Proposed Guidelines for Inclusion of Digital Map Products in the National Geologic Map Database

By David R. Soller[1], Ian Duncan[2], Gene Ellis[3], Jim Giglierano[4], and Ron Hess[5]

[1]U.S. Geological Survey
908 National Center
Reston, VA 20192
Telephone: (703) 648-6907
Fax: (703) 648-6937
e-mail: drsoller@usgs.gov

[2]Virginia Division of Mineral Resources
e-mail: iduncan@geology.state.va.us
U.S. Geological Survey
e-mail: gellis@usgs.gov
[4]Iowa Geological Survey
e-mail: jgiglierano@igsb.uiowa.edu
[5]Nevada Bureau of Mines and Geology
e-mail: rhess@unr.edu

INTRODUCTION

The enabling legislation for the National Geologic Mapping Act of 1992 includes requirements for development of a National Geologic Map Database (NGMDB), and for standards and guidelines necessary to support its ready access and use by the public. [See the 1992 Act and its 1997 Reauthorization at <http://ncgmp.usgs.gov>]. As detailed elsewhere (for example, in Soller and Berg, this volume), the National Geologic Map Database (NGMDB) is designed as a distributed system developed through consensus among its primary builders, the Association of American State Geologists (AASG) and the U.S. Geological Survey (USGS). It is not intended to be a single entity managed by one group. Because of the rapid evolution of digital mapping and methods for distributing map products, the NGMDB is not a conventional database; primary emphasis has been to develop a searchable catalog of available maps in paper and digital form, at <http://ngmdb.usgs.gov>, and a set of standards and guidelines that are agreeable and beneficial to each agency, described at <http://ncgmp.usgs.gov/ngmdbproject)>.

At some time in the future, the system we are building will lead to a distributed database of digital maps. These maps will be managed by each producing agency and served to the public in a fashion that will enable users to access maps from disparate agencies and use them together, for analysis and display, without the current level of effort required to integrate them. We are now, as a geoscience community, discussing the level of standardization among agencies that is appropriate (and affordable). This paper is intended to contribute to that process.

In August, 1996, technical representatives from the AASG and the USGS met in St. Louis, MO, to identify the standards and guidelines needed to support the NGMDB. As a result, several AASG/USGS Working Groups were formed to conduct the needed work. [Informal minutes of the meeting are available at <http://ncgmp.usgs.gov/ngmdbproject/standards/mtgs/St.Louis>.]

The Data Information Exchange Working Group was charged to develop certain proposed guidelines for producers of digital geologic maps, specifically: "what files and file structure should be "packaged" into a digital geologic map, to promote useability?" In recent years, certainly within the past five, the USGS and state geological surveys have increasingly produced their maps in digital format, and provided them to the public through various mechanisms including traditional over-the-counter sales and the Internet. This Working Group was formed to pro-

vide technical advice that could lead to more uniformity to the manner in which geologic map information is provided in these products; not the scientific content, but mostly in the organization and content of the various files that accompany the map. Further information on this Working Group can be found at <http://ncgmp.usgs.gov/ngmdbproject/standards/dataexch/dataexchWG.html>.

This paper is authored by the AASG/USGS Data Information Exchange Working Group, and contains its report. The report is based on earlier (October, 1996) recommendations to USGS participants in the NGMDB and on a new USGS Geologic Division policy ("Publication Requirements for Digital Geologic Map Publication", enacted May, 1999) for which one of us (Soller) was partly responsible while a member of the USGS Geologic Division Information Council. To gather further technical input, the proposed guidelines were presented at the Digital Mapping Techniques '99 meeting, in a special discussion session. The document was well received, and minor changes were suggested. The revised report (contained herein) recently was submitted to the AASG's Digital Geologic Mapping Committee for consideration as a voluntary guideline applicable to all participants in the NGMDB. We emphasize that this is a guidance document, developed collaboratively, and is not meant to proscribe how an agency must release its data. It is intended to provide mapping agencies with information on helpful, typical map data files and documentation that commonly are included in a digital map product made available to the public.

REPORT TO THE AASG DIGITAL GEOLOGIC MAPPING COMMITTEE

Proposed Guidelines for Inclusion of Digital Map Products in the National Geologic Map Database

NOTE - the following DRAFT document concerns a potential cooperative agreement between the AASG and the USGS, in support of requirements of the National Geologic Mapping Act. The Act stipulates the development of various standards, to support the National Geologic Map Database. This document addresses the general format of map products to be made available through the Database. It does not include discussion of a standard data model. It is meant to be an informative guideline, not a requirement, and is intended to provide these agencies and the public with more compatible, better documented, and hence more useable map products. Because digital mapping has evolved rapidly, the specifi-

cations in this guideline periodically will be revisited, and may be revised.

Geologic map information supports the needs of a broad range of users. To increase its utility and to promote integration with related data sets produced by other organizations, the information should be readily available, well-documented, and well-structured. The National Geologic Mapping Act of 1992 and 1997 articulates these goals, by stipulating development of various standards and guidelines necessary to promote the more efficient use and sharing of information. The Act calls for these standards to be developed by the AASG and the USGS in support of their cooperatively-built national resource, the National Geologic Map Database (NGMDB). Information is available about the standards now under development, at <http://ncgmp.usgs.gov/ngmdbproject>.

Map users are, increasingly, integrating in a GIS the map products of various geological surveys and other map producers. This integration is made easier where the products are well-documented and share certain common elements (e.g., metadata, browse graphics, readme files). This document addresses only these general elements of a map product, and is intended to promote uniformity among the agencies that collaborate to build the NGMDB. It does not include requirements for a standard geologic map data model, nor does it stipulate scientific content or data interchange format. Those more complex elements of a geologic map and its presentation will require far more discussion among the AASG and USGS.

In the transition from production of maps solely on paper, to production of maps in both digital and paper format, the map's geographic, cartographic,and scientific information has been transformed from a strictly visual medium to one based on electronic files. "Digital" maps now commonly contain the coordinates for various map features, and a database of information about the features, which users may analyze. This document addresses the requirements for preparing a single digital map product for publication, and does not address the integration of data across maps of adjacent areas.

1. CONFORMANCE TO EXISTING REQUIRE-MENTS — Digital map products (referred to as "products", below) included in the NGMDB will conform to the respective agency's policies and guidelines for approval and publication of products. For example, USGS map products contributed to the NGMDB will conform to Division and Bureau policies, including the requirements of Executive Order 12906, USGS Manual chapter 504.1, and Geologic Division Policy Manual chapter 6.1.3.

2. SCOPE AND RESPONSIBILITIES — These requirements apply to products intended for release to the public in both formal and open-file series. Each agency is

responsible for promoting conformance of their products to these guidelines.

3. DATA FORMATS — A specific data format is not required, because of the variety of data systems employed by all cooperators in the NGMDB, and because the NGMDB does not yet provide an online mechanism for users to display and query map data from various agencies. Agencies are, however, urged to provide their map products in one or more commonly-used data formats (for example, Arc/Info export and/or Shape format, AutoCAD format). If the map data are expressed in a non-proprietary format that is not supported by published documentation, the format should be fully and clearly documented in the product.

4. ASSOCIATED FILES — All associated files, tabular and otherwise, containing attribute data should accompany the map data files. Lookup tables and color and line palettes (e.g., Arc/Info symbolsets and shadesets) also should be provided to permit users to display the map data interactively to a monitor.

5. FILE NAMING CONVENTION — For the widest possible usage, file names should conform to the "8.3" convention. This convention requires that file names be limited to 8 characters or less, followed, if needed, by a period and a 3-character extension. An example would be the file name "readme" or "readme.txt". The name and extension should be entirely composed of lower-case (not mixed-case) letters, numerals, underscore, and hyphen. The name should begin with a letter.

6. COORDINATE SYSTEMS — Map data provided in geographic coordinates (latitude and longitude) is most generally useable. The author may choose to provide the map data in geographic coordinates and/or in projected coordinates, in the map projection and ground units typically used for maps of that scale and location (e.g., the UTM projection for 30-minute by 60-minute,1:100,000-scale quadrangle maps, with ground units in meters). To avoid loss of data quality due to resampling during projection, raster thematic (e.g., maps showing spatial variation of a single phenomenon, such as geophysical data) should at least be provided in the original, unprojected form. If the GIS software does not create a file containing essential information about the projection, such a file should be created by the author.

7. BASE MAP — Wherever possible, map products should be georeferenced to a digital base, preferably the one on which the map was compiled. As a service to users, the author may elect to include the base map with the product; this is highly recommended if the base is not published or is not commonly available. If a digital base was used, and if the base was revised to correct for spatial or attribution errors, it should be supplied (in vector or raster format) with the product. Revisions to published base maps should be supported with metadata that describes the data processing. However, not all geologic maps are compiled on a digital base, generally because one is not available. In such cases, it is suggested that a) the base be scanned and georeferenced, b) the geologic map be geoferenced to the base, and c) the base be provided, in vector or raster format, with the product.

8. METADATA — All geologic and base map data should be documented with metadata conforming to the Content Standard for Digital Geospatial Metadata (CSDGM) of the Federal Geographic Data Committee (FGDC). Conformance of the metadata to the structure defined in the CSDGM can be determined using the USGS metadata parser "mp". This parser verifies the specific indented-text format compatible with the Geospatial Data Clearinghouse. This specification should not, however, preclude each agency from exploring other options for managing metadata, including relational databases.

9. README FILE — A brief, overall introduction and guide to the product should be included in a plain-text file named "readme" or "readme.txt". This file should include, but is not limited to, the identity of the product, a brief product description, introductory instructions on how to extract information from the product file(s), a table of contents describing how the product's directories and files are organized, and the location of the detailed metadata.

10. BROWSE GRAPHIC — A low-resolution "browse" graphics file that represents the finished map product should be provided in GIF, JPEG, TIFF, EPS or PDF format. This file is intended to be a relatively simple depiction of the data that enables the user to quickly visualize the map from the author's perspective. Typically, this graphics file is not a fully-detailed depiction of the map data; in such cases the graphic should contain, next to the map image, the following disclaimer: "NOTE: This image is not an authoritative representation of the data."

11. PLOT FILE — The author is encouraged to also include a "plot file" (preferably EPS or PDF), intended to provide the user with the author's full interpretation of the map data. Commonly, these plot files are as detailed as published geologic maps. The decision to include a plot file might be based on the map content and complexity (is the product a complex, multi-purpose geologic map, or simply a derivative map showing areas of greater and lesser geologic hazard?) and the size of the file (will it, with the map product, fit on the intended media?). If a plot file

is included, the author should note, in the metadata or readme file, the plotter and the RIP software with which the map has successfully been plotted, and the dimensions of the plot image.

12. PRODUCT FILE — The product should be packaged in one or more files in a universal, cross-platform format. At present, the "tar" and "gzip" formats best fit this description. The decision of whether to use one product file or more should be based on the content and size of the product. Generally, one product file is preferred because product integrity is more easily maintained. However, if the product is relatively large and contains an extensive base map and/or a large plot file, the author may choose to package the plot file or base map in a product file separate from the geologic data. In that case, both

product files would contain the readme file. The author should provide in the readme file the information needed to unpack the product file; this may include providing URLs where tar or gzip software may be freely obtained. The product file is intended to provide users with a simple means for copying the product to a local disk, which is especially helpful for products with many data files.

13. SUPPORTING DOCUMENTATION — Potential users of the data may want a brief overview of the product before deciding whether to acquire it. Therefore, authors should provide the following separate files to accompany the single-archive file containing the product (these are duplicates of files contained in the product): the readme file, the browse graphic, and the metadata file in plain-text and, optionally, in HTML format.

Digital Mapping Techniques '99— Workshop Proceedings

Edited by David R. Soller

May 19–22, 1999
Madison, Wisconsin

Convened by the
Association of American State Geologists
and the
United States Geological Survey

Hosted by the
Wisconsin Geological and Natural History Survey