GEOLOGICAL MAP PRODUCTION USING GIS SOFTWARE

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ABSTRACT

Our primary goal is to produce geological maps using digital outlines of geology from AutoCad, FieldLog, scanned images, and other systems, incorporate digital base map information with geology, add text, line work, symbols, surround information, and output the results on colour electrostatic plotters and film imaging systems. Work has included the development of routines to handle external digital sources of base data, development of archiving procedures, cartographic editing routines, CMYK colour modelling specifications, font handling procedures, and plotting procedures to obtain hard copy output from postscript files.

CARTOGRAPHY SECTION

The section's map production procedures are based on the Environmental Systems Research Institute's (ESRI) ARC/INFO 6.1.1 computer assisted mapping and geographic information management system. The primary platform used is the SUN SPARC2 work station. Work stations are linked in a Local Area Network (LAN). This configuration offers the optimum combination of digital mapping applications, workstation performance, and network environment.

ARC/INFO software links cartographic data in vector files (ARC) with attribute information (INFO). ARC and INFO are both independent and fully integrated. Data files can be separately manipulated, and updating one system automatically updates appropriate data in the other system.

Routines and expertise that will greatly facilitate future map production is continually being developed in cooperation with the Computer Technology Section. These routines, menus or graphical user interfaces (GUI), include procedures for creating a watermask, labelled neatline, key maps, legends, scale bars, and streamlining routine tasks such as attributing geological polygons and adding complex structural symbols by providing AML routines to prompt and present logical choices. Symbol libraries for various fault types, colour tables for shading polygons, and geological symbols are being created or imported from other systems and stored in our symbol library.

THE COMPUTER TECHNOLOGY SECTION

The Computer Technology Section provides expertise by testing and evaluating hard copy output procedures, developing aids to import external digital data sources, and advice on the acquisition and future direction for automation.

WORKING WITH DIGITAL TOPOGRAPHIC BASES

Users should acquire digital base imagery from a recognized cartographic mapping institution such as NRCan, provincial mapping agencies, and private sector companies with a good track record for supplying quality digital mapping imagery. If you change the data resolution by generalizing or weeding out vertices to make the base digital imagery more manageable on PC based systems, be sure to retain the original copies for Cartography to bring the imagery back up to pre-press quality. Publication submissions should include digital bases and geological outlines. We will mix traditional and digital technologies to produce hard copy maps.

PREPARING HARD COPY MANUSCRIPTS
FOR DIGITAL PRODUCTION

A. Ink all geological contacts and faults on a photolysis image or a matte film overlay using drafting pens as follows:

- Contacts (#000 pen); Faults (#2 pen).
- Ink density should be as black as possible, linework should be sharp, clean and unbroken.

- Cartography will attribute contacts and faults after scanning.
- Contacts in parallel should be no closer than the ink width of the contact (i.e. line weight 0.012", the distance between the parallel contacts should be no less than 0.012")
- Close geological contacts through open bodies of water; all contacts should be closed polygons.
- Tie edges to adjoining sheets.

B. Structural symbols and reference letters must be placed on a separate overlay.

C. Any additional information such as radiocarbon date boxes, area showing drift cover, etc. should be on a separate overlay.

D. Compile on a photolysis or reverse cronaflex image, and include at least 4 reference points (tics) at known latitude and longitude co-ordinates for maps at both 1:250 000 and 1:50 000 scales and every 1 or 2 degrees (including the interior co-ordinates for smaller-scale mapping). Ensure that the manuscript is carefully registered to the base. Indicate each overlay by map name, theme (i.e. contacts), a date, and a number identifying the overlay as 1 of 4. Maximum size is 40" x 70".

PREPARING GEOLOGICAL MANUSCRIPTS FOR DIGITIZING USING A DIGITIZING TABLET

It is sometimes faster to use a digitizing tablet to convert imagery to digital data. This image must be carefully registered to planned publication base. How data is converted depends on what hardware and software is available, and on the expertise available to use it. At GICD Cartography, scanning technology is used as much as possible. Large format digitizing tables are available to add new or edited line work to previously scanned and vectorized imagery.

PREPARING DIGITAL GEOLOGICAL SYMBOLS FOR PLACEMENT ON THE MAP

This can be a challenging task for both the geologist and cartographer. There are hundreds of structural symbols used on geological maps, and the Cartography Section is only just beginning to build its own symbol library. Each symbol must be designed and digitized into a template, so that it becomes an object which can be positioned and rotated at a referenced point location on the map. With ARC/INFO, the symbol is designed and stored as a "marker symbol" that can be scaled and rotated. The author can supply an ASCII or DXF file containing location, type, and angle of each symbol. Cartography then adds the symbol to its library. Cartography is cooperating with other GSC divisions and also with the USGS to accumulate an extensive symbol library. This will require considerable time and effort. It has taken years to build up the library of templates for traditional geological maps, and it will require effort and resources to put all these symbols into a digital format. The approach is to create the new digital symbols on an "as required basis" for new

publications and then to add them to the library of symbols. Authors' symbols can be submitted to Cartography in a digital format which is then imported into ARC/INFO.

PREPARING GEOLOGICAL MAP DATABASE DEFINITIONS

Guidelines for this file and coverage specifications for a digital geology database are being prepared by the GICD Computer Technology Section. If you wish to have a preliminary copy or some input into these guidelines, please contact either Cartography or the Computer Technology Section

DIGITAL BASE SOURCES

1. NTS 1:250 000 and 1:50 000 bases. These can be ordered from NRCan (613-995-0314).
2. ESRI, DCW, 1:1 000 000. These bases are available to GSC users for geological map production. The coverages are in geographic co-ordinates of 5 degree by 5 degree tiles.
3. National Atlas 1:7 500 000 and 1:2 000 000 bases in ARC/INFO format.
4. ESRI, Arc/World at 1:25 000 000 and 1:3 000 000 in ARC/INFO format.
5. ESRI, Arc/USA at 1:2 000 000 in ARC/INFO format.

DIGITAL GEOLOGY SOURCES

1) CAD DXF from PC AutoCad systems and MAC CAD systems. These files are imported into ARC/INFO with the DXFARC command.
2) DLG (digital line graph) from Intergraph or SPANS are imported with the DLGARC command.
3) Raster files (TIFF, RLC, SUN raster file)
4) ARC/INFO software
5) Spans software

HARDWARE AND SOFTWARE

1) One Sparc10 Server
2) 18 Sparc2 workstations
3) 19 Arc/Info 6.1.1 licenses
4) 1 PC-ARC/INFO 3.4d running on a 486.
5) 5 Island Graphic licenses
6) 4 AutoCad stations, 1 with ArcCad overlay
7) 3 Tektronix X terminals.

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