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OF THE INSTITUT CARTOGRÀFIC DE CATALUNYA

Generalitat de Catalunya
Departament de Política Territorial
i Obres Públiques
Institut Cartogràfic de Catalunya

Information about the production, development and research projects
of the Institut Cartogràfic de Catalunya

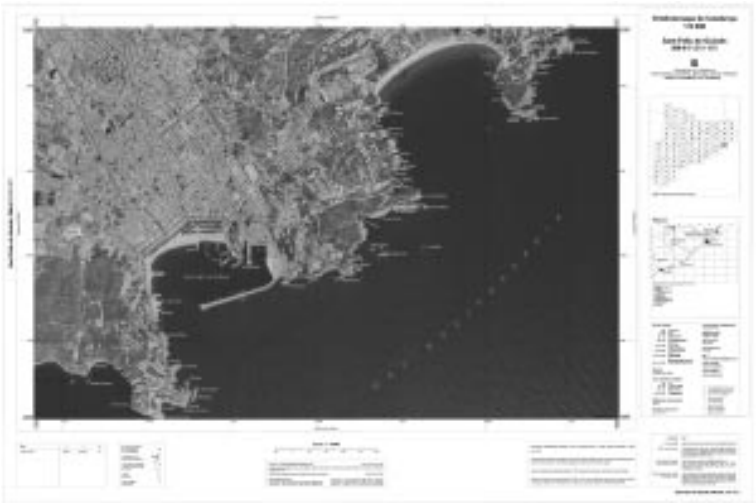
Ortofotomapa de Catalunya 1:5 000. Second edition

In 1994, the Institut Cartogràfic de Catalunya (Cartographic Institute of Catalonia, ICC) began the second edition of the *Ortofotomapa de Catalunya 1:5 000 (*Orthophotomap), a series composed of 4 269 sheets in black and white. Each sheet covers 2.3 x 3.4 km, which represents approximately 800 hectares. The first edition of this cartographic series was published between 1986-1992.

The second edition includes the technological changes and the changes in cartographic design that have been implemented since 1992: the application of new algorithms that improve the image, thereby optimizing the capacity to extract information; homogenization of the sheets already published; densification, where necessary, of the toponymy, and a new design of the series and the key. Furthermore, in completing this edition, the elevation data of the areas where building has been completed in the last few years has been updated, using rectification with triangles for the first time. Another new feature has been the use of computing tools that perform semi-automatic image adjustment, which enables the radiometric defects of the affected areas of the image to be detected and repaired, while tools are also provided to make special radiometric adjustments. To date, these minor changes had been made on different systems of the image production environment itself. All these improvements mean that updated cartographic bases of the entire territory of Catalonia on a large scale are made available. Another new feature has been the presentation of the sheet in a size that is 50% larger than the first edition: the sections of the second edition are produced from the sub-division 8 x 8 of the *Mapa Topográfico Nacional 1:50 000* (National topographic map, MTN), while those of the first edition were generated from the sub-division 12 x 8 of the MTN, which led to a series of 6 331 sheets, each covering some 530 hectares.

The base of the orthophoto is the same photographic image: the new edition has been completed following a specific flight at 1:32 000 scale in the years 1994-97, which, using current methods (latest generation cameras, high-precision photogrammetric scanners, intensive image processing, etc.), enables orthophotos to be obtained quickly and economically.

The planimetry is made up of all the elements that form the land surface which are visible from the air and from a vertical levelling point. Following geometric rectification, the scale is the same for all the area represented. The relief is observed according to the natural elements themselves: shaded areas produced by the light of the sun or different shades of colour due to the variations in vegetation cover. The spot heights of the vertices and the points distributed across the surface of the image provide exact altitude values.



Elements of reference and position are superimposed on to the orthophotographic image, which facilitate identification, interpretation, location and positioning on the territory. These elements are, for example, the grid of the network of UTM co-ordinates, the geographic co-ordinates, the geodetic vertices and the toponyms, which have been checked and updated on the basis of information obtained from the first edition and from the field data for the densification of those areas that showed low or uneven densities. The average number of toponyms that appear is 80 per sheet and they are of different kinds: population, constructions, orography, hydrography, communications network, etc. and, since this is a detailed scale, the names of elements of a limited size also appear, such as streets, wells, springs, caves, etc.

As a complementary information, the margins of each sheet include the key, the numerical and graphic scale, the map showing how the sheets in the series are distributed, the administrative division map, the magnetic and reference data, the cartographic projection, the names and co-ordinates of the geodetic vertices, a short text explaining the production process and the information sources.

This document can be purchased at the ICC's distribution points in both digital and plotter output format (paper format, measuring 60 x 89 cm). With the first option, as at December 1997, there are 2 510 sheets and, with the second, 1 143.

Due to its detail and high information content, this is a basic cartographic document for work of various kinds: town and country planning, cartographic representation of municipal development plans, territorial delimitation, especially with reference to municipal boundaries, and updating of the country land register, among others. In short, like all basic documents, it can be used as a source of information (to inventory, interpret and analyse) and as a cartographic base (to superimpose thematic information).

Automatic generalization in the generation of the *Mapa topogràfic de les comarques de l'Ebre 1:100 000*

The sheet *Mapa topogràfic de les comarques de l'Ebre*, published in December 1996, and part of the series *Mapa topogràfic de Catalunya 1:100 000* (Topographic map), was obtained by generalization of the *Mapa comarcal de Catalunya 1:50 000* (Regional map) of the ICC, and in accordance with the cartographic design previously defined for the new series. The software was designed combining automatic tools with manual edition tools assisted by computer, which enabled the data to be updated and the results of the automatic processes to be improved. The software used was MapGeneralizer (MGMG) of Intergraph, some specific applications developed at the ICC and the software MicroStation of Bentley.

Before applying generalization, the data was prepared to optimize the results. The pre-process included:

1. The creation of tables of concepts needed to start any MGMG or ICC process.
2. The elimination of the data that does not appear in the final product. It has to be applied at the beginning of the workflow, in order to reduce the size of the files and the timing of further processes.
3. The creation of chains and nodes in the linear elements.
4. The generation of flags on the polygons with an area smaller than the minimum area value. These will be used later to decide whether the small polygons have to be collapsed, aggregated, exaggerated or eliminated.

The automatic generalization included the following operations: simplification and smoothing of linear elements and perimeters of areas; scaling of symbols and texts, and typification of point data. It is very important to follow the order of these operations to maintain the original information as far as possible and to optimize the workflow.

Simplification is the first operation to be applied, allowing superfluous details of the original data to be eliminated. Smoothing reduces angularity of the linear elements, mainly produced during the previous simplification. Both operations have been applied with the same algorithms and parameter values to the complete list of linear elements. The quality of the results basically depends on the density of the vertices contained in the elements; for example, hydrography and roads were digitized in the original database with a similar number of vertices and the results are homogeneous, whereas the footpaths were digitized in some cases in a very simplified way and in some cases with a high density of points, and the result was not acceptable, so the final decision was not to apply automatic generalization.

The scale factors applied to symbols were 1.25, 1.5 and 2, depending on the size of the original data. The texts were scaled using ICC software, mainly applying the factor 2. In accordance with the change of scale, some texts changed their typography.

Typification allows some elements to be eliminated selectively using distance criteria, in an attempt to maintain the original distribution of the data. This has only been applied to point data.

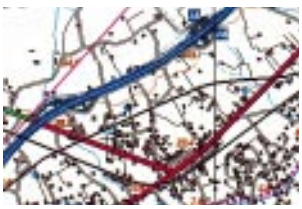
The tasks that have not been automatically solved and which required manual interactive generalization were selective elimination of spot heights, peaks, footpaths, connecting roads; exaggeration of connecting roads, beaches, gardens; collapse of polygons to linear elements as rivers or banks; collapse of polygons to points as cemeteries or castles; simplification and aggregation of buildings and, finally, conflict resolution. Some editing was added to improve the legibility of the map and to make it more attractive for the user.

The original data size was 50 Mb, after automatic generalization it was 33 Mb, and the final product after the manual editing was 27 Mb. Thus, the size was reduced by approximately 46%.

The time needed to process the data automatically was 2 hours, substituting the estimated time of 140 hours for manual work. The manual interactive generalization needed 550 hours, distributed as following: 35% for selection, 25% for generalization of urban areas, 10% for exaggeration, collapse and standardization, and 30% for conflict resolution and edition to improve the legibility and the aesthetics of the map. The estimated saving in time was 20%.

In conclusion, automatic generalization tools, although they have their limitations, are an important aid in cartographic production. The limitations stem from the software available and also from the simple database structures. Implementation of automatic tools in production workflow enables the performance to be improved, the state-of-the-art to be evaluated, more specific tools to be requested and it facilitates collaboration in the research and development of automatic generalization carried out by the cartographic community.

Original data plot scale 1:50 000



Automatic generalized data 1:100 000

Final generalized data 1:100 000

Cycle of lectures on history of cartography. Years 1990-2000

Since the 1989-1990 academic year, the Institut Cartogràfic de Catalunya (Cartographic Institute of Catalonia, ICC) and the Department of Geography of the Universitat Autònoma de Barcelona (Autonomous University of Barcelona) have organised annual courses devoted to the history of cartography for post-graduated university students. Since 1992-93 the duration of the course has been 15 scholastic hours, when prior to this it had been 10 hours.

The structure of this cycle was designed so that, as a whole, it would offer an idea of the development of the field of cartography in countries where it has played an important role, while giving an account of the main map libraries and their documentary resources. Following these objectives, the first course was begun, which consisted of a general presentation of the position of cartography; in subsequent years the various countries have been presented one by one. Finally, in the year 2000, the course will focus on a subject of a more general nature, the theoretical aspect of the history of cartography will be covered, and the cartographic schools not dealt with individually will be included.

The lectures given are published as part of the ICC's *Monografies* (Monographs) collection, once the course has finished. Thus, to date, the following have been published: *Introducció general a la història de la cartografia* (General introduction to the history of cartography; year of publication, 1990), *La cartografia de la Península Ibèrica i la seva extensió al continent americà* (Cartography of the Iberian Peninsula and its extension to the American continent, 1991), *La cartografia italiana* (Italian cartography, 1993), *La cartografia dels Països Baixos* (Cartography in The Netherlands, 1995), *La cartografia francesa* (French cartography, 1996), *La cartografia dels països de parla alemanya –Alemanya, Àustria, Suïssa–* (Cartography of German-speaking countries –Germany, Austria, Switzerland–, 1997) and *La cartografia anglesa* (English cartography, 1997). The titles of these books are in Catalan, but the texts have been published in the language employed by the lecturers.

When the XVII International Congress on the History of Cartography was held (Lisbon, 6-10 July 1997), the experience obtained and the future prospects of this cycle of lectures were publicized at a poster session. This opportunity was taken to present the latest volumes published. The presence of delegates who are specialists in the history of cartography contributed towards creating a highly favourable setting in which to focus international attention on the cycle.

Academic course and dates	Subject	Teachers and professors
History of cartography I 30 January-1 February, 1990	General introduction to the history of cartography	Eila Campbell Montserrat Galera i Monegal Monique Pelletier
History of cartography II 11-14 February, 1991	Cartography of the Iberian Peninsula and its extension to the American continent	Montserrat Galera i Monegal Rodolfo Núñez de las Cuevas Maria Fernanda Alegria João Carlos dos Santos Garcia
History of cartography III 17-21 February, 1992	Italian cartography	Marica Milanesi Emanuela Casti Moreschi Leonardo Rombai Vladimiro Valerio
History of cartography IV 15-19 February, 1993	Cartography in The Netherlands	Dirk de Vries Peter van der Krogt Jan Smits
History of cartography V 21-25 February, 1994	French cartography	Monique Pelletier Philippe Prost Gilles Palsky
History of cartography VI 20-24 February, 1995	Cartography of German-speaking countries –Germany, Austria, Switzerland–	Wolfgang Scharfe Ingrid Kretschmer Hans-Uli Feldmann
History of cartography VII 19-23 February, 1996	English cartography	Catherine Delano Smith Roger J. P. Kain
History of cartography VIII 24-28 February, 1997	Cartography of Slav countries	Iaroslav Matviichine Janna Matviichina
History of cartography IX February, 1998	Latin-American cartography	Max Justo Guedes José Ignacio González Leiva Rodolfo Núñez de las Cuevas M. Luisa Martín-Merás (another professor to be confirmed)
History of cartography X February, 1999	Catalan cartography	Vicenç M. Rosselló i Verger M. Carme Montaner i Garcia Montserrat Galera i Monegal
History of cartography XI February, 2000	Approaches and challenges in a worldwide history of cartography	David Woodward (other professors to be confirmed)

Seismic guidelines for the construction of buildings and structures

Last June, two congresses were held at the headquarters of the Institut Cartogràfic de Catalunya (Cartographic Institute of Catalonia, ICC) on the application of the recent seismic guidelines for the construction of buildings and structures.

The first, held on 26 June, was the *Technical congress on the application of the "Norma de Construcción Sismoresistente NCSE94" in Catalonia*. An exposition was made of the rules and the criteria for calculation and structural design applying the NCSE94 standard and the difficulties encountered in their application in Catalonia. This congress was organised by the Asociación Española de Ingeniería Sísmica (Spanish Seismic Engineering Association), the Associació de Consultors d'Estructures (Association of Structure Consultants) and the ICC.

The second congress, entitled *Colloquium on comparative structural calculation according to the Spanish, French and European seismic guidelines*, was held on 27 June. An analysis was made of the results of applying the Spanish (NCSE94), French (PS92) and European guidelines (EC8) to the same structure. This congress was organised by the Asociación Española de Ingeniería Sísmica and the Association Française du Génie Parasismique, with the collaboration of the ICC. The recent development of these three guidelines is due to the gradual sensitization of European society to protection from the effects of earthquakes. The aim of the European guidelines is to provide with a common basis in order to facilitate the approach of the other guidelines and thereby achieve a degree of co-ordination.

The continuation of these meetings for the purpose of joint analysis and discussion is assured over the next few years.

Agreements with the provincial councils. Past and present

Digital cartography for the management and planning of the territory and the necessary updating of existing information is of increasing interest to the administrative bodies that use it. For this reason, the collaboration between the provincial councils of Girona, Barcelona, Lleida and Tarragona and the Institut Cartogràfic de Catalunya (Cartographic Institute of Catalonia, ICC) in the field of cartography through the signing of agreements for the production of digital cartography has its precedents.

Ten years separate the first agreement signed with the Diputació de Girona (provincial council) in 1987 for the digitalization of topographic maps of the *comarques* (administrative division in Catalonia) of Girona –a total of approximately 588 960 ha– and the two agreements signed in 1997. In 1990, two agreements were signed, one for the elaboration of a cartographic base and the subsequent printing of the sheets of the eight *comarques* that make up the province of the *Mapa comarcal de Catalunya 1:50 000* (Regional map) series (a topographic series that is necessary in order to gain a real picture of the area and one that is widely distributed in Catalonia), and another for the production of 3D digital cartography of this area at 1:5 000 scale. In 1991, an agreement was reached to carry out the technical work required to obtain digital cartography at 1:1 000 scale, based on a photogrammetric flight at 1:5 000 scale, of the urban nuclei of the municipalities in the province. Later, in 1996, two new agreements were signed for the completion of digital cartography of such centres at 1:1 000 scale, based on a flight of 1:5 000 and an area mapped of 3 000 and 7 400 ha, respectively. In 1997, two other collaborative agreements have been signed. One for the ICC to complete the publication in its collection *Atles comarcals de Catalunya* (Regional atlases) of the volumes corresponding to its *comarques*: Baix Empordà and Garrotxa (1997), Alt Empordà and Ripollès (1998), Pla de l'Estany and Cerdanya (1999) and Gironès and Selva (2000); all these volumes will also be available on CD-Rom. The second agreement was signed for the completion of two topographic maps at 1:100 000 and 1:200 000 scales, and two political maps on the same scales, representing the regional and municipal administrative division of the province.

In 1993, the first agreement was signed with the Diputació de Barcelona to implement the necessary processes whereby this body might avail itself of the 3D digital cartography produced by the ICC at 1:5 000 scale corresponding to the area of this province. In 1994, a general framework of agreement was signed for collaboration in cartographic material, which provided for the possibility, subject to subsequent agreements, of: exchanges and updating of digital cartography; planimetry and cartographic formatting work; undertaking of joint experiments in the processing of multispectral images for the evaluation of natural resources and obtaining of thematic cartography; the planning and completion of photogrammetric flights and subsequent plotting and analysis of aerial photograms; collaboration in the geodesic support network; toponymic studies and the preparation, completion and joint publication of base cartography, thematic cartography and atlases. In 1995, an agreement was signed for the completion and publication of a map of the province at 1:150 000 scale (two maps were made, one with topographic information and the other with topographic and thematic information). In 1996, an agreement was reached for the completion of the following cartographic work: completion and printing of a topographic map at 1:350 000 scale, completion and publication of a land use map at 1:150 000 scale, completion and printing of the municipal base map of the province of Barcelona, and granting of the licence to use the digital cartographic base of Catalonia 1:50 000 and the sheets of the *Ortofotomapa de Catalunya 1:25 000* (Orthophotomap) colour series corresponding to the province. In this same year, the last agreement to date was signed, whereby the Diputació would purchase the digital orthophotographs at 1:5 000 and 1:25 000 scales in black and white.

Collaboration with the Diputació de Lleida began in 1988 with the signing of the agreement to obtain cartography of 2 887 ha at 1:1 000 scale of 200 urban nuclei in the province, based on a photogrammetric flight at 1:5 000 scale, and in 1996 another agreement was signed whereby the ICC would produce topographic cartography of the provincial area at 1:200 000 scale.

An agreement was reached with the Diputació de Tarragona in 1996, whereby the ICC granted use of the 3D cartography at 1:5 000 scale corresponding to the 628 300 ha of the territory in the province.

This co-ordinated collaboration between the respective provincial councils in Catalonia and the ICC, which is necessary for the completion of specific projects and which it is hoped will continue into the future, should serve to provide information for the correct administration of the territory, and thereby increase the presence and diffusion of the cartography produced by this Institute.

ICC Reports honoured

The Sindicatura de Comptes (Accounts Commission) of the Generalitat de Catalunya (Catalan Autonomous Government), a body within the Parlament de Catalunya (Catalonia Parliament) for the control of economic, financial and accounting management in the public sector, has awarded a prize to the Report for the 1995 fiscal year issued by the Institut Cartogràfic de Catalunya (Cartographic Institute of Catalonia, ICC) in the annual report competition for Public Administration bodies in the section comprising autonomous, administrative, commercial, industrial and financial institutions. This competition seeks to honour the reports of organisations in the public sector that, by dint of their content, fulfil the following prerequisites: they allow the available resources of the respective organisation to be analysed and criteria of efficiency to be applied; they supply information about the quantity, quality and costs of the services that they provide and, at the same time, they are widely circulated. This is the second time that the ICC has received this award, since the Report for the 1993 fiscal year was also honoured in the same section.

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