.epn_core`. The result shows 28 matches. The table below displays the first three rows of the result.

Granule_uid	Granule_gid	Obs_id	Dataproduct_type	Target_name	Target_class	Time_min [d]	Time_max [d]	Time_sampling [s]
PM-MAR-MS-Crommelin_CTX_Mosaic_v1	PM-MAR-MS-Crommelin	CTX_Mosaic_v1	im	mars	planet	N/A	N/A	
PM-MAR-MS-Crommelin_CTX_Mosaic_v1a	PM-MAR-MS-Crommelin	CTX_Mosaic_v1a	im	mars	planet	N/A	N/A	
PM-MAR-MS-Crommelin_Merged_DEM_shaded_relief	PM-MAR-MS-Crommelin	Merged_DEM_shaded_relief	im	mars	planet	N/A	N/A	

Figure 1: Exemplary access to PLANMAP PM\_ID data products (granules).

Long-term availability and ESA GSF, in addition to the PLANMAP data portal and web services, is envisaged (See also [D7.6-public](#)). The first batch in late 2020 has been handed to ESA for review and interactions. The batch included a subset of the geologic maps available at the time (vector and raster data), with specific ESA-required metadata (PUG).

The dataset-level hierarchy is chosen at the level of each individual map product, e.g. PM-MER-MS-H05\_5cc). The resulting granularity of the GSF (See D7.6) matches the authorship of each mapping product: each map has different co-authors.

VESPA-compliant data on the other hand have a more fine-grained data product granularity, e.g. a search on a certain area or PM\_ID returns the entire set of products/files associated (vector file, basemaps, additional rasters, etc.). Therefore, all files and products included within a PLANMAP map can be found independently, in addition to their top-level map dataset.



## Code and tools

In the course of the last reporting period, updates to existing tools have been added on the customary web repositories.

Project-derived code, scripts have been made available from the [PLANMAP GitHub organisation](#). Contributions to [OpenPlanetary](#) were also provided by individuals/groups (See [D7.4-public](#), [D7.6-public](#)), e.g. within the 2019 VESPA/PLANMAP mapping workshop<sup>3</sup>

- <https://github.com/PLANMAP-eu> - GitHub organisation for PLANMAP
  - <https://github.com/PLANMAP-eu/PLANMAP-app-server> - PLANMAP web app, server-side
  - <https://github.com/PLANMAP-eu/PLANMAP-app-client> - PLANMAP web app, client-side
  - <https://github.com/PLANMAP-eu/PLANMAP-notebooks-code> - workflows, mapping utilities, scripts for reproducibility
  - <https://github.com/PLANMAP-eu/PLANMAP-guides> - Interactive guides, workflows)
  - <https://github.com/PLANMAP-eu/3d-data-workshop-open-source-tools> - VESPA / PLANMAP mapping workshop 2019
  - <https://github.com/planmap-eu/mappy> - MAPPY, (Penasa et al., 2020)

Upon the end of PLANMAP, the code and tools developed will be kept available on the PLANMAP GitHub organisation. Moreover, further developments will be taken over by other projects, such as the Europlanet GMAP infrastructure.

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<sup>3</sup> <https://epn-vespa.github.io/mapping2019/>

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