GEOschools

GEO SCHOOLS

CURRICULUM COMPARISON RESEARCH

Part two: Analysis of geological contents in Secondary School textbooks

FINAL RESULTS

2011

GEOSCHOOLS - TEACHING GEOSCIENCES IN SECONDARY SCHOOLS

FINAL RESULTS: CURRICULUM COMPARISON RESEARCH

Part two: Analysis of geological contents in Secondary School textbooks

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The final results of the second analysis regarding the subject Curriculum comparison research are reported. The research is part of the frame of the European project GEOschools whose objective is the investigation of the interest of students in the context and teaching strategies of geosciences in secondary schools. GEOschools is a European Union project supported by the Lifelong Learning Programme.

The key topics to be addressed in the development of the project are:

- Curriculum comparison research
- Interest Research
- School Geosciences Dictionary
- Subject Teaching Modules

Curriculum comparison research II: Analysis of geological contents in Secondary School textbooks

Besides comparing curricular contents, the research should also focus on the analysis of geological contents in secondary school textbooks in the five participating countries, based on a detailed review of the amount and quality of the information given to students.

In this way, the ultimate goal is to find effective ways of engaging students and Geosciences teachers in a new learning approach, and, at the same time, placing Geology at the same level of other sciences, such as Biology, Chemistry and Physics in secondary schools.

According to Hedley (2000) scientific contents included in textbooks should consider the following matters:

- ✓ What is doing textbooks in sciences publishing and its teaching?
- ✓ Is there a single text that can be considered as standard textbook? If so, when was it published?
- ✓ Do students need help when learning or do textbooks attract students?
- ✓ Are textbooks different depending on the country where they are published?
- ✓ What makes a textbook a success and what role does it play in the dissemination of science?

In our research we didn't aim to give answer to these questions. Although, based on Hedley (2000) we wonder to what extent the authors are aware of the needs of the students. Is there any pedagogical intention in those textbooks which provide information in a more systematic way?

In the case of Geology must be added that the stimulus posed by geology contents that are taught throughout the different levels of Secondary Schools is minimal. Surely if we were to ask students from Secondary Schools how they valuate Geology, probably some of them would answer that it is a boring subject and, what is studied, useless, however some others hopefully will find it more interesting and useful for everyday life. The study of many geology contents (rocks, minerals, tectonics like folds, faults, ...) requires memory activity and has a static character that make them uninspiring. The recognition of the dry geological study of the Secondary Education contents is the origin of the change initiative in how to teach Geology and the starting point that we have applied to analyze the content reflected in the textbooks.

The first step to carry out this research has been to analyze the contents included in the indexes of Sciences textbooks from Secondary Schools and identify topics devoted Geology (Figures 1-5).

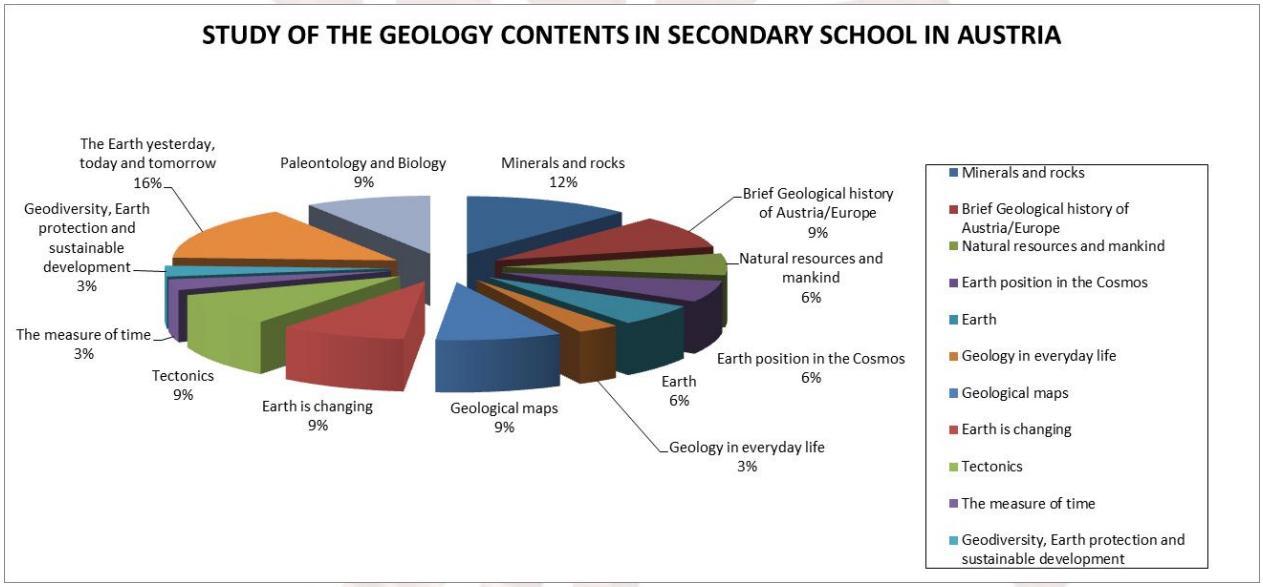


Figure 1.- Percentage of geological contents included in textbooks of Secondary School in Austria (López Carrillo, M.D.).

The figure 1 shows that in the Austrian textbooks for Secondary School the topics with greater representation are:

1. The Earth yesterday, today and tomorrow (16%),
2. Minerals and rocks (12%).

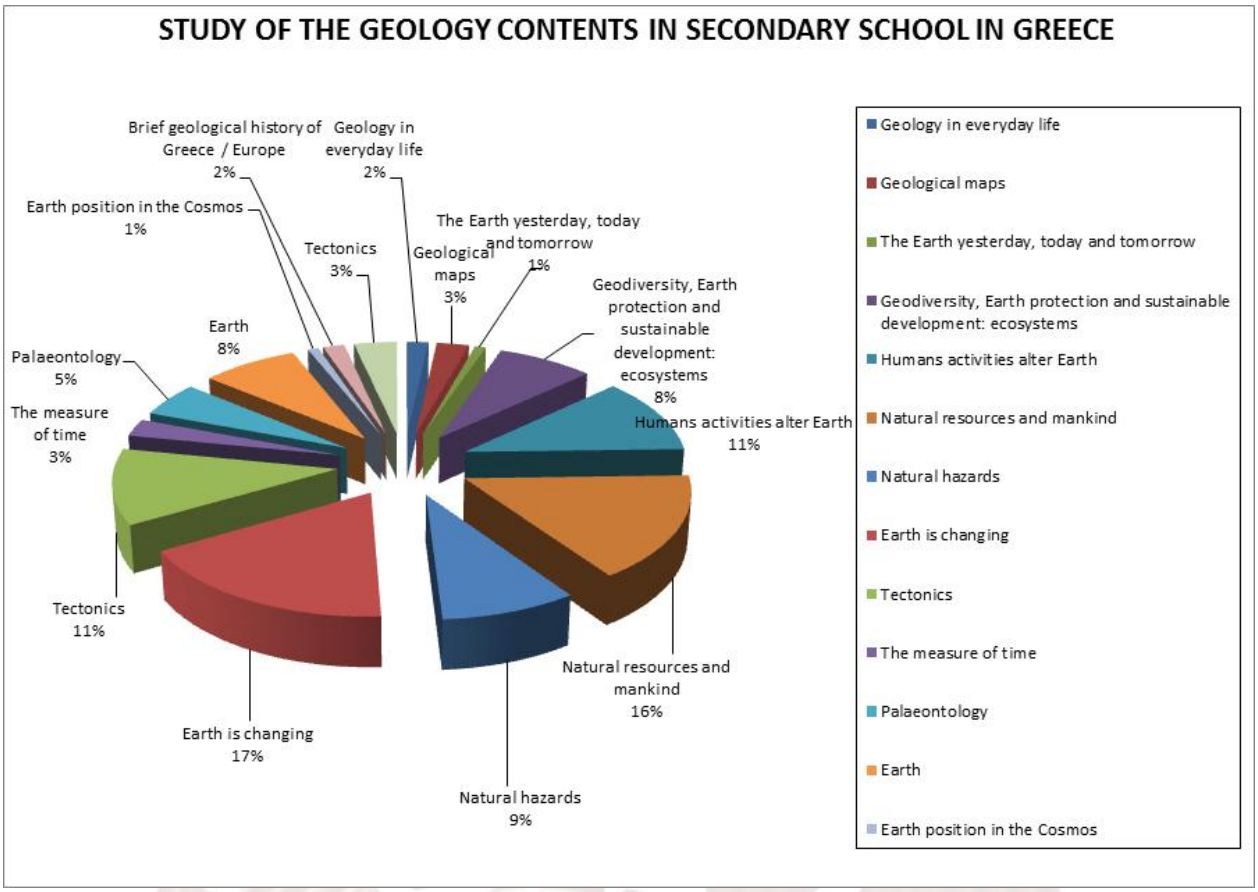


Figure 2.- Percentage of geological contents included in textbooks of Secondary School in Greece (López Carrillo, M.D.).

In the case of Greece (Fig.2) the most studied subjects in secondary education are:

1. Earth is changing (17%)
2. Natural resources and mankind (16%)

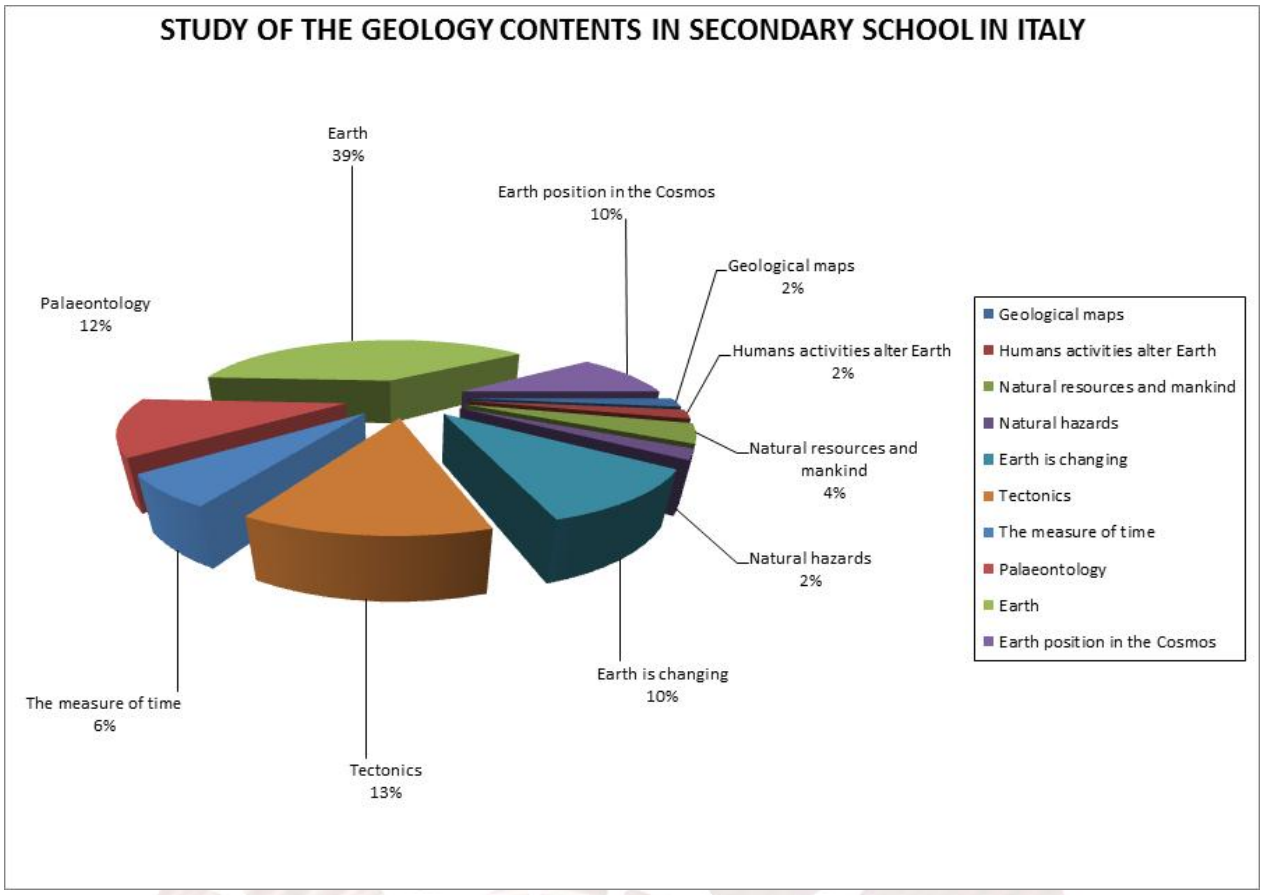


Figure 3.- Percentage of geological contents included in textbooks of Secondary School in Italy (López Carrillo, M.D.).

In Italy (Fig. 3) textbooks devote greater extent, almost half of them, to the Earth (39%) and in a lesser extent to other topics such as tectonics (13%), palaeontology (12%), Earth within the Universe (10%) or the geological time (6%).

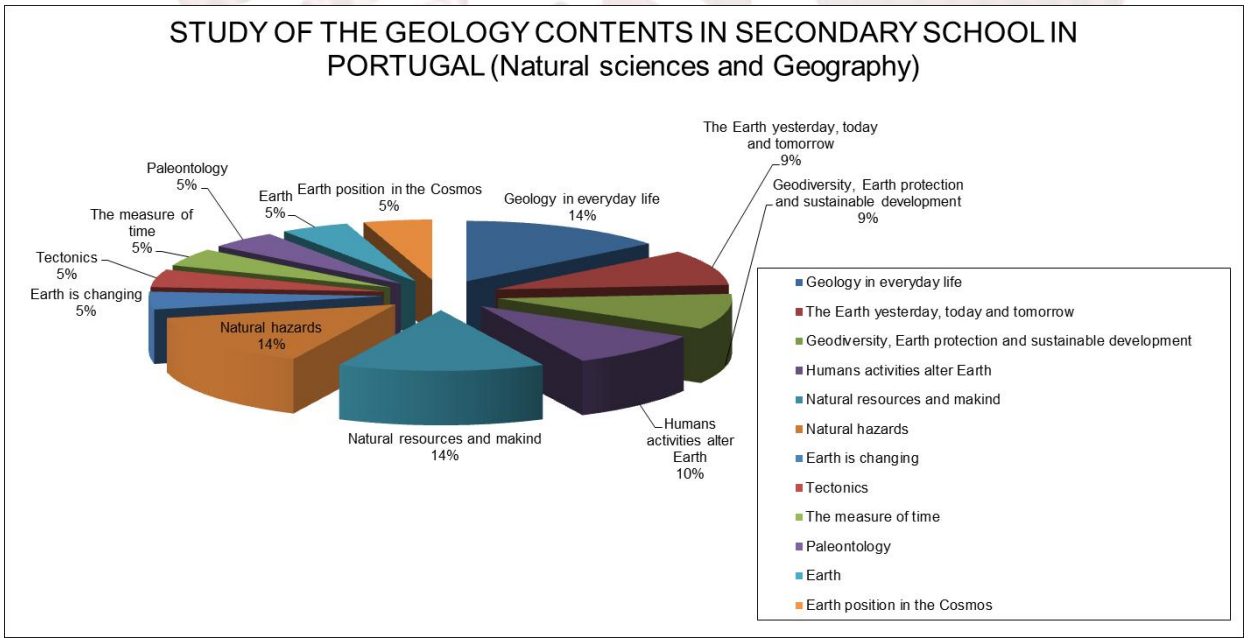


Figure 4.- Percentage of geological contents included in textbooks of Secondary School in Portugal (López Carrillo, M.D.).

The geological contents taught in Portugal (Fig. 4) are mostly related to natural resources and mankind (14%), natural hazards (14%) and Geology in everyday life (14%).

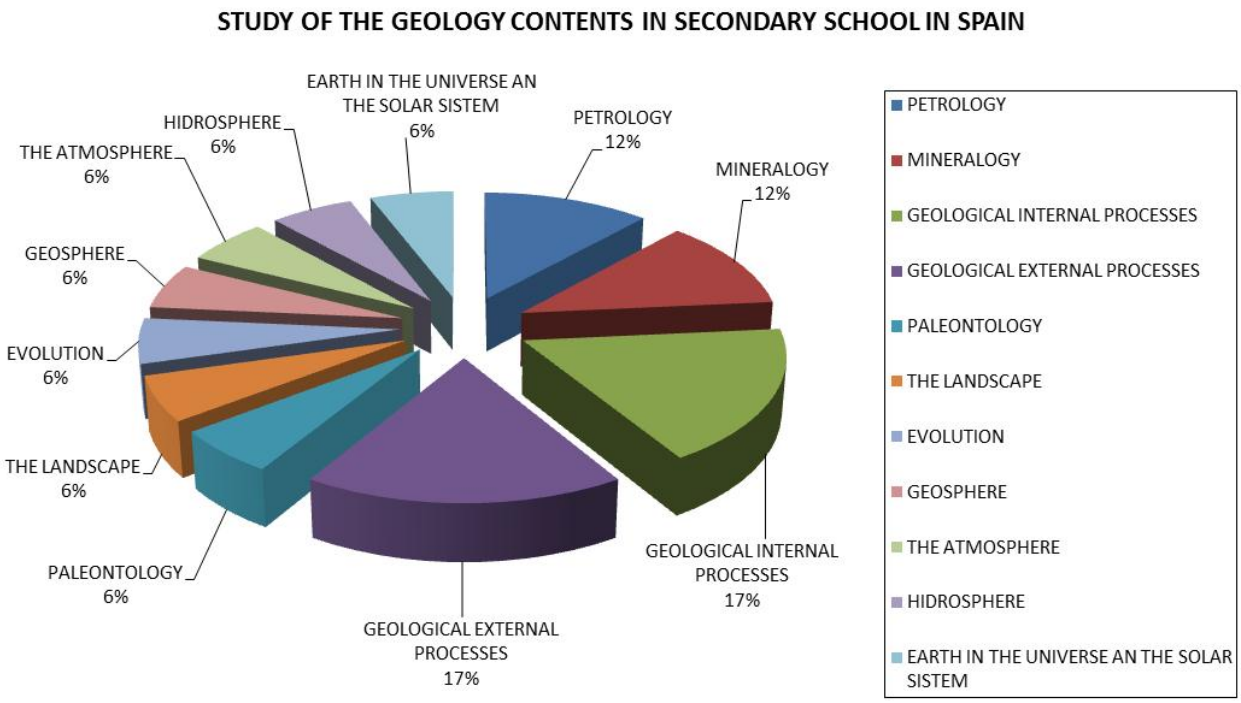


Figure 5.- Percentage of geological contents included in textbooks of Secondary School in Spain (López Carrillo, M.D.).

Finally, in Spain (Fig. 5) the most studied topics are related to geological processes followed by Earth materials:

1. Geological internal processes (17%),
2. Geological external processes (17%),
3. Mineralogy (12%) y
4. Petrology (12%).

Final remarks

According to the above discussed data we can conclude the following considerations:

1. There is no uniformity in the topics taught in the five countries participating in this research.
2. In the case of each of these countries there is not a single textbook inspiring the contents of others. It seems that the authors according to their training and experience propose, summarize or expanded geological contents targeting them to the specific situation of the course.
3. The topics taught in Portugal are the closest ones to the interests indicated by the students*.

Some of the causes responsible for the failure of interest of students in geosciences at the end of Secondary School could be answered as follows:

1. There is by no means an effective teaching of Geosciences
2. Lack of updated geological information of teachers involved in Geosciences teaching
3. In many centres geological contents are not taught or taught only very quickly to devote more time to other subjects considered to be more relevant for the following university studies.

All this research is worthless if we do not understand and find a way to propose that Geology teaching has to change. Evidently geology contents in geological textbooks should be updated in Secondary Schools, for example, the slow incorporation of new paradigms mostly come much later (as happened, for example, in plate tectonics) and this is one of the causes of the delay in Geosciences of European students.

The scientific, economic and social relevance of the geological contents has been increasing in recent decades. Most natural disasters (volcanoes, earthquakes, floods, landslides and those derived from "El Niño" phenomenon) are studied in Earth Sciences. To underline this statement it is sufficient to note that, in the first six years of this century, these disasters caused 473.000 deaths and damages worth more than 3 trillion Euros.

Thus, more than ever, it is necessary that a Secondary Education student finishes his/her compulsory education with a basic geoscientific literacy that allows him/her to know, appreciate, and participate in those subjects which affect him/her. The geological contents must occupy a significant position, not only as a cultural knowledge but as a necessity to create vocations and to attend the generational change. Have a look at any newspaper and its noticed that two out of three scientific news, and quite a few of social ones, are related to Geology, particularly in relation to the health, the environment and natural disasters.

Therefore, the economic interest represented by mineral resources (industrial rocks, fossil fuels or groundwater) the main problems which affect mankind and the future of our planet have been added (climate change, desertification, geological hazards, natural resources management, etc.) These are issues that may not be understood without the theoretical knowledge and procedures provided by Geology.

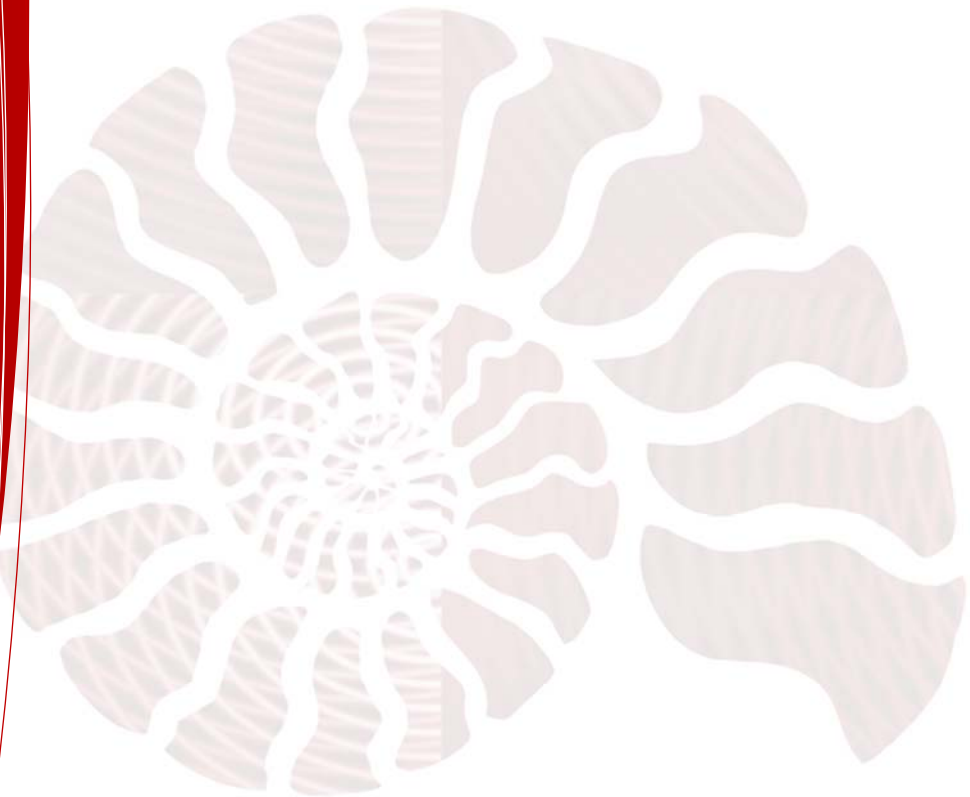
In summary, we recommend modifying and updating the contents that make up the current geological textbooks of Secondary Schools and the way in which these contents are taught in order to make them more attractive to students. Geosciences should become a separate curriculum within all European Secondary Schools. We are sure that the Geology answers questions from the scientific point of view far from be superficial. The planet Earth, and the changes that have occurred on it over time, is not a specific knowledge but instead it is a cultural science whose knowledge should be spread throughout society.

Bibliography

Hedley Brooke, John (2000). Introduction: the study of Chemical Textbooks. In Lundgren and Bensaude-Vicent editors. *Communicating Chemistry, Textbooks and their audiences*, 1789-1939, Science History Publications, USA.

*Preliminary results of the Interest Research study that has focused on the analysis of the preferences of children from Greece and Spain, towards some selected topics of geosciences. The data were obtained in 2012 on a sample of 707 children from 27 schools, in Greece and Spain. The most interesting subjects in total score for students from both countries are:

- ✓ The most interesting subjects in total score for students from both countries are “Natural hazards” and “Palaeontology”.
  - ✓ Both groups give a high rate to “Teaching strategies” i.e. the way they are presented and taught the Earth Sciences.



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