EPSC Abstracts
Vol. 12, EPSC2018-258, 2018
European Planetary Science Congress 2018

Four Centuries of European Planetary Mapping: Towards Mapping for New Human Surface Operations

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Abstract

We have attempted to map the complete professional planetary mapping scene from the beginnings to today and compiled a catalog of over 2200 standalone planetary maps published between 1600 and 2017 internationally, including the USA, Soviet Union/Russia and European countries (especially Germany's DLR/TU/FUB map production outputs). The motivation for the creation of this catalog is that recent advancement in international cooperation and national space programs outside the United Stations, in particular in Europe and China, led to a proliferation of planetary maps that are published uncoordinated, without a central repository. Several of these recently produced planetary maps are not even available online. Our catalog aims to inform the planetary community about the recently completed maps worldwide, to aid planetary geologists in finding the appropriate previously published maps for their analysis. This database stems from the Integrated Database of Planetary Features [1]

1. Introduction

Europe is where planetary mapping began and after a long decline in producing original materials, in the last decade Europe returned to the planetary mapping field with a rich variety of map products and a number of maps reaching those produced in the USA. On the other hand, the USGS is still the single publisher for *peer-reviewed*, professionally edited planetary geologic maps that are *published in a coordinated manner*, since 1961 [2]. The production of USGS planetary maps are supported by NASA's different elements of the Planetary Science Research Program where individual researchers or groups of researchers produce maps that are edited and published by USGS. *In Europe*, however, ESA policy is not supporting planetary mapping unless it is part of an ongoing mission or the planning of a future mission. Even if workers find support, European planetary researchers do not have any publishing house that would take the responsibility to coordinate or publish European-produced planetary maps. This has led to map publications distributed in a variety of journals, online platforms, creating difficulties in finding the published maps and a variety of standards, formats, and qualities of works. Standalone mapping efforts have become more common in recent years and the number of published major (large-size) planetary geologic maps in journals are now comparable to those released by USGS [3]. International cooperation within single space missions, such as Dawn and Cassini, resulted in mapping tasks distributed over groups in different nations, according to the origin of suppliers of cameras or other instruments aboard the spacecraft [11]. The need to quickly publish geologic maps during the active missions also generated geologic maps outside the slower peer-review process [4,5]. European plans for landing or flying their missions also resulted in the publications of various geologic and geomorphic maps [6]. Chinese scientists have begun producing their own lunar maps [e.g., 7].

1.1 Historic aspect

Previous map catalogs could not quantify the total map production. Our catalog contains data that can be filtered to authors, year, country, scale, etc., which can reveal long-term trends in planetary mapping and in general, planetary science activities [10] (Fig. 1). Although this is mostly of historical interest, this catalog also can keep track of recent dramatic changes in planetary map production internationally. Our catalog is available through the website of the ICA Commission on Planetary Cartography [9] and is being updated regularly with both newly resurfaced historic maps (especially commercially published maps in which field the catalog is far from complete) and new additions. On longer term, we plan to add maps that have been published in journal articles (perhaps with the help of A.I.-based search methods) and also to digitize the feature location information on those maps that are only available in non-GIS formats. It is still under consideration how we can include and compare GIS layer maps to formerly formally published map sheets in the database statistics.

2. An overview of planetary maps published in 2017

New planetary maps are distributed online and many are produced for online use. We classified recent maps into *Web Map Services* (WMS), *geologic maps*, *base maps* and *citizen maps*. WMS's and citizen maps are new developments in planetary mapping. WMSs are changing how we access, use and produce maps. WMSs are organized into map layers, which allow the user to view and analyze the terrain in detail. Highlights include the MoonTrek by NASA/JPL/Caltech, the Solar Atlas System created by ESRI, Space Maps by Google with original photomosaics, and the European initiative of OpenPlanetaryMap (OPM), which is the first attempt to create a vector-based Mars base map. Classic geologic maps with large-sized sheet layout completed in 2017 mostly represent the Martian geology [8, 9], however, there are also Mercury [6] and Ceres projects [5]. In 2017 there were also ongoing projects of other celestial bodies (Moon, Charon, Europa) that remain to be finished in the future. New Horizons, Dawn and Cassini spacecrafts provided materials for new base maps of Pluto, Ceres, and Mimas. End products include the Pluto color photomosaic image, while Ceres and Mimas are shown in classical cartographic sheets, produced at DLR in Germany. The largest group of maps produced in 2017 came from citizen scientists.

3. Challenges

Maps are used for mission planning, surface operation and post mission analysis. Maps serve as the interface between humans and the spatial infrastructure data. In the near future maps will be key components of planning and operating new human missions, e.g., Moon villages. These would require large-scale maps and the development of new digital mobile map interface simulated in a number of analog missions [12]. Observable is an evolution of planetary mapping from traditional static (print) layouts to forms more adjusted to the digital, dynamic online medium. We live in a transition period where static maps that characterized the last 400 years may soon become extinct and new, dynamic digital map services and GIS layers for scientific use could, or already did, replace them. This has major consequences on the art aspect of cartography in which online and dynamic applications provide new opportunities.

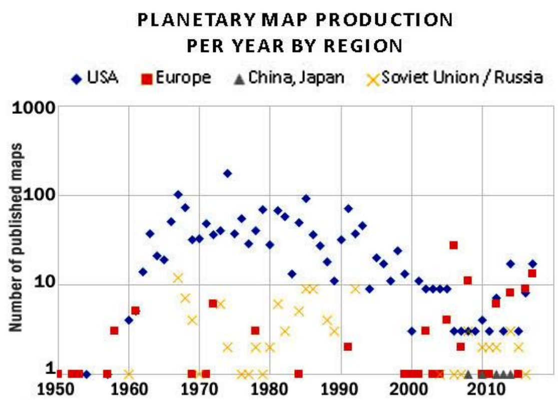

Figure 1: Planetary maps of all types published by professionals in map sheets or atlases, since 1950. Note logarithmic scale for the number of maps.

4. Acknowledgements

This work is supported by the International Cartographic Association.

References

[1] Hargitai H (2016) DPS 48/ EPSC 11 Meeting #426.23, Pasadena, CA. [2] Shoemaker, E., Hackman, R.J. (1961) Lunar Photogeologic Chart LPC 58. USGS, [3] Pitura, M, 2017. 2017 in Review 2: New Planetary Geologic Maps. ICA Commission on Planetary Cartography, [4] Williams, DAet al. (2017) Icarus, doi: 10.1016/j.icarus.2017.05.004, [5] Williams, DA et al. (2014). Icarus, 244, https://doi.org/10.1016/j.icarus.2014.03.001 [6] Guzzetta, Let al. (2017). Journal of Maps, 13, 227–238. [7] Liu Jet al. (2017) LPSC XLVIII, #1447 [8] Dębniak, K et al. (2017) Journal of Maps 13 (2): 260–269. [9] Okubo, C.H., and Gaither, T.A. (2017) USGS SIM 3359 [9] **https://planetcarto.wordpress.com**/ [10] Hargitai H and Naß, A, in prep., Springer [11] Hargitai H., Gulick VC, Glines NH, in prep., Journal of Maps [12] Hargiai H et al. (2007) Cartographica 42, 2 179-187