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15 maps merged in one data structure - GIS-based template for Dawn at Ceres

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Abstract

Derive regional and global valid statements out of the map (quadrangles) is already a very time intensive task. However, another challenge is how individual mappers can generate one homogenous GIS-based project (w.r.t. geometrical and visual character) representing one geologically-consistent final map.

1. Introduction

One aim of the NASA Dawn mission is to generate global geologic maps of the asteroid Vesta and the dwarf planet Ceres. The geological mapping campaign of Vesta was completed and published, e.g. [1], but mapping of Ceres is still ongoing. The tiling schema for the mapping project based on recommendations by [2], and is divided into two parts (for Ceres described in [3]): four overview quadrangles (Survey Orbit, 415 m/pixel) and 15 more detailed quadrangles (High Altitude Mapping HAMO, 140 m/pixel). The first global geologic map based on survey images [4]. This served as basis for generating a more detailed view of the geologic history and also for defining the chrono-stratigraphy and time scale of the dwarf planet [5]. The most detailed view can be expected within the 15 quadrangles based on HAMO resolution and completed by the Low Altitude Mapping (LAMO) data (35 m/pixel). For the interpretative mapping one responsible mapper was assigned for each quadrangle. Once the mapping is finished, all datasets must be combinable in ESRI's ArcGIS™.

Within this contribution a template will be presented which was generated for the process of the interpretative mapping project of Ceres to accomplish the requirement of unifying and merging individual quadrangle. The template

1. accommodates the requirements for data storage and database management (e.g., [6]),
2. uses standards for digitizing, visualization, data merging and synchronization,
3. based on new technological GIS innovations within GIS software and individual requirements for mapping Ceres, and
4. furthermore, on developments regarding symbology and framework described in [7], [8].

2. Mapping Template

The mapping template is based on the ArcGIS format file-geodatabase (FGDB) and split in three main layers: 1) basis data layer (bdl): as placeholder for the map-projected images, upon which the mapping based on, 2) map sheet layer (msl): includes map graticules and the different quadrangle boundaries and 3) geologic mapping layer (gml): contains the layers for vector-based mapping all planetary features. Beside this the FGDB structure includes (a) *5 feature classes* representing specific types of geologic features (all vector based), (b) *subtypes and domains* are hierarchical, or domain-controlled, attributes that are coordinated within each main layer, (c) c*artographic symbols* follow [9] as far as possible, and (d) *speciality*: the colours for the geological units were defined by individual needs and requests within the mapping team. The colour choice was based on established colour values used in geologic maps, e.g., generated by USGS.
Furthermore, the mappers were supported by (e) *instruction documents,* (f) a *metadata template* based on standardized metadata keywords, e.g., defined in [10], [11], and (g) *extra template* arrange all map components (legend, map title, grid, projection information etc.) uniformly in a predefined map sheet (usable in vector-based software).

3. Review and Open Questions

The mapping template has served as a necessary basis for the mappers to generate their individual but comparable maps, and thus gives the possibility to merge 15 quads to one global map (see figure 1). The current status and general information of the mapping project are summarized in [12]. Because the creation of the mapping template was and is an iterative

process which is still in progress, there are still some topics (focus on GIS and cartographic visualization) to discuss on the way to a homogenous and comparable map layout. These are, e.g., the *boundary regions* of all quads have to be strongly reviewed to enable a consistent description of Ceres, regarding the individual *colour scheme* it has to decide very carefully if additional colours for individual and regional phenomena should be used, and an updated version of the already existing *feature catalogue* (by Katrin Krohn, DLR) and the generated *global map legend* could be *combined* to describe the different features generically and visually. This would provide a first global view of the objects and units on Ceres and could be used for more detailed investigation.

4. Summary

The template for (GIS-base) mapping presented here directly links the generically descriptive attributes of planetary objects to the predefined and standardized symbology in one data structure. Using this template the map results are more comparable and controllable. Merge and synchronize the individual maps will be far more efficient, and first possible. The template can be adapted to other planetary body, is also useable in open source software QGIS and could be transfer to database systems like PostgreSQL, and/or be used within future discovery missions (e.g., Lucy and Psyche) for generating reusable map results.

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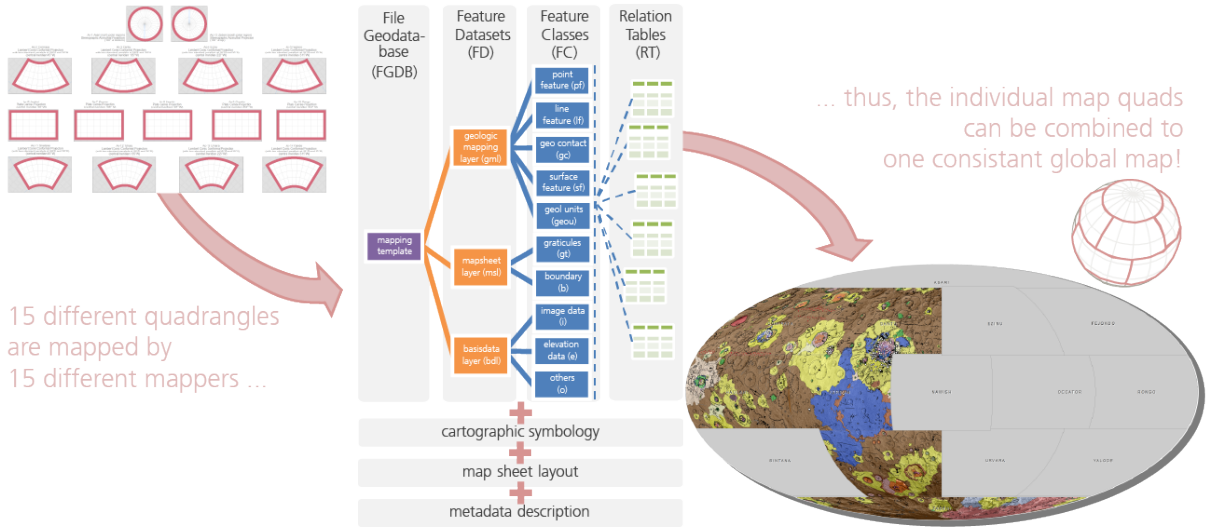

Figure 1: Schematic view on file geodatabase-driven Geological Mapping Template for Ceres.