

FROM GEOLOGICAL DATABASES TO GEOLOGIC OFFSET-PRINTED MAPS

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FOREWORD

In 1972 the Geologic and Mining Institute of Spain (IGME) initiated the second series of the project of Geologic National Map (MAGNA), with a total of 1124 sheets, at 1:50.000 scale, that cover all the territorial Spain. The main disadvantage of this cartographic series is that it lacks continuity between sheets due to changes of authors, criteria and tendencies in the geology science throughout the 30 years of the project.

In 1997 as a result of the collaboration between the Generalitat de Catalunya (ICC and Environment Department) and the IGME begins the project of Digital Geologic Base of Catalunya (BGC50M) (Puig et al., 2000). From cartography MAGNA systematization tasks are made, homogenisation and geologic synthesis as well as adaptation to the new topographic bases to give cartographic continuity to the BGC50M database.

BGC50M DATABASE

At this time we are working in the synthesis of last 6 sheets of the 89 that cover more than 32,000 km² of the territorial Catalonia (Fig. 1).

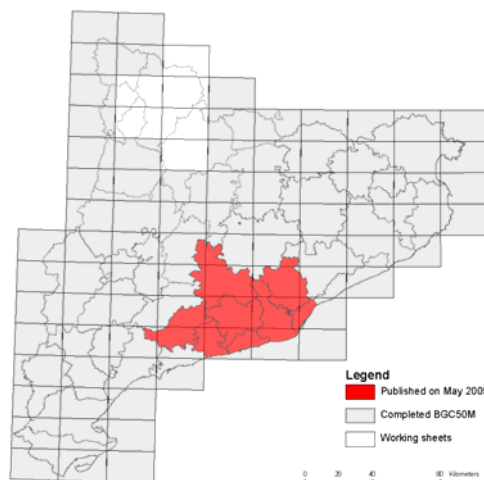


Figure 1 – Distribution of the 1:50.000 sheets and regions of Catalonia. Extension of the BGC50M cover and publishing progress.

The BGC50M database is stored and managed from the geographic information systems following the Esri ArcInfo technology. It is formed by four different geometric covers:

- a cover with polygon and arc topology, formed by more than 55000 polygons corresponding to 1022 cartographic units differentiated and more than 155000 arcs corresponding to 42 types from contacts between the different geologic units.
- a cover with arc topology, has almost 10000 arcs of 15 types of geologic elements of linear representation (fold axes of fold, strike-lines, etc).
- a cover with arc topology, that contains the location of 160 geologic cross sections.
- a cover with point topology with more than 15000 elements corresponding to 14 types of structural measures, paleocorrens, mining evidences, etc.

This data covers are complemented with diverse alphanumeric tables that contain the elements descriptions, as well as the lithologic and chronologic characteristics of the different units. The database is completed with the geologic cross sections and the strata columns.

In order to be able to represent the BGC50M database graphically and to obtain work and consultation maps some symbol libraries was elaborated (linesets, markersets and shadesets). These libraries include the specific creation of geologic fonts from the Esri ArcInfo Workstation. In addition the use of look up tables allows making automatically symbolized compositions of maps.

COMARCAL GEOLOGIC MAP OF CATALONIA SCALE 1:50.000 (MGCC50M)

At the end of year 2004, in the ICC the first work for the future publication of the regional geologic maps begun. The possibilities are analyzed using the generated automatic exits with Esri ArcPlot module, the methodologic viability is valued and the first tests with a satisfactory result are obtained.

So, the first 4 regions or “comarcas”, of the 41 that form the series, are published in May of 2005 (Fig. 1).

PUBLICATION PROCEDURE

GIS tasks: The GIS tasks next mentioned are totally automated. It had a collection of macros (AML) that are linked to make the graphical

extraction, the map compositions and the tables to build legends:

- Regional extraction from continuous BGC50M database.
- Table extractions for each legend map. Three tables are obtained: geologic units in polygons, geologic contact and other linear elements in arcs, and point elements in points.
- ArcPlot composition maps. In order to facilitate the handling of the graphical information as well as to structure the edition, it was chosen to pass the geologic information of the map in 5 different layers:
 1. Coloured and hatched polygons.
 2. Cartographic unit labels.
 3. Geologic contact arcs.
 4. Other linear elements.
 5. Point elements with related texts.
 Each map composition has a subgroup of the information of the BGC50M with their automatic symbolisation and its representation at scale 1:50.000. These maps compositions are exported to Adobe Illustrator (AI format).

Cartographic edition tasks and printing: The series follows the general design of the institutional rules and the corporate image. Once it has the pieces (AI files and tables) begins the formation of the map:

- Edition of the geologic information of the map.
The symbolized elements in the AI file generated by Esri ArcInfo (Workstation) are individualized. This allows edit easily each element: either to clean (eliminating elements that are too dense) and to clarify (separating elements and relocating labels so to read easily the map) (Fig. 2). This editing process is made with Adobe Illustrator.

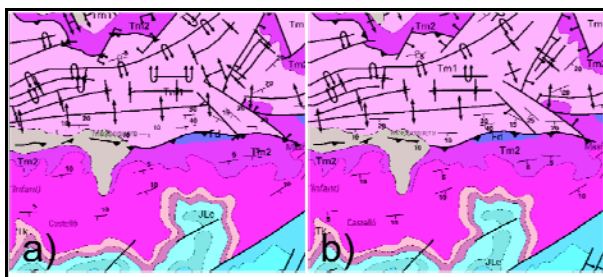


Figure 2 – Detail view of the editing process. a) Overlapped 5 AI files coming from automatic symbolisation process, b) Results after editing.

To the geologic information is overlaid a file in format Adobe PDF with the information corresponding to planimetry and altimetry data (symbolized for this series in gray colour). This cartographic base comes from the cartographic base of Catalunya 1:50.000 (BC50M) in format Microstation DGN.

- Edition of covers, peripheral and legend.
Export AI file from Esri ArcInfo with the legend of all the existing elements in the BGC50M. Of this complete legend the elements are selected that according to the tables are represented in each map.

With Adobe Macromedia FreeHand distribute the elements of the legend, mount the covers and other peripherals are included.

- Map composition
The map composition contains the title page, legend, peripheral and thematic map with its cartographic background. The map is mounted with ARTPRO of Artwork Systems in the Macintosh interface of Apple, in this stage raster information and vectorial information coexist. Finally, a hillshade image is superposed (in format tiff).
In this perfectly color calibrated equipment (Colour Management System, CMS), a plot of correction for revision is generated just as the exit that will be obtained from the press. The last edition adjustments are made (readjustments by harbor work, updated coastline, displacement of labels that are overlapped with toponymies, etc.).
- Preparation for the press
From the ROOM technology (Rip Once Output Many) of Nexus it is generated a 1 bit image for each colour press (Fig. 3). With these images a test-colour plotted of the certified hatched (certified FOGRA, Graphic Technology Research Association) is performed. Also, these files are used to generate the impression plates (ISO 12647-2).

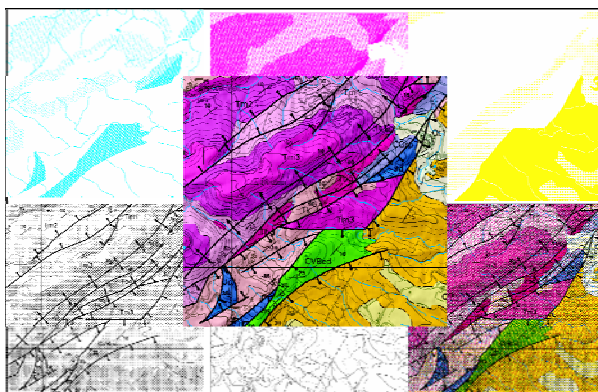


Figure 3 – 1 bit tiff image simulating printed colours.

- Offset-print outs
The files are taken to the press, where the maps are printed in line to 5 colours: CMYK colours plus the Pantone colour 444c of the cartographic background (planimetry and topography). The approval of the impression occurs directly in the machine (Fig. 4).



Figure 4 –Frontal panel for the manual ink control of the prints-outs maps (sheet of the Barcelones region).

The print-outs (Fig. 5) are 1000 units printed in 1 face coated paper of 80 g/m², special for cartography designs and with a maximum dimensions about 120x160 cm.

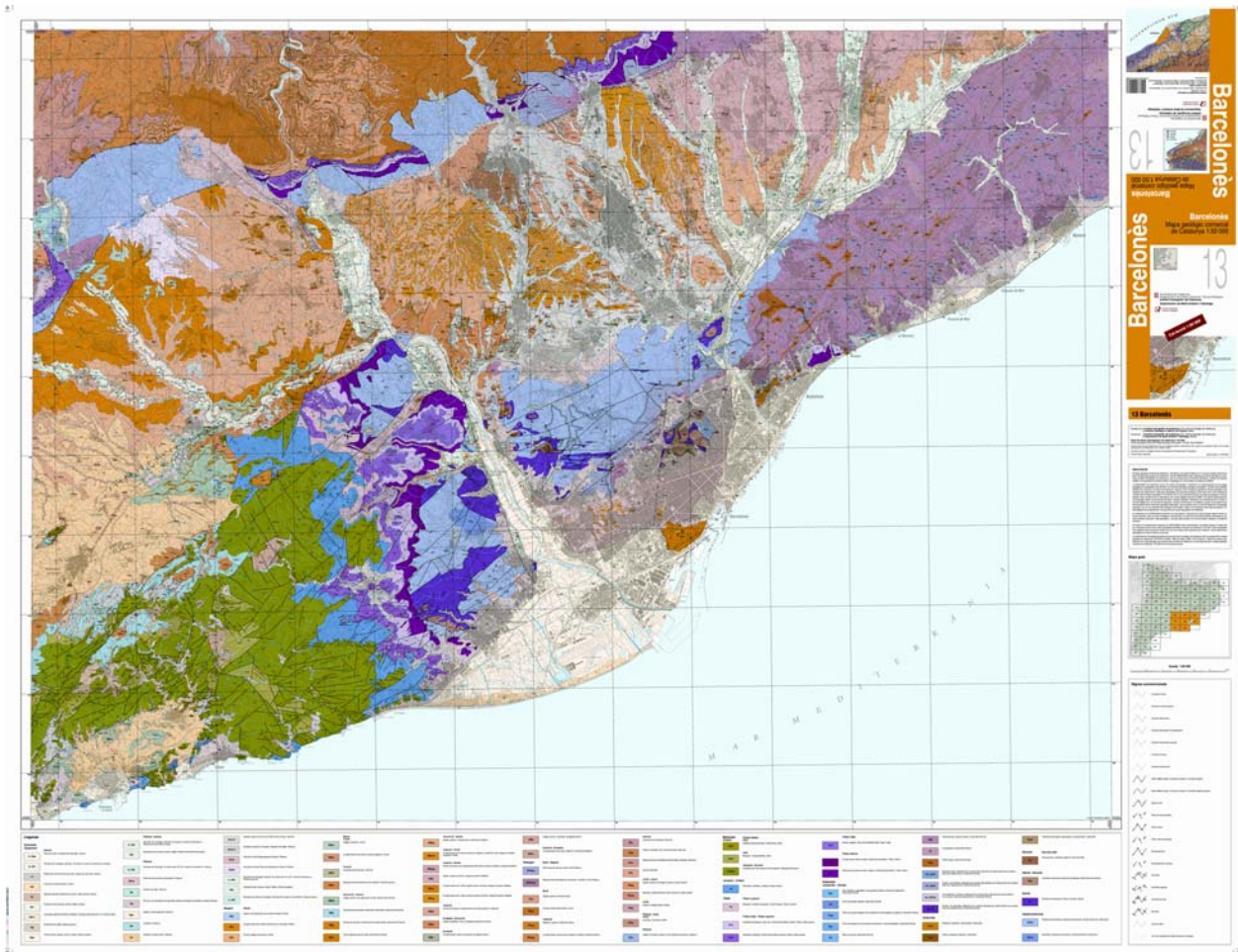


Figure 5 – Regional geologic map of Catalonia (sheet of the Barcelonès region).

CONCLUSIONS

We are satisfied with the results of the published maps. We can affirm that, for this type of maps and even those of geologic cartography (with complex simbology and dense information), it is viable the use of tools of automatic symbolisation, that facilitates the work and allows to preserve the edition effort in the improvement of the finished product of the cartographic document.

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REFERENCES

ISO 12647-2, 2004. Graphic technology-Process control for the production of half-tone colour separations, proof and production prints-Part 2: Offset lithographic processes.

Puig, C., Berástegui, X., Barnolas, A., 2000. The new 1:50 000 geological map of Catalonia and related databases. An ICC-ITGE corporate experience. Proceedings of Third Congress on Regional Geological Cartography and Information Systems, pp. 248-252.