GEOLOGICAL ATLAS OF CATALONIA 1:50.000: A NEW TOOL FOR MAKING KNOWN TO SOCIETY THE GEOLOGICAL CONSTITUTION OF THE TERRITORY

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INTRODUCTION AND OBJECTIVES

The Geological Atlas of Catalonia 1:50.000 is a new project carried out by the Institut Geològic de Catalunya (IGC) and the Institut Cartogràfic de Catalunya (ICC) to bring knowledge about the geological constitution of the territory closer to society.

This work presents the Geological Map of Catalonia, 1:50.000, in a format and a content structure similar to those of a conventional atlas; that is to say, the strictly cartographic part is accompanied by introductory pages jointly prepared with the University of Barcelona, with additional information to facilitate the consultation and the understanding for the non-specialized reader. The idea is to have a reference book for the office, or just a book to glance through, and not a field reference work, which is the case of the conventional geological maps.

It contributes an approach which includes innovative ingredients in the way of transmitting the geological constitution of the territory, the history of its formation and evolution, some of its peculiarities and an accessible summary of Catalonian geology.

The Geological Map of Catalonia 1:50.000, which constitutes the cartographic part of the Atlas, has already been published in the conventional format in a series of 41 sheets, one for each Catalonian county (Mapa geològic comarcal de Catalunya, 1:50.000, IGC and ICC, 2005 to 2007). This article deals specifically with the introductory part and with the rest of the information that accompanies and complements the geological map.

STRUCTURE

The Geological Atlas of Catalonia, at a scale of 1:50.000, has been structured in two clearly differentiated parts: the first part, introductory, with a strictly geological content and a second one with a cartographic content with the geological map 1:50.000, its legend and an explanation of the methodology used in the formation of the Geological Database of Catalonia (Puig et al., 2000), wherefrom the Geological Map of Catalonia 1:50.000 is derived.

The introductory part provides a regional geological framework aimed at facilitating the understanding of the entire Atlas, not only for the non-specialized reader but also for those users with a partial knowledge or with an interest in certain subjects. We should not forget that many people are mineral or fossil enthusiasts, or they like collecting coloured pebbles, or just like to know on which rock they are stepping when trekking or assuring their pitons when climbing.

So, the first part is the most innovative, where a real effort has been made in trying to find the best way of conveying the knowledge on the geological constitution of the country in a plain and pleasant manner, without compromising the rigor of the content.

With these objectives we established the content structure and the formats to facilitate the finding and the understanding of each one of the subjects dealt with in the volume.

- Format / structure: each subject occupies an independent double page spread (or several if necessary); this structure is typical of the conventional atlas, where the different aspects of the territory, the population, the climate, etc. are individually dealt with. This allows the reader to easily locate the subject which he/she is interested in.
- Contents: it provides, for each subject, an general overview of what is expressed or can be deduced from the geological map. The contents are developed in the following section.
- Language: an attempt has been made to use a relatively plain language. Of course, the terminology is typical of the geological sciences, but avoids the use of technical terms.
- Graphics: in the entire first part of the Atlas, the graphic expression of the geological content has been homogenised, i.e. we have used the colour codes internationally established for rocks of each age, expressed in the Geological Time Table (IGC, 2006), and the standard ornamentation for each rock type. This unification, in addition to providing coherency to the whole, also facilitates immediate information of a geological nature.

CONTENTS

The first chapter is devoted to geological maps: what are they, the history of their development as a means for summarizing and transmitting the geological knowledge and, especially, as a prospective and predictive tool. These values are often difficult for the general public to understand,

but they are very important, as the social value of geology lies in this predictive ability.

We have included a collection of reproductions of historical maps and of the current cartographic series, at different scales and with approaches which have enormously evolved during the last few years, following the advances in the theory of geological sciences and the requirements of the epoch.

Finally, the different geological subjects which can be cartographically represented constitute what we have called geo-thematic maps: one map per subject. All the maps grouped in this chapter, either already published or specifically prepared for the Atlas, have been represented on the same scale and have a common treatment, with an explanatory text on the specific geological content.

In the first place, there is a map of physiographic (or relief) units, which provides the geographical framework for the entire work. This map has been expressly compiled for the Atlas and also sets out the regional toponymy used in the entire work, including the continental platform.

The remaining geo-thematic maps represent the geological constitution of the territory (the conventional geological map), the lithologic types (Figure 1) and the superficial and underground waters, all of them extractions from the Geological Map of Catalonia 1:250.000 and from the Geological Database of Catalonia 1:250.000 (BGC250M); part of the content of the structural and the geomorphologic maps, prepared especially for the Atlas, also derives from BGC250M. Finally, the last map tackles seismicity.

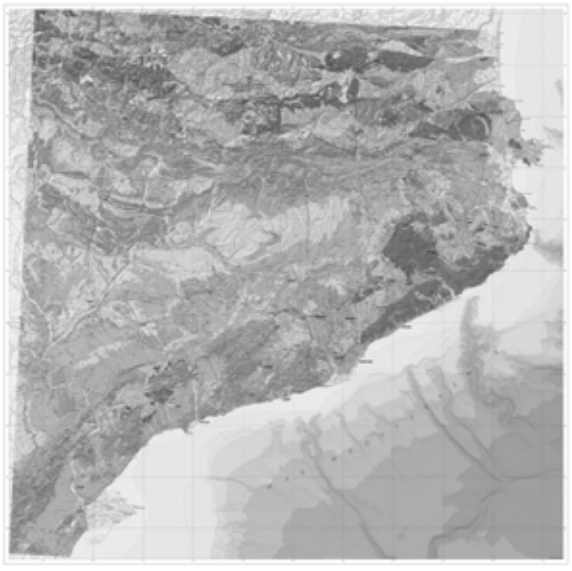

Figure 1 – A Geo-thematic map devoted to the lithology.

The geo-thematic map, which shows the lithologic constitution of the substratum, also includes a simple explanation of the types of rocks and of unconsolidated deposits outcropping in Catalonia, illustrated by pictures. In this section we have followed the classical genetic classification of rocks, which can be found in any manual or text book. The aim of these pages is to provide an image of the lithologic diversity which forms the geological records of Catalonia.

Of course, many more geo-thematic maps could have been included, but we have restricted the Atlas content to those maps already published by the IGC (mainly on a 1:250.000 scale) and to those summarizing the geo-morphological features, the geological structure and the major structural units, indispensable for providing a framework for the entire work.

The second chapter is devoted to geological history. Catalonia has a long and complex geological record and, from this point of view, it can be considered a privileged country. In a territory of 32.182 sq. km. the sedimentary record of the last 550 million years can be studied. We have excellent examples of structures generated in compressive and extensive tectonic contexts, a large variety of intrusive and effusive igneous rocks and the imprint of hercynian metamorphic processes.

In the first place, we explain the concept of Geological Time, very difficult to capture for the non-specialized reader, and the Geological Time Scale, the chronological dimension which embraces the Earth's history. This scale also permits the evaluation of the speed of some geological processes.

Then, we explain the geological history in a continuous text, intended for more curious readers. This section is illustrated with many palaeographic reconstructions of different scope and summary table of the geological events which have occurred in Catalonia and its surroundings.

The geological record is expressed in a set of pages (Figure 2) arranged in a geochronological order, from the oldest to the newest. These pages include, besides the sedimentary record, the igneous and metamorphic events. The way of presenting the information is the same in each section, regardless the subject, although the age intervals become smaller as we advance in the geological time.

The difficulty in this chapter lies in the fact that some processes, within the geological record, are easier to capture for the non-specialized reader due to their proximity and the consequent easiness to intuitively apply the principles of actualism and uniformitarism; good examples of these are the expansion of a delta or the erosion inland. On the contrary, some of them are very difficult to understand, even for professional geologists, such as the metamorphism and certain deformation processes.

The Geological Time Table is present on all pages devoted to the geological record, with a

clear indication of the specific time lapse considered.

Each page has a diagram with the outcrops distribution of the rocks under consideration; this has been included to provide, at the first glance, a clear picture of the situation of a determined group of rocks within the territory. This information would be difficult to capture from the general geological map. It can give, even to professional geologists, an approach which is different from the one we are used to.

The rest of the content is a short text of a general and regional nature, with a collection of pictures and photographs illustrating the aspects mentioned in the text, synthetic stratigraphic series, correlation panels, details of representative outcrops, interpreted photographs, etc.

This chapter also reflects the human action on the territory, with a page of the same structure and type of content as the rest of the pages.

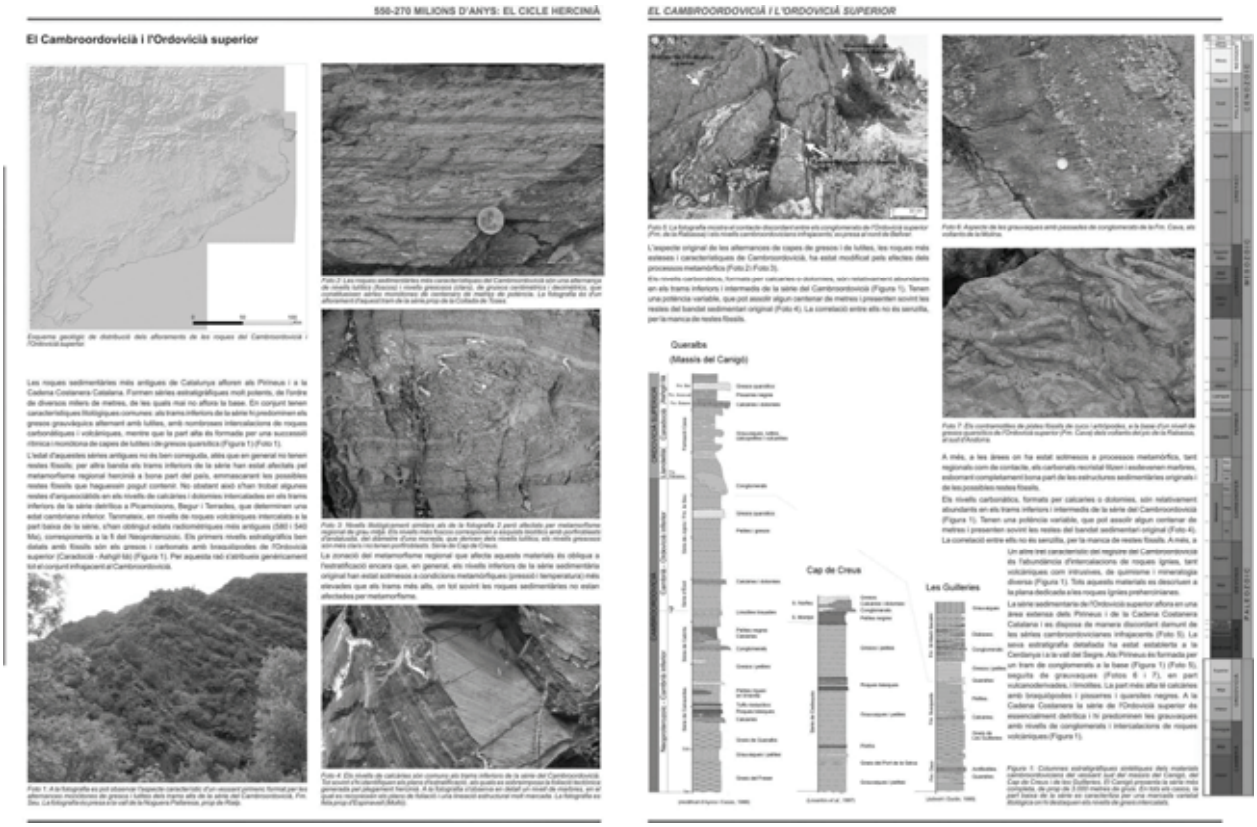

Figure 2: Example of a draft page of the Atlas, specifically that devoted to Cambrian and Ordovician periods. The scheme of outcrops distribution and the geological time table on the right hand side of the page are common to all of them.

The geological structure of Catalonia is expressed through a map of structural units, derived from and complementary to the structural map, and a series of cross-sections with different ranges, distributed through areas of diverse contexts and structural styles. As in the former sections, we have drawn up a short introduction to facilitate the understanding of what a geological cross-section expresses, where the procedures used in their construction, the methods for obtaining underground data and the restrictions limiting their depth are explained.

In this section, the geological cross-sections are shown in a double-page spread with a location diagram, an introduction to the geological context and partial details, interpreted photographs, restored cross-sections and other information complementing each one of them.

All together, 10 geological cross-sections are presented, which show the tectonic alpine evolution, compressive and extensive, with some details of the hercynian structure. Two of these cross-sections have a larger depth range. We have taken advantage to explain in more detail the Pyrenees formation and the evolution of the Valencia Trough.

Finally, there is a lithospheric scale cross-section of this portion of the Iberian Plate within its context, i.e. as a piece which has evolved back from the Triassic period, 250 million years ago, up

to the present time between the larger European and African tectonic plates.

We have tried to summarize all this, and even more, in the introductory part of this Atlas.

The second part of the geological Atlas is strictly devoted to the Geological Map of Catalonia, 1:50.000. There is an introduction where we explain the formation of the BDGC50M (Puig et al, 2000) and its graphic representation (de Paz et al, 2006), which culminates with the publication of the Atlas.

The geological map has the conventional format of a geographic atlas, with the entire map divided into pages, 201 pages in total.

The legend consists of 1.047 cartographic units, identified by an alphanumeric epigraph and an index number. They are filed in geochronologic order, from the most recent to the oldest. To facilitate the location of a unit in the legend, there is an alphabetic list of all the epigraphs with their index number.

The legend in the cartographic units is very concise; it only mentions the dominant lithology, the minority lithology (if necessary), some typical fossil remains, the mineralogical composition, the formal name (if this exists) and the age. The list of conventional signs is also quite reduced, because the geological map does not graphically express all the information gathered in the BDGC50M.

All geological terms (or those with a specific meaning in geology) appearing in the legends have been compiled and a glossary has been expressly prepared for this work; it consists of 581 words or expressions and has been attached as an appendix to the legends to facilitate the consultation for non-specialized users. Common patterns have been established for the drawing-up of the definitions in each group of subjects; so, all the rocks, minerals, sediment components, fossil remains, etc. are described following the same structure and criteria. The terminology used in these definitions is accessible to any inquiring (or curious) reader.

A short etymology has also been included for the words identifying the geo-chronological units set out in the Geological Time Scale, 164 terms in total. This work was undertaken in order to translate into Catalan the current Geological Time Table (Gradstein et al., 2004, IGC 2006) and is one of the “curiosities” the readers will probably appreciate.

As any conventional Atlas, it has a toponym index and also includes an index of the pages where each cartographic unit is located.

DISTRIBUTION AND DERIVED PRODUCTS

To assure the maximum diffusion of this work, it will be distributed to those Public Administrations entities which have some kind of relationship with Earth sciences and territory management and to other entities, such as museums, totally or partially devoted to subjects related to geology.

In a parallel way, it will be distributed to central and regional libraries, university documentation centres, research centres and pedagogic resources centres, among others.

An important part of the content will be uploaded, duly adapted, to the web page of the IGC: the chapters devoted to geological maps, glossaries and some of the new geo-thematic maps on a scale 1:1.100.000. The translation into Spanish and English is being considered.

SUMMARY

The Geological Atlas of Catalonia 1:50.000 is intended to be a reference work and, at the same time, a pleasant book to glance through, with simple explanations in spite of the diversity and difficulty of some of the subjects dealt with.
The objective is to improve the citizens’ perception of the geology of Catalonia by making available to them a new tool which facilitates the understanding of the geological constitution and the succession of processes which have led to its present configuration.
This Atlas will also provide students and teachers in the high schools where matters related with Earth sciences are being taught with a reference tool for better recognizing their geological environment.

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