Informal Educational Strategies in Teaching Geosciences When Formal Courses Are Unavailable: The Experience of AulaGEA in Buenos Aires, Argentina

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ABSTRACT

The presence of geosciences in the curriculum of primary and secondary schools in Argentina has been highly dependent on educational policies that change frequently under political circumstances. Subjects related to geology, geophysics, meteorology, and astronomy make their appearance and disappear under the influence of educational initiatives that shift focus under changing political circumstances. This paper briefly refers to the evolution of the process in recent decades and describes the efforts made by the Department of Geological Sciences of the University of Buenos Aires to cope with the situation. In 1998, the Department established a science popularization program, AulaGEA ("geo-classroom" in English), with the goal of helping preuniversity students, teachers, and the general public acquire basic knowledge of the geosciences. This was accomplished through different activities and initiatives that are presented here with the hope that they can be useful and inspiring to others working in educational environments that pose similar challenges to geosciences education. © *2013 National Association of Geoscience Teachers*. [DOI: 10.5408/11-217.1]

Key words: geosciences, education, developing countries, IESO, outreach programs

INTRODUCTION

Geosciences suffer from serious discrimination by uninformed members of the educational bureaucracy in many countries, both in the developed and developing worlds. Spain can be regarded as an example of the former, while Argentina is representative of the latter. This paper will focus on the case of Argentina.[2] In both countries, the curriculum (including educational projects) are subjected to continuous review and change, with Earth sciences (and the sciences in general) steadily losing importance to the fields of biology and humanities, respectively. The geological community fights against this situation, working hard to help secondary school teachers cope with the task of teaching geology and advising decision makers and citizens about the importance of Earth sciences for everyday life. The quantity and quality of the activities and materials developed by the Spanish organization, AEPECT, is excellent and no doubt of great use to all Spanish-speaking countries. The effort of AEPECT is reinforced by many other educational projects based at public and private geological and educational institutions.

In the case of Argentina, educational policies—and consequently the curriculum—change continuously. Although sometimes geosciences have made a quiet appearance in the primary or secondary school classrooms, they have never reached the tertiary and university institutes where teachers and professors are taught and trained (Sellés-Martínez, 2004a). The obvious result of this omission is that teachers cannot teach what they have never learned (Bonán and Sellés-Martínez, 2002). Moreover, given the lack of official interest in the subject, there is no serious reason for publishers to invest in the development of curriculum materials or books on geosciences. The educational resources are, as a consequence, not always adequate and most of the time they lack local examples or, even worse, they are poor translations of materials developed abroad. These materials are usually translated by individuals without training in Earth sciences, with the logical consequence of mistakes in jargon, misunderstanding of concepts, and even erroneous interpretation of words and sentences.

The most serious consequence of this lack of information about Earth sciences is the negative impact on the education of the general public. The second most serious consequence is that student enrollment in geosciences degree programs at the university level is very low and fluctuates depending on students' knowledge of geology or geophysics they learn from their exposure to the subjects outside of the classroom. What is most astonishing is that this situation contrasts with the natural interest that the general public and students at all levels of education show in Earth sciences when they are asked about or get involved in geosciences learning activities.

The present contribution focuses on the efforts made at the Department of Geological Sciences of the University of Buenos Aires to help knowledge of the Earth sciences reach broader audiences. Although this paper may seem self-referenced in excess, the reader is advised that it aims to describe the situation as seen from the author's perspective. However, the reader must understand that educational materials in the field of Earth sciences are extremely scarce in Argentina, and most of what is published lacks either revision of technical parts when the original is written by an educator, or pedagogical clarity when written by scientists.

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[2]The reader interested in the case of Spain is directed to the Spanish Association for Geosciences Teaching (Asociación Española para la Enseñanza de las Ciencias de la Tierra, or AEPECT; www.aepect.org) for further details on the subject.

The reason to quote so many previous contributions from the author is not a case of egocentrism, but instead, the author aims to offer the reader the opportunity to have access to detailed descriptions of the different subjects covered in this brief presentation.

EARTH SCIENCES IN THE PREUNIVERSITY EDUCATIONAL CURRICULUM

Earth sciences and their relevance for society seem to be poorly understood by Ministry of Education experts and curriculum developers and, when incorporated after a long struggle with educators, they are easily eliminated at the first opportunity. This may be because curriculum developers have never learned about Earth sciences, or because the availability of teaching hours for all the disciplines cannot be increased infinitely. As a consequence, all the "disciplinary lobbies" struggle for the same piece of the cake and subjects related to geological hazards (such as earthquakes, volcanism, geomorphologic hazards, and floods) to which the country is prone, are hardly taught or not taught at all in schools (Sellés-Martínez et al., 2005). Lacreu (2012) has clearly pointed this out when he says that it would be impossible for a student to leave school "prepared to understand natural processes and phenomena" (as the documents of the Federal Council of Education postulate), if he or she has never learned anything about Earth sciences!

A couple of decades ago, the Ministry of Education organized a series of workshops and meetings to discuss the new curriculum, in these workshops the inclusion of Earth sciences was under debate. It was found that, as mathematics, biology, and language had been chosen as the axial disciplines of educational plans, all other subjects (with the exception of physics) only appeared infrequently in the plans. In the case of teacher training and the education of future professors, the prevalent idea at that time among policy makers was that these educators could learn Earth sciences after graduation from their programs. The fact that a great deal of language and mathematics can be taught and learned outside of classroom hours and that lab and outdoor activities associated with Earth sciences provide excellent opportunities to learn how to write and calculate, was never taken into consideration. However, although this issue is relevant to the current discussion, this topic largely exceeds the subject of this contribution.

The Oscillating Pendulum

Geosciences have appeared and disappeared from the curriculum many times during recent decades. Paradoxically, basic concepts about mineralogy and geology were present in books for secondary school in the first half of the twentieth century. Surprisingly, continental drift is indeed mentioned in some books written in the 1930s for secondary school. However, without clear reasons for it, all reference to geology has been absent from manuals and books during nearly the entire central part of the twentieth century. The extensive reorganization in the middle 1980s, incorporating the hard work of a colleague, Dr. Héctor Lacreu, at the Ministry of Education, bore some fruit (see Lacreu, 1996; 2009 on the subject). At that time, under the umbrella of natural sciences, many geological, paleontological, geophysical, and meteorological concepts were introduced in the curriculum for primary and secondary schools. On the other hand, they were only very superficially included (if at all) in the curriculum of the teacher training institutes. The result was that, with the exception of the efforts made by very enthusiastic but isolated teachers, these concepts never reached the classroom, despite the fact that they were supposed to be taught. In addition, the results of educational research conducted at the University, as well as materials and strategies designed for improved science teaching, are not published in magazines available to teachers, but instead only in academic journals intended for the research community. Teaching materials and strategies presented, for example, at educational symposia during Argentina Geological Congresses, rarely (or never) reach the classroom. Papers like those of Casadío et al. (2010) and Silva-Busso and Amato (2010) can be quoted as examples of papers that, despite describing successful experiences, will likely never reach the desk of any teacher and thus, will never fulfill the authors' objectives.

Political changes during the 1990s and early years of the twenty-first century eventually eroded the curriculum content introduced a few years before. The situation seems to be changing again, with some areas of geosciences appearing (albeit shyly) in the natural-sciences–oriented secondary schools, at least in the Province of Buenos Aires and probably also in the programs of the institutes for teacher education in the city of Buenos Aires.

WHAT CAN BE DONE IN THE MEANTIME?

With almost no Earth sciences taught at school, the only chance for citizens to acquire some literacy on the subject is generally through the media (such as after great geology-related catastrophes), and in informal environments (i.e., outside of the classroom). The problems and limitations of geological information in the media will not be discussed here, but what must be said is that it does not always reach the necessary level of accuracy. Many important errors have been identified in articles intended to be not only informative, but also educational (see Sellés-Martínez 2010b for examples).

Production of Materials and Activities for Teachers and the General Public

An exception to the general rule of insufficient teacher training in the area of Earth sciences, the SENEGEO (National Seminar in Geoscience Education) initiative was proposed in 1995 by the National University of San Luis, and organized and taught by geoscientists. The second symposium was held at the National University of Bahía Blanca (Lacreu, 1997) in 1996, but no others followed. Several activities for teacher training were conducted in the late 1980s by non-geologists who had only read a couple of books on Earth sciences. Attendees of those seminars acknowledged that the results of these activities were poor.

Referring to the production of high quality teaching resources, the only products known to the writer are three boxed collections of fossils, minerals, and rock samples. Each collection is associated with a collection of cards describing the samples and a book explaining fundamental concepts related to the contents of each box. These teaching collections were produced by the National Universities of La Plata (fossils) and Buenos Aires (minerals and rocks) in 1998 for the Ministry of Education. During that time of

political changes, the collections were underused because many of the boxes arrived late or were never sent to the teachers, and the associated training courses never reached the recipients.

Two recent publications explore the fundamentals of geology, the first by Folguera, et al. (2006) and another by Spikerman (2010). Additional materials for science popularization (primarily books, many of them about dinosaurs) have been produced by professional associations, including the Asociación Paleontológica Argentina, SEGEMAR (Argentine Geological Survey), and private foundations such as Yacimientos Petrolíferos Fiscales (YPF; "Treasury Petroleum Fields") and Fundación de Historia Natural Felix de Azara, that are interested in natural sciences and their popularization. Despite the high quality of these materials, they are generally found on the shelves of students and interested citizens, but not necessarily on the desks of many teachers.

INITIATIVES FROM THE DEPARTMENT OF GEOLOGICAL SCIENCES

With the alarming general situation of the 1980s in mind, the Department of Geological Sciences of the University of Buenos Aires launched the AulaGEA Program in 1998, and placed it under the coordination of the author. The following items briefly describe the different programs the initiative has accomplished in order to fulfill its objectives. This information is offered with the hope that it could be helpful for others in similar circumstances.

As a means to communicate with the universe of people interested in geology and geosciences education, a website for the AulaGEA was clearly necessary. While active, the website had many visitors from the Spanish-speaking world, but the lack of funds to maintain the site required closure until new funding can be secured.

Earth Science Week: An Enjoyable Wunderkammer and a Student Recruitment[3]

Following the idea of the Earth Sciences Week (ESW) organized by the American Geological Institute (http://www.earthsciweek.org), this event was instituted by the Department of Geological Sciences of the University of Buenos Aires in the year 2000, and in the following year, the Faculty of Sciences organized "weeks" for each of the disciplines taught in the institution. The first Earth Science Weeks (actually three day events) proved to be a great success, and continue to be successful events.[4] In the case of Earth sciences, the Department of Geological Sciences and that of Sciences of Atmosphere and the Oceans work together, displaying exhibits with hands-on activities, videos, collections of minerals, rocks, and fossils, and other Earth-sciences–related topics. Private enterprises (e.g., oil and mining firms) and public institutions (e.g., the Natural Science Museum, the Argentine Antarctic Institute, the National Geological Survey), usually have displays in the exhibition and not only show their research and findings, but also serve as examples to illustrate where Earth sciences professionals can find jobs. Many companies also use this platform to recruit fresh human resources "at their source," due to the fact that our undergraduate Earth sciences students are involved in the week's activities.

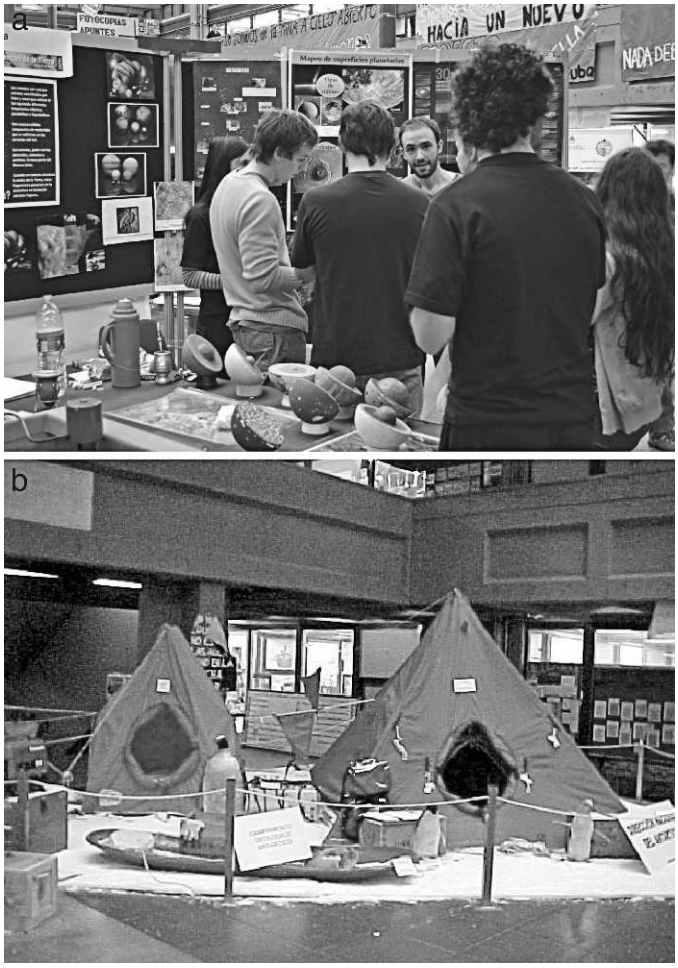

FIGURE 1: (a) Talking with researchers. (b) The tents of an Antarctic camp.

The event is held primarily in the central court of the Faculty building (see Fig. 1), an open space that allows participants to explore exhibits freely. Additional activities are held in the labs, museums, and classrooms of the various departments. Printed materials covering different aspects of Earth sciences are distributed to visitors each year. Sponsors support the publication of these materials, usually photocopied or loaded onto CDs, and this year, printed booklets were incorporated to the teachers' portfolio. Titles originally published by the Geological Survey of the United Kingdom, translated into Spanish and published by a Spanish publisher, were sold at low cost to participants (about 70 cents [USD] each) in "opportunity bookstores." The Department bought all the available copies in order to help accurately written and well illustrated scientific information find its way to the teachers, the most practical conduits for the dissemination of information.

The most outstanding and successful activities at Earth Science Week include:

- Science contests with different subjects.
- Visits to science labs.

[3] *Wunderkammer* means "room of wonders" in German.
[4] Please visit the website of the events at http://exactas.uba.ar/extension for further details.

- Exhibitions of rocks, minerals, fossils, and reconstructions of dinosaurs.
- Conferences on different topics for the general public, professors, and students.
- Workshops and training courses for teachers.

One very important lesson from the ESW experience is the active involvement of undergraduate students in all activities of the program, including development of activities, and are available during the event to guide groups and answer questions. They are easily identifiable to other participants in that they wear distinctive, specially designed t-shirts, and freely interact with visitors to the programs. Secondary school students view the undergraduate participation as a positive, accessible feature of the programming, and we strongly recommend that others interested in organizing similar events include undergraduates in the program planning and activities.

About 3,000 visitors attend the ESW each year, including secondary school students, teachers, and the general public, which is a very positive response for the Faculty of Science, and encourages support for future ESWs.

Demonstrations and Hands-on Experiences Are Good for Everybody

The number and variety of models and simulations that are performed in the ESW increases each year, and this is primarily the result of increased enthusiastic involvement of the students in the Department of Geology. Along with the fact that young visitors communicate better with our students than with researchers, an unexpected (but welcome) outcome is that, while preparing and demonstrating models and answering questions from the public, our students learn more on the subject than they would in their normal classroom situations.

Talking Face-to-Face to Science Students, Researchers and Professionals

The ESWs give young visitors the opportunity to talk about the experiences of "being a science student" and "being a scientist" with our undergraduate students and researchers (see Fig. 1a). This firsthand information is important during the time they are making decisions about courses of study and the places to study. This aspect of the program is highly appreciated by academic authorities, so programs involving the presence of university students in secondary schools and that of university preparatory students at the Faculty are run every year with great success.

Training Workshops for Teachers and Professors

Most teachers lack any serious training in Earth sciences subjects. To help solve this problem, several workshops are conducted each year to provide information to teachers, and to support their work with teaching materials and strategies. Geological hazards, fossil formation and classification, continental drift and plate tectonics, water resources, and structure of the Earth are some of the topics covered. Participating teachers agree that these workshops are useful and fulfill their expectations. Indeed, it is interesting that they find these workshops more interesting and applicable than those they occasionally receive from nongeologists. They pointed out that experience working and investigating in geosciences makes a great difference when teaching the subject. The quality and quantity of information, plus the personal involvement in the different subjects, cannot be approached by trainers that just teach from what they have read in books.

The Art and Science Approach to Science Popularization

The use of art history and masterworks has proven to be one of the most effective strategies in teaching about geosciences in informal environments. Several activities on the subject have been developed and are summarized below.

Intriguing Talks

The use of intriguing titles is a longtime practice in journalism, and the author has borrowed this practice for his profusely illustrated, 60- to 90-minute talks. Both well-known and rare examples interweave through each talk, with the speaker acting as a guide, explaining concepts and making the relationships among them more evident, without taking on the role of the old-fashioned lecturer. Examples of popular talks are "Geology of the Wedding Anniversaries" (Sellés-Martínez, 2004d), "What Do Seismic Waves Tell Us?" (Sellés-Martínez, 2005b), "How Was the Plate Tectonics Theory Built Up" (Sellés-Martínez, 2006), "Fortunately I Found Stones in My Way" or "Pebbles in Culture" (Sellés-Martínez, 2010c), and other ones, not yet published, such as "Science and Art: The Tale of an Impossible Love?", "Learning from Mistakes," and "The Earth: Guilty or Innocent?".

Fishing for Geosciences With an Art Hook

The importance (and even the need) to relate science and art as complementary disciplines has long been recognized and recommended by education agencies like UNESCO, and many articles on the subject have been published in educational journals. To this end, several initiatives have been conducted that have produced very good results, namely:

- Courses on "What is Art made of"? (Sellés-Martínez 2008b) and "A Sculpture Named Earth" (Sellés-Martínez, et al. 2004).
- Presentations on "Volcanism, an Eruption of Art," "Geosciences in Advertising" (Sellés-Martínez 2010a), "Illustrated History of Knowledge About the Earth's Interior" (Sellés-Martínez 2008a), "Can Beauty be Reduced to a Mathematical Expression?" (Sellés-Martínez 2005a), and "How Do New Ideas Take Shape? Part 1: Exploring What Artists and Scientists Share (and What They Do Not Share)," (Sellés-Martínez, 2009).
- Workshop on "Using Art to Teach Science." Different presentations and bibliography related to science (mainly Earth sciences) and art are analyzed and discussed. Teachers are encouraged to prepare a class following the art and science approach and, afterward, the group comments on and evaluates the results.
- Short articles in the Faculty journal, *Exactamente*. The name of the Faculty journal plays with the Spanish words "exactamente," which means "exactly," and the related one, "exacta" (exact, accurate) and "mente" (mind, brain). It targets mainly secondary school teachers and the general public and, in the

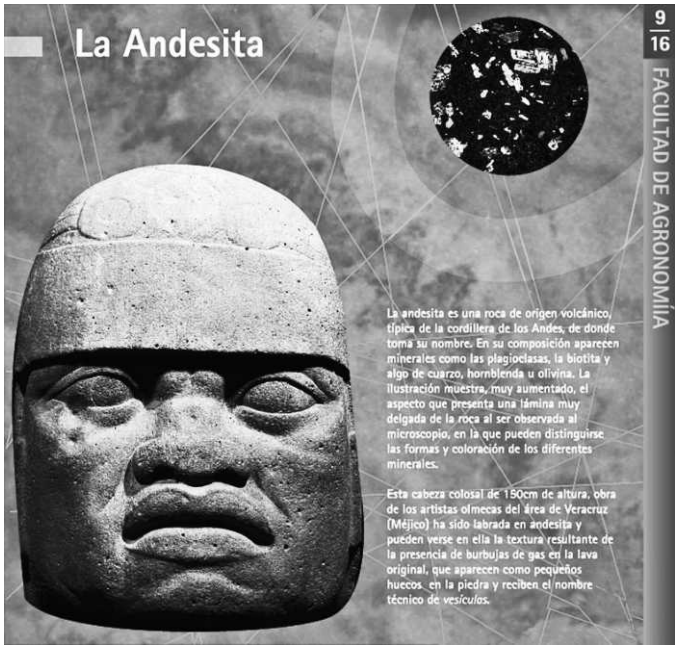

FIGURE 2: Panel from the exhibition, "Geologic Materials in the Arts." From a set of 16 panels, each measuring 1.40 m × 1.40 m.

most recent issues, a section related to relationships between art and science has been incorporated. These short articles are published and distributed in hard copy form, but they are also available at the magazine blog[5] and have received positive comments from visitors.

- Exhibitions on "Geosciences in the Arts" and "Geologic Materials in the Arts" (Sellés-Martínez 2004c) have initiated the activities of AulaGEA on the subject and have been highly successful (see Figs. 2 and 3).

At present, two other exhibitions are in preparation. One will be displayed in the City Institute for Historical Research and Patrimony. Titled "What Are You Made of, Buenos Aires?", the exhibit describes how geologic materials, in both raw and manufactured forms, appear in the city. Displays with information presented in text and visual illustrations are complemented by an exhibition of archeological, historical, and present-day materials that involve rocks and minerals in their manufacturing.

The second exhibition is called "The Pampas Before the Wire . . . and Afterwards." This exhibit is funded by the Faculty, and involved the participation of the Department of Atmosphere and Oceans Science and the Department of Geology. The exhibition describes the evolution of the Pampas landscape as humans, cattle, and crops invaded the area over the last three centuries. Under this general scheme, texts from travelers, historians, and writers describing the landscape during different times are included in the panels. The same was done with painters, whose works depicting this region are reproduced to enhance the learning

FIGURE 3: Panel from the exhibition, "Geosciences in the Arts." From a set of 17 panels, each measuring 1.20 m × 0.90 m.

experience of visitors. The scientific approach of the Pampas exhibit includes the description of the morphology, soil, and subsoil of the region, along with surface and underground water resources. The continuing problem of drought and flood cycles is also taken into consideration from historic and scientific points of view. Geological resources of the area are also presented and the environmental issues associated with their exploitation are analyzed briefly. The meteorological and climatic aspects are also covered, with maps and diagrams employed to explain the regional and local features. Figure 4 reproduces 2 of the 19 panels of the Pampas exhibition, and both exhibits are designed to be available to schools and civil societies, along with training workshops and presentations on the subject.

Teaching Geology to Artists

An invitation from the National University Institute for the Arts (IUNA) to present a conference on the links between art and science resulted in a joint proposal to present a seminar on "Exploring the Relationships Between Art and Science" for multimedia students in 2010. This event marked the beginning of a period of fruitful relationships between science- and art-teaching institutions in Buenos Aires. "The Role of Art and Science Communication" and "The Materials Used by Artists" are the titles of the seminars offered in 2011 and 2012. Most recently, for the IUNA degree program, Preservation and Restoration of Patrimonial Goods,[6] the professor teaching the course on materials asked the author for a classroom presentation on the origin and properties of natural stones. The presentation was so well received that the author was invited to join the regular teachers of the materials course in a visit to the Monumental Cemetery of Buenos Aires, a training activity for the students that is an important part of the course.

Teaching Earth sciences to nonscientific audiences that need scientific knowledge in specific fields for professional

[5] See, for example, http://www.fcen.uba.ar/fotovideo/EXm/NotasEXm48/exm48artes.pdf.

[6] Historic conservation and preservation of works of art and heritage decorative and practical objects, both secular and religious.

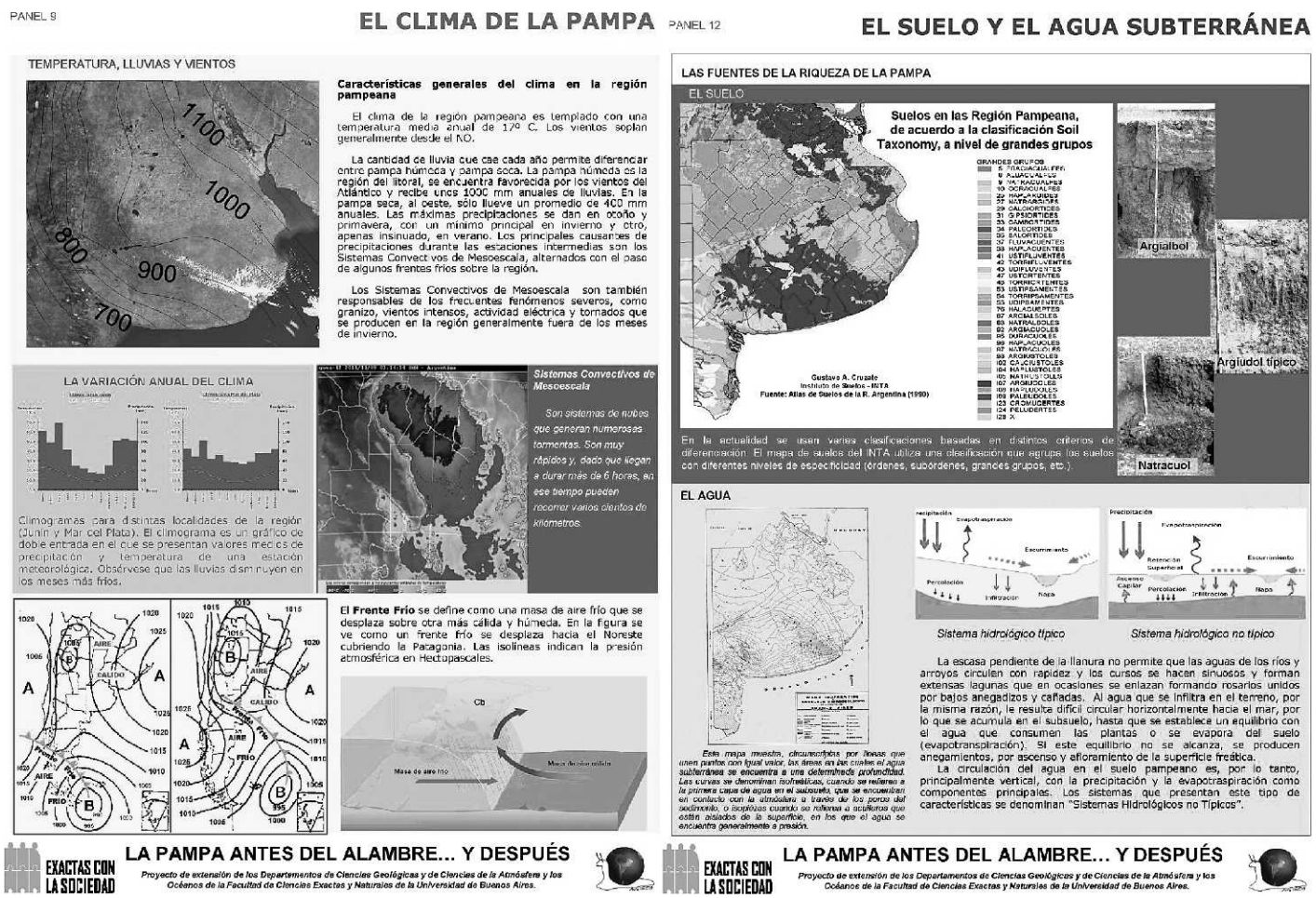

FIGURE 4: Panels from the exhibition, "The Pampas Before the Wire . . . and Afterwards." Two panels from a set of 20, each measuring 0.60 m × 0.90m.

reasons proved to be a rather interesting and enriching experience. Depth and breadth of scientific concepts must be balanced with the specific interests of the audience to maintain the equilibrium of material presented. Key points to success in these classes incorporating scientific information into arts-oriented curricula include (1) including as many illustrations as possible, and (2) keeping physics, chemistry, and mathematics at their conceptual levels with as few equations as possible.

Let Them See What You Are Talking About!

Giving talks with an eye-catching appeal is, undoubtedly, the key to keep listeners' attention and foster their interest in the information presented. It is not news that the present generation responds less well to long, lightly illustrated lectures, and relies more and more on visual learning. Taking this into consideration, our presentations include many illustrations and occasionally feature animations if they are needed to clarify a point. More than one hundred drawings, photographs, and other illustrations are used in each of the presentations, but they are all very simple and easily understandable at a glance. These illustrations help with "wrapping up" concepts, and visually describe processes and phenomena, providing clues and facilitating mental associations that help to fix concepts in the participants' minds. PowerPoint and other presentation tools make the use of illustrations and animations simple and economical, rendering excellent results that were unimaginable at the time when projection of slides or transparencies were the only means to add visual interest to a long talk.

The Earth Sciences Olympiads

Earth Sciences Olympiads are not yet an activity throughout the world, but the interest in them is rising in the international geology-teaching community. More countries organize them at the national level each year, and more countries participate in the international Olympiads since they were launched in 2007. AulaGEA considered them a good opportunity to make Earth sciences visible to the citizens and, thus, decided to get involved in the organization.

The National Earth Sciences Olympiad Project in 2006

The author, as member of the International Committee of the IGEO (International Geosciences Education Organization) was invited to participate in the meeting that fostered the organization of the IESO (International Earth Science Olympiad), which took place in Seoul, South Korea, in 2004 (see Kim and Youngsun, 2004 for details). After returning to Argentina, the author initiated efforts to implement and organize the local Olympiad to raise interest in Earth

sciences, and to serve as a means to select Argentine representatives to the IESO, following suggestions by participants at the Seoul meeting for competition preparation and development of evaluation strategies (Kim and Youngsun, 2004; Sellés-Martínez 2004b).

Although the subject was promoted through professional associations, the fact that Earth sciences were not recognized as a distinct discipline in the curriculum did not allow the Ministry of Education to recognize and back the event financially. In spite of this disadvantage, the Faculty of Sciences of the University of Buenos Aires decided to undertake implementation of the Argentine Olympiad and called on the Geology Department and the Atmospheric and Oceans Sciences Department to organize it. The organizers created a national committee, but were disappointed in the number of participating institutions. In spite of the lower than expected participation of teachers around the country, the committee developed teacher training workshops and materials for the program. The subject of the Olympiads was chosen carefully to facilitate the participation of geography teachers, and to represent knowledge from the Earth and atmospheric sciences together, with an emphasis on social relevance of the disciplines. The Olympiads were thus organized around the subject of the floods in the Buenos Aires Province. Unfortunately, few teachers who expressed interest in the Olympiads attended the workshops, and few of the students that were selected to take the exam were adequately prepared. These disappointing results (contrasting with the excellent results obtained by the same institution when organizing the Chemistry Olympiad, for example) and the lack of official support from the Ministry of Education, has frozen any initiative for Argentina's official participation in IESO. On a broader geographical scale, UNESCO officers at the Montevideo, Uruguay, headquarters for the Latin America and Caribbean (LAC) region welcomed the idea of a regional Olympiad when they were informed that Argentina was planning its national Olympiad. Leaders designed this ambitious project, but, unfortunately, it never found financial support.

OTHER STRATEGIES THAT PRODUCED GOOD RESULTS

Incorporating Prestigious Partners

Joining a Successful Worldwide Initiative

Earth Learning Idea (ELI) is an outstanding initiative from a group of teachers at Keele University in Great Britain (www.earthlearningidea.com) that provides interesting and easy activities to use in teaching Earth sciences that use low-cost materials and may be downloaded for free (King et al., 2009). When AulaGEA became aware of the initiative, the organization immediately offered to translate ELI services into Spanish. The idea was to bring these activities, with a minimum of effort, to the Spanish-speaking community of geology teachers around the world. More than 50 of the initial activities have been translated into Spanish and the number of visitors to the Spanish-language site increases continually.

A Partnership With the Scientific Society of Argentina

In 2011, a new project was launched that involves organization of cultural activities by AulaGEA in association with the Scientific Society of Argentina (SCA), the oldest of its kind in the country. The SCA provides AulaGEA with its convenient and comfortable facilities for presentations, courses, and conferences. The campus of the University of Buenos Aires (where the Faculty of Sciences is located) is located far from the center of the city and is not convenient for the general public, so the offer of space in SCA's convenient central location is crucial for AulaGEA to attract participants to its programs. The first programs offered by AulaGEA in this location have been successful, judging from the increased number of participants and the interest in programs expressed in evaluation forms submitted after events. Activities to date include:

- A cycle of conferences on "For the Love of Art . . . and Science" that includes many of the author's most popular topics.
- A course on "Marbles and Granites: From the History of Earth to the History of Art" was followed enthusiastically by more than 50 people with widely varying backgrounds, ranging from architects to students of art, to collectors of stones, to curious citizens. The course covered the origin and classification of minerals and rocks, and their use in architecture and sculpture, from the Venus of Willendorf to the present. Materials focused on the geographical distribution of old quarries and on the origins of the names of rocks, including local types of stone, quarries, marbles, and granites. In addition, it addressed issues of care and preservation of stone monuments, with an emphasis on several restoration works carried out on well-known buildings in the city of Buenos Aires. Thin sections of rocks, the fantastic "Fossil Art" production (Seilacher, 2008), and images of many well-known and lesser-known works of art made the 9 hours of the course visually compelling and the entire program a significant teaching and learning experience. The course wrapped up with a geological survey along one of the commercial streets in the city, where a great variety of ornamental stones can be found in the façades of buildings, providing an interesting real-life experience in identifying stones utilized in architecture.
- A cycle of presentations, "Celebrating UNESCO Days of Observance," relates to the science-related days of UNESCO (such as World Water Day, World Oceans Day, and World Climate Day). Presentations are organized with one eye on science and the other on art. For the World Water Day, a program entitled "The Art of Water" was presented. The invited artist was Alicia Antich, who is largely involved with the use of water in her visual art. She spoke about her production technique and the reasons why she is so interested in water as the material of her work. A short PowerPoint presentation served as an introduction to the scientific side of water, its properties, and its importance for life in general and humankind. In a similar way, for the International Mother Earth Day, another artist, Teresa Pereda, was invited to talk about "The Earth: Subject and Matter of Art." Future presentations will continue along this line with such titles as "Life in the Oceans of the Past" for the International Days of the Oceans, and so on.

CONCLUSIONS AND RECOMMENDATIONS

Shadows and Lights

Argentina has experienced difficulty promoting and maintaining geosciences education over the last several decades. This lack of continuity has resulted in difficulty implementing courses of study in Earth science. The fact that these courses had not been taught consistently to educators has resulted in teachers and professors being unprepared to utilize the curriculum. Regardless of the efforts made by different institutions, the average citizen does not have exposure to academic study of the geosciences. This leads to situations such as widespread misinformation about the relevance of minerals to everyday life and the passing of laws that forbid any kind of mining activities in many provinces. More intensive work at Ministerial levels and initiatives such as Earth Science Week, which should be adopted by all universities that teach geology, are urgently needed to create the basis upon which to start building a widespread perception of the relevance of geosciences for society. In addition, these initiatives should be designed to change the popular idea that geologists are people that only study ancient civilizations, or simply strange individuals who study rocks for no clear reason.

Several initiatives have been implemented, primarily by the Department of Geological Sciences of the University of Buenos Aires, to counterbalance these negative factors. Most of them have been listed and summarized in previous paragraphs. The purpose of these initiatives is to raise interest of the general public in geosciences, and to help the public realize the importance that geology and related sciences have for both everyday life and the long-term future of the planet Earth.

In conclusion, it can be added that, despite the "official" indifference towards geosciences, citizens are generally deeply and enthusiastically interested in them. This interest is encouraging, and can support the success of any program involving exhibitions, lectures, Earth Science Weeks, or other geosciences-related events that bring knowledge in the areas of geology, meteorology, and other Earth sciences to the general public. It is important to point out here that successful events are not necessarily expensive and, in most cases, foundations and enterprises related to the geosciences can help fund the projects. For example, the cost of the 20 panels for the exhibition, "The Pampas Before the Wire . . . and Afterwards," printed in full color on heavy paper, was less than $1,000 US. Most important, however, is the dedication of enthusiastic and informed individuals who volunteer to research, select, and organize the information and to design the panels in an accessible and clear way that captures the interest of the visitors. Fortunately, these talents and skills are readily available, even in places or countries where Earth science education is not (yet) strong.

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