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Stratigraphy Data Model Component for Planetary Mapping

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Currently, a small number of (available) datamodels for DBMS-driven GIS usage are available which aim at helping geologic mappers to conduct a variety of different tasks needed for mapping of solid-body surfaces in terms of the geologic and geomorphologic inventory.

Basic requirements for such a mapping conduct is the management and consistent handling of attribute data that is needed for (1) applying an assignment of standardized cartographic symbologies or (2) for performing spatial queries and analyzing data, or (3) for combining and homogenizing mapping efforts performed by different groups.

Specific mapping tasks, such as assignments of surface materials, or handling of keys, or the assignments of stratigraphic units within a chronologic context and the subsequent selection of cartographic symbols can usually be handled using standard relationship models physically implemented within a geodatabase and managed via the GIS environment. The handling of such tasks is, however, limited to very few tasks only and the treatment of the real-world geology and geomorphology is usually reduced to implementing only specific and isolated solutions. The complexity but also the performance grow significantly if a datamodel is employed which is capable of dealing with all such requirements at the same time with the help of object-oriented model components.

We here present a geologic mapping datamodel component that has been implemented within a spatial database management system and which forms a working basis for any GIS application established ontop. The model aims at systematic mapping conduct of different planetary surfaces without being limited by spatial reference constraints or other boundary conditions.

One model component deals with properly handling planet-specific stratigraphic systems (chronostratigraphic units) and allows to establish links between the lithostratigraphy in terms of formations/supergroups/groups, materials and lithologic units and the absolute timing in terms of established chronologies. Stratigraphic specifics are modeled using relational cascades (including subtypes) and simply depend on the complexity of a given and employed stratigraphic system and nomenclature. As the baseline stratigraphic systematics are the same for each planetary object, the depth of the cascade is simply a function of available information. The chronology on the other hand not only links the rock-stratigraphic information but also provides a baseline for attribute data on absolute age determinations.

Another component allows to directly link mapped unit materials to genetic context information as provided by standards of the Federal Geographic Data Committee (FGDC) for cartographic symbols in geologic mapping. Rather than using a confusing assignment structure within a single relation, a nested subtype/domain-controlled mangement of hierarchical information has been envisaged in which subselections help to reduce factual errors. Both features in combination allow to extract geological as well as geomorphological (or other thematic) information from different map units and provide a basis for easy data access based on dedicated key selections.

Model components have been implemented using domain controls via subtypes to achieve a high level of integrity of attribute data. The datamodel in its current form is independent of the specific GIS platform and exact handling of map data and can be tranfered to other GIS environments capable of communicating with spatial DBMS. The stratigraphic model component *sensu lato* as outlined above is covered by the actual mapping model component that includes data querying, organisation and attribute data administration using a GIS/DBMS environment. The component forms the integral part of a higher-level model covering also data-organisational and data-search issues.

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