

Building a lexicon of scientific terms on earth sciences

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Abstract: The elaboration of an Earth Sciences Lexicon, i.e. a series of glossaries covering the main branches of Earth Sciences available for High schools students is a main goal of GEOSchools project. It is included as one of the main Work packages and must be fulfilled in several successive phases along the three years of development of the project. This work package is coordinated by one of the partners of the project (Guillermo Meléndez, University of Zaragoza, Spain) who is responsible for the selection, and proposal to the other partners, of most meaningful and useful terms of Earth Sciences. The final purpose of the Lexicon will be to offer a multi-lingual version of those terms most commonly used, appearing as basic or relevant in text books. In this way, it is intended to become a useful tool for students and interested people to an easy and quick access to main concepts of Geology, and an accessible comprehension, when dealing with common social problems having a geological origin (as it is the case, e.g. of Geological risks).

Introduction

The elaboration of an Earth Science Lexicon constitutes one of the main goals of the project Geo-schools. The lexicon is conceived as a set of glossaries covering the main disciplines conforming the geological sciences that can be accessible for both secondary school students and teachers, as well as for other persons attracted by geology. Included within the core purposes (“work packages”) of the project, the building of the lexicon must be fulfilled in successive stages of progress during the three years of the development of the project. Its elaboration is convened by one of the members of the project; Guillermo Meléndez; University of Zaragoza, Spain, which holds the responsibility for selecting and proposing the other partners the most meaningful and useful terms of the different disciplines of Earth Sciences. The ultimate goal of the lexicon would be to offer a multilingual version of the geological terms, which are more frequently quoted and explained in Secondary school textbooks. In this way the lexicon strives to become a useful tool for students and interested people, not only geologists, providing a quick and easy access to basic geological concepts. It can also be a way to understanding those geological concepts holding a wider social concern and interest, as it is the case, e.g. of geological risks.

The primary database

The primary databases on which the glossaries are built are, obviously, a selection of terms appearing in the most spread dictionaries of Earth Sciences (Fig. 1). Some of these dictionaries, the most classical ones belonging to well known academic editorials (Penguin; Oxford Univ. Press; Anchor...) have a wide generalist character and cover all Earth science specialities. In that sense they have been extremely useful to form the fundamental ground for this work package together with some other more precise or specific glossaries (Fig. 2). However, the complexity and width of some terms included has

made it inevitable to “filter” and carry on a selection of these terms. Such first selection work is in progress at present. However, we can make here a first distinction between those terms integrating the so called “*Permanent database*”, which will be the most of them (this is the first phase in which the selection is at present) and those that will finally form the first version of the edited lexicon, and that will probably be just a small part of them.

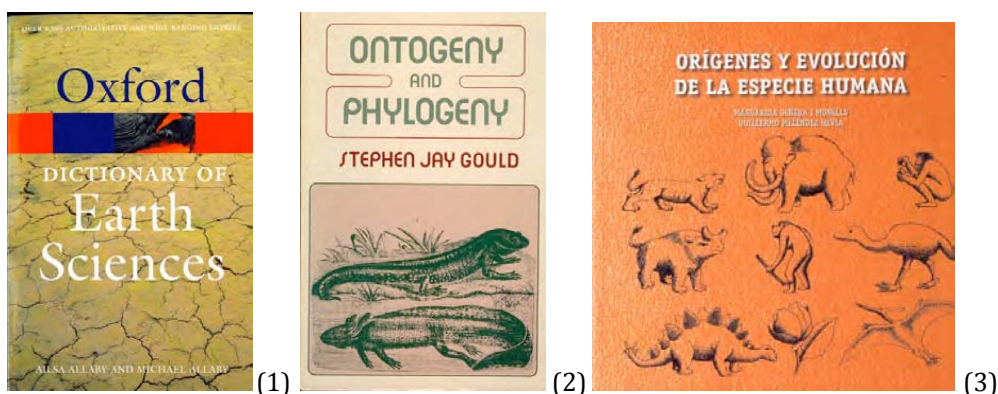


Fig. 1: Dictionaries of geological Sciences, as a basic source of geological terms for the building of the primary database.

Fig. 2: Glossary of terms on Evolution and Phyllogeny (S.J. Gould).

Fig. 3: Specific glossary of archaeological terms (M.Genera and G. Meléndez).

The second phase will include some more specific terms from specialized glossaries. Often these glossaries are included in small books and works dealing on more particular disciplines of Earth Sciences such as Phyllogeny (Fig. 2), taphonomy, Archaeology, or Geomorphology and geological risks (Fig. 3). All these glossaries have supplied new, more detailed terms on some particular aspects of Earth Sciences. In some cases, these glossaries can include local references beyond the purposes of a “universal lexicon”. These terms may not be directly incorporated to the lexicon, although they could remain as a useful part of the database.

Main information resources

As regards the main goals of the project; i.e. serving as a terminological guide and base for Secondary school students, teachers and interested people including geology students, it seems reasonable that the lexicon should cover, at least, the different fields treated and developed in the Secondary and high school texts.

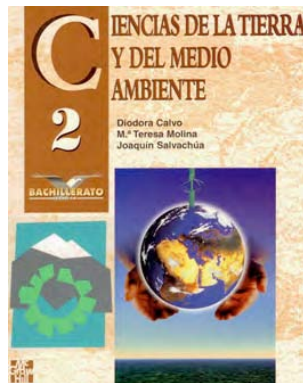
In this sense, a basic source of contents, both thematic (i.e. relative to disciplines treated) and terminological (relative to the precise terms included) have been the official textbooks of Earth Sciences and close disciplines around that are a part of Secondary school curricula.

The compilation and selection has been focused do far on Spanish texts but this should not represent a serious problem, as we can assume that geological concepts will be roughly the same in most of the countries, perhaps only with slight, minor variations from one country to the other. In Spain, the lower, obligatory secondary school level (ESO) covers the 4 year period from 12 to 16 years, whilst the upper, high school, level covers the last two years (16-18). In both such intervals two main modules named: “Natural Sciences” and “Earth and Environment Sciences” are widely taught (Figs. 4,5) whilst in the fourth

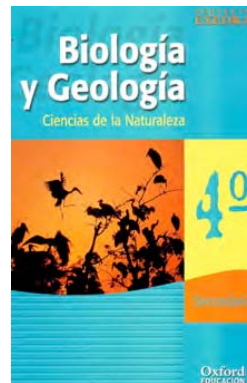
year, a module covering “Biology and Geology” is developed (Fig. 6). All of them include some superficial geological terms (most clearly in the last one) although the Geological part is always **much less** developed in extent in relation to Biology.



(4)



(5)



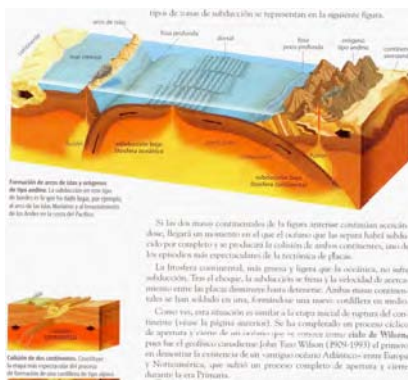
(6)

Fig. 4: Textbook of Natural sciences (1st year ESO)

Fig. 5: Textbook of Earth and environmental sciences (upper high school)

Fig. 6: Textbook of Biology and Geology (4th year ESO)

In the upper, 3rd and 4th years of the Obligatory Secondary School (ESO) a module called “Biology and Geology”, which could be very convenient to spreading basic geological concepts among the students. However, this module is only taught as an optional subject, not being compulsory, e.g. for the proofs of access to the University, so It is normally followed by few students (Fig. 6). Anyway, some important geological concepts are already developed here, from plate tectonics to some fundamentals of geological analysis and the History of life, so that students can get familiar with geological concepts entirely similar to the ones they will see in the University. For all these reasons we can consider geology textbooks as a good guide, and marker, of the geological concepts to be included in the lexicon.



(7)



(8)



(9)

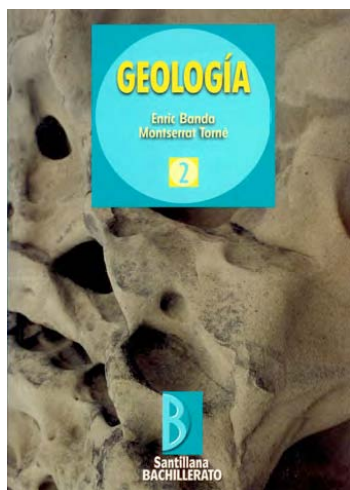
Fig. 7: Diagram included in the textbook of Biology and Geology, showing the basic concepts of Plate tectonics.

Fig. 8: Textbook of Biology and Geology, corresponding to the lower (1st year) of High school.

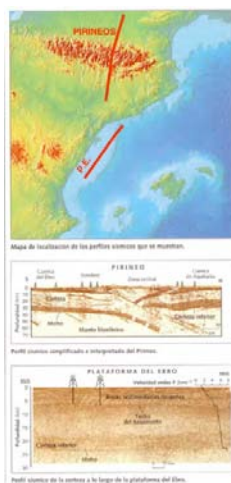
Fig. 9: Geological time table and chronostratigraphic units appearing in the same Biology and Geology textbook.

In the first (lower) and second (upper) year of highschool (i.e. from age 16 to 18) respectively, geological textbooks include, in the lower year, a “Biology and Geology” (the Biology being more developed) and, in the second, a module of “Geology”, again as

optional subjects. These textbooks clearly develop the geological concepts more in depth than they have done in former years. They include detail descriptions and classifications of rocks and minerals, as well as the geological timetable and the periods of Earth history (figs. 8-9).



(10)



(11)

El Actualismo: Un principio básico de interpretación

Una de las herramientas básicas para la interpretación de las huellas dejadas por acontecimientos pretéritos, es el *principio del Actualismo* enunciado por James Hutton en 1788 y cuyo significado queda bien expresado por la frase *el presente es la clave del pasado*. Es decir, que para interpretar hechos del pasado, es fundamental conocer la actividad geológica y biológica en la actualidad, así como la impronta que deja su acción. De esta manera podremos reconocer, en las rocas antiguas, los resultados de la acción de un torrente, una erupción volcánica o el medio donde vivieron determinados seres vivos (figs. 5 y 6).



Fig. 5. a) Llanura aluvial con río meandriforme y meandros abandonados. b) Depósitos fluviales antiguos de canal y de llanura de inundación.

(12)

Fig. 10: Textbook of Geology (2nd year; Upper level, High school).

Fig. 11: Diagram showing the structure of Pyrenees mountain range obtained by well-logging seismic analyses (2nd year; Upper level, High school).

Fig. 12: Uniformitarianism as a geological principle, exemplified in present day and past meandering river channels (2nd year; Upper level, High school).

In the module of Geology for the second year of High School (age 17-18) the concepts developed as they appear in the textbook (Fig. 10) are not significantly different from those that could appear in a textbook for University students. The approach may vary from one text to another depending on the authors, but basically, the geological concepts developed include the knowledge and scientific terms characteristic of a specialized subject, from tectonics, geophysics and sedimentology to petrology, geochemistry and palaeontology (Fig. 11).

It may be concluded that in Spanish Earth sciences textbooks, as well as in other European countries, the degree of complexity of geological concepts increases remarkably from lower to upper levels in Secondary and High school curricula. As a consequence, it is understood that a lexicon trying to cover the different terms treated and developed in school textbooks of this wide age span should also consider many aspects of all geological disciplines, which will not always be obvious or easy. A second conclusion, resulting from this difference in concept difficulty, would be that, although the lexicon would even include such complex or hard terms as those appearing in the book of Geology from the upper high school year, it would not mean the work being less useful or accessible since, all and all, a lexicon is basically a consult book in which every student should be able to find the term he is interested in.

Contents

Within the developed topics of the lexicon it can be stated that all disciplines that are a part of Earth Sciences have received similar attention. In a first phase during the first year, a special attention has been paid to the work of compiling a wide database covering the

main, fundamental fields of such geological disciplines as palaeontology, evolution, taphonomy, stratigraphy, geodynamics (partly including geological risks) and petrology. Some of these fields, most particularly petrology and mineralogy, are still in an early phase of term selection. The main final purpose for the first year of the project would be to finish the database of the following fields:

- Palaeontology (Systematics).
- Archaeology (basic concepts and general chronologic framework).
- Taphonomy (main concepts and processes, relative to fossilization processes).
- Stratigraphy: the general chronostratigraphic timetable and units.
- Geomorphology, partly including geological risks and geohazards.
- Petrology: including the detailed account of most relevant sedimentary, Metamorphic and igneous rocks.
- Mineralogy: including the most common and relevant groups of minerals.

The last two fields or topics would require a wider and detailed debate between the partners of the project, taking into account the enormous amount of entries they would include. For this purpose, the detailed revision of Secondary and High school texts, as discussed and shown above, might perhaps be a good pattern, as they already include a first selection of the most common minerals and rocks.



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