THE POCKET ATLAS OF MARS: A PUBLIC OUTREACH PROJECT. H. I. Hargitai[1] , [1]ELTE University Dept. of Media and Communications, 1088 Budapest, Múzeum krt. 8. hargitai.henrik@btk.elte.hu

Introduction: In the last two decades, several global thematic feature mapping project had been completed on Mars, providing an unprecedented wealth of thematic information. Many of these were collected and made GIS-ready in a previous work [1]. This time we merged these datasets with a classical, relief view of Mars, producing a map most similar to the familiar terrestrial physical geographic maps. We published the map as an Atlas, a series of map pages, for use by Astronomy Club members and elementary school to university students in Central Europe, as the project was supported by the Europlanet Central European Hub. The maps were created using ESRI's ArcGIS software. This paper reports the realization of our Atlas plan presented earlier [5]. The atlas "Mars 36" represents a geographic approach to planetary mapping both in content and graphic design (Fig. 1).

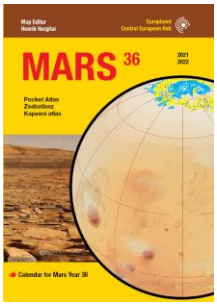

Fig. 1. Title page of the Atlas

The structure of the Atlas: The 84-page, A/5 format Atlas contains four overview maps (albedo, topography, weather, index), the standard 30-sheet MC quadrangles (in 1:10M scale, in contrast to the 1:5M scale the MC was developed for), maps of the polar caps and climate maps [2] including cloud maps for each season. The data on the climate maps were derived from the averaged MY 24-31 scenarios in the Mars Climate Database [3] and MY 28-30 MRO Mars Color Images (MARCI) observations.

Languages: The Atlas has three languages, English, Hungarian and Czech. These languages are added because the Atlas is distributed in only Hungary and the Czech Republic.

Albedo map: A vector-based albedo map was created specifically for this Atlas (Fig. 2). This is the first vector albedo data set that was manually made, tracing MGS TES and MEx OMEGA data recorded between MY23-31. The map merges the changes occurred between these years. A Mars-like color ramp was used for this map proportional to actual values. The albedo map, like all other overview maps, are shown in a two-hemisphere Azimuthal Equidistant Projection, similar to the practice of early 20th century School Atlases.

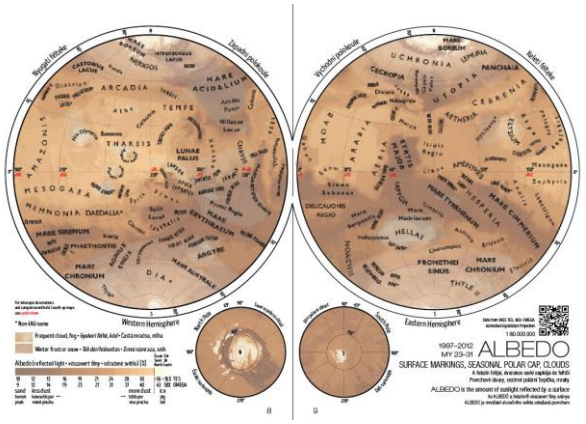

Fig. 2. Albedo map of Mars, showing surface albedo, frequently cloudy regions and the maximum extent of the seasonal polar caps

Weather map: We selected the two end-member seasonal periods (Ls=110, 290) and show the Western hemisphere's maximum daily temperatures at 0m, with actual min/max. values displayed at several locations, similar to mobile applications that display terrestrial weather.

Legend: The legend (Fig. 3) contains not only the symbols and corresponding explanation but also the references (sources of the particular feature database) and one image sample for each type of feature.

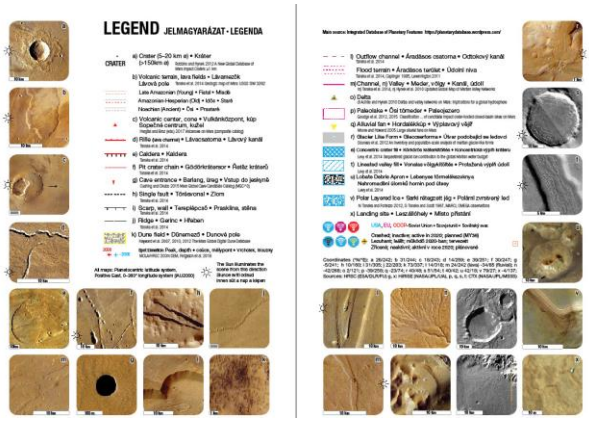

Fig. 3. The legend spread of the Atlas

MC quadrangles: The main part of the Atlas consists of the MC quads (Fig. 4). They are all displayed on a double A5 spread, in uniform landscape format, including the areas beyond the actual quad borders. The nomenclature is based on the feature-linked ArcMap dataset [4] updated until late 2020. The map pages include the following thematic layers: Volcanic

terrains, an outline created from all volcanic terrains mapped by Tanaka et al. 2014; volcanic centers and cones (from [1]), rilles, calderas, pit crater chains, fault lines, scarps, ridges (From Tanaka et al. 2014), Cave entrances (from the Mars Global Cave Candidate Catalog), dune fields (from the Mars Global Digital Dune Database), and deltas, paleolakes, and glacier like forms, from various databases published in journals and digitized into GIS-ready files in [1]. Flood terrain (of outflow channels) were mapped globally for this project. Additionally, peaks and low spot elevations were measured in each quadrangle and for each major mountain. The permanent polar caps are shown in sybols similar to those used for terrestrial polar ice, traced from geologic maps (Tanaka and Fortezoo 2012, Tanaka and Scott 1987), updated using MARCI and OMEGA observations.

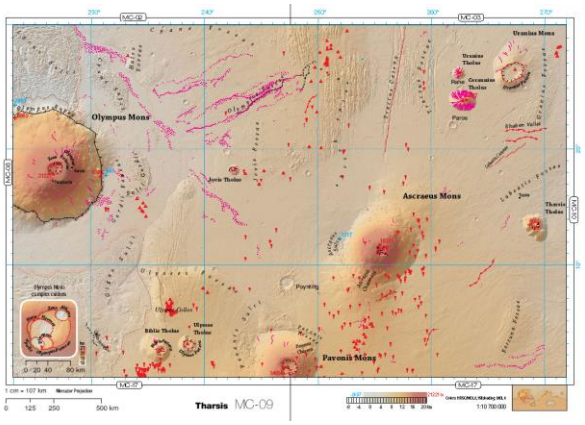

Fig. 4. The MC-09 quadrangle spread in the Atlas

Color ramps: Since the color coding of the elevations use a color ramp of only brown to orange to yellow to white images, and avoids greens and blues, to maximize the relief visualization for each quadrangle, we used the Dynamic Range Adjustment (histogram stretch) function of ArcMap. As a result, each page has a differing height and depth legend and colors do not correspond to a single elevation.

Calendar: One of the unique features of the Atlas is a one-page Calendar for the MY36 (hence the title). This includes conversion to terrestrial dates and lists climatic and other seasonal events and planned landings on Mars. We plan to update the Atlas every Mars Year.

Future plans: We believe that geographic multilayer maps are the future of planetary cartography. in addition to single-themed relief (elevation, hillshading, nomenclature) and geologic maps, feature themes (valley networks, glacial features, dunes etc.) will be added to the maps. This requires the maintenance of GIS-ready feature databases in a public online repository, and the creation of new datasets, either from imagery, or from non-GIS works published in the literature. Such multi-themed maps could be used for both outreach and science, because they show the assemblage of features that are important for the interpretation of the geologic evolution and the estimate of astrobiologic or ISRU potential.

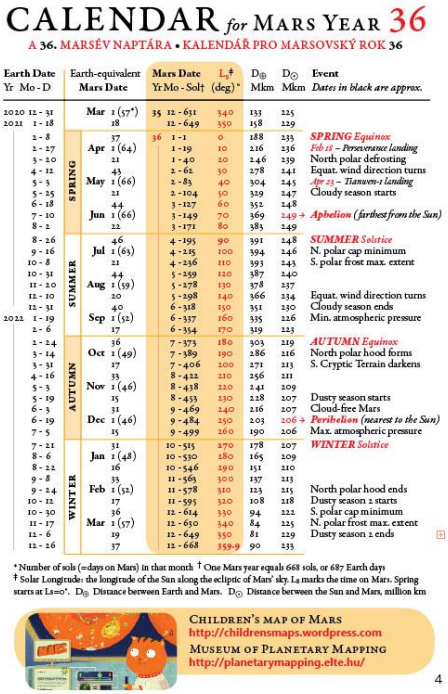

Fig. 5. The calendar page of the Atlas

Availability: The Atlas is distributed to Clubs and Schools in Hungary and the Czech Republic free of charge, in the form of a prize for a Mars-themed competition. To promote creative group work, at this moment only groups can apply to receive the Atlas and each member (up to 18 years old) receives one copy. A digital version is also planned to be produced in 2021.

Acknowledgments: The Atlas was supported by the European Science Foundation through the Europlanet Central European Regional Committee Funding.

References: [1] Hargitai H 2016 Metacatalog of Planetary Surface Features for Multicriteria Evaluation of Surface Evolution: the Integrated Planetary Feature Database. *DPS 48/ EPSC 11 Meeting* #426.23, Pasadena, CA. [2] Hargitai H 2021, *LPSC* 52, this volume. [3] [1] Millour E et al. (2018) The Mars Climate Database (v5.3). *Scientific Workshop: "From Mars Express to ExoMars"* 27–28 February 2018, ESAC Madrid, Spain. [4] Hunter MA et al. Feature-linked annotation of lunar and martian nomenclature. *LPSC* 47 #1903. [5] Hargitai H, Bérczi Sz 2020. Creating the student atlas of Mars Geography – An Active Learning Project. LPSC 51 #2640