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VIEWS

Educational Materials for Schools to Promote Geosciences and Mining

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The Earth is our home, and we all depend on its natural resources. All of our minerals and metals, as well as much of our water, energy, and construction materials, come from the Earth's shallow crust. Our understanding of the Earth through geology can lead us to the safest areas to live and allow us to construct cities, roads, dams, etc., and it can help us to obtain the resources we need in order to live in as sustainable a manner as possible. Anything that is made of minerals, metals, plastics, sand, stone, and cement is provided by Mother Nature. The products we use every day—from cars to cell phones and computers—come from elements that are derived from minerals after they have been recovered by the process of mining. For these reasons, geosciences and mining are critical for modern society.

The mining industry in Mexico is one of the most important economic activities of the country, as well as being essential to society, and yet it is poorly understood by many people in government, as well as by nongovernmental associations, social groups, the media, and communities near mines. This lack of understanding has increased in recent years, and is commonly based on the mistaken premise

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that mining is fundamentally harmful to humankind.

Mi Mexico es Minero is an educational project about geosciences and mining for secondary school teachers and students, undertaken by the Mexican Mining, Metallurgical and Geological Engineers Association (AIMMGM), the largest association related to the industry in Mexico. At the beginning of this project, several mining groups and mining services companies provided support to print the final products.

The Association realized that it is crucial to educate teachers, students, and society in general about the geosciences, the importance of mining and the materials it produces, and the essential role that mining plays in our lives. In order to promote geosciences and mining, both to plant a seed to influence their treatment in formal education and to emphasize that we all need mining for a modern and comfortable way of living, the Association concluded that it should help to inform people during their first years of education. The AIMMGM education committee that I chaired from 2010 to 2012 accepted the challenge of producing educational materials to promote the geosciences and mining to Mexican students.

The first product, launched in 2011, was a little book for elementary school students entitled *Mining in Our Everyday Life (La Minería en Nuestra Vida Diaria)*, with 70,000 copies printed and distributed both in elementary school libraries and to students directly around Mexico. The first edition of *Mi México es Minero* was distributed in 2012 to high school libraries and teachers. Its main purpose was to advocate for geology, mining, and metallurgy and demonstrate that mining in Mexico can be a sustainable activity that considers the environment. There was also an emphasis on the professions related to these topics, so that students with an interest could recognize career opportunities. All in all,

the publication was meant to (1) promote awareness of the essential contribution that mineral resources make to the modern way of life, principally by providing teacher education in mineral resources, including geology, exploration, development, extraction, uses, conservation, and the economics of minerals, (2) awaken interest in the study of the geosciences, mining and metallurgical engineering, and the sustainable development of mineral resources, and (3) provide fact-based educational material to help balance the negative view that Mexican society has developed about the nature of mining. Although initially intended as a useful resource for teachers to strengthen the process of teaching and learning for high school students, we also found that the information in this book, along with the simple way in which it was written, was suitable for society in general.

In order to develop appropriate material to complement the school curriculum, we first conducted a detailed examination of the courses and textbooks that are studied by junior high school students in Mexico. After identifying the subjects related to geology, mining, and metallurgy that were included in those courses, the authors devised complementary topics or chapters that should be included in *Mi México es Minero*. The objective was to provide support material for high school courses such as geography and chemistry, focusing on various topics that are covered by these courses, including plate tectonics, volcanic activity, seismicity, mineral resources and mining regions in Mexico, qualitative properties of minerals, methods of separation of minerals, crystallization, transformation of mineral materials, and the recovery of metals. In this way, we sought to ensure that the book was pertinent to

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the national curriculum, so the teachers and students would be able to use it as a reference or study guide.

Through the topics addressed in this book, teachers have the material to provide factual, science-based education to their students. Teachers may increase their knowledge of the geosciences, analyze information to develop lesson plans appropriate to different grade levels, and, most importantly, understand the importance of mining and the minerals industry in today's society.

Twenty thousand copies of the first edition of *Mi México es Minero* were printed and distributed around much of Mexico. At this stage, we realized that we needed many more copies to reach more schools and that the topics included in the book were sufficiently general that they could help a wider audience to better understand the geosciences and mining. Thus, a second edition was prepared, including two new chapters on the use of water in mining and the role of cyanide during gold processing. A further 10,000 copies of this second edition were printed.

The scope of the third edition of *Mi México es Minero* (2015) was revised in order to expand on the previous editions. Based on the first two editions, we realized that these materials can help to inform public servants in government offices and the public in general about the realities of mining.

The new edition* is richly illustrated with pictures of minerals, rocks, mines,

and industrial plants, and includes topics such as the following: what a mineral is and how it is formed, what a mineral deposit is, the process of mineral exploration, discovery, and exploitation, steps to make a mine and how a mine operates, how minerals are extracted from rocks, and respect for the environment. Discussion is included on proper care of the environment during the mining process, facts about the use of cyanide as well as water in mining, and the minerals used in the technological world.

Copies of the first and second editions of *Mi México es Minero* were distributed by either the association office or mining companies to both high school libraries and students, largely in mining states, and subsequently to whomever we thought would benefit by having this text available.


Approval by the Federal Board of Education in Mexico to use this material nationwide has not yet been formally requested or granted. It is very difficult to implement modifications, as any addition to a curriculum that has a fixed number of hours in a year means cutting back on something else. However, this material has been used informally by teachers and students through their school libraries. Having a printed book as reference in a library also aids teachers in developing lessons and homework related to geosciences and mining.

Including this material in the nationwide curriculum will require

considerable lobbying by AIMMGM to the Board of Education, with the task being difficult if the educational board members are not convinced about the importance of geosciences and mining to society.

We have learned that preparing materials to promote the geosciences and mining to people who are unaware of the necessity of mining is an elaborate task. Knowledge of the related topics included in the high school curriculum is essential to provide ideas for the subjects and chapters that should be included in a book for school use.

Our next goal will be to have similar materials available online, as it will be easier for young people to learn about the geosciences and mining when they search the Internet about these subjects. This is essential to help counter the disinformation that is widely present online.

Finally, since the issues and problems of exploration and mining from a social point of view are similar in many countries around the world, despite different languages and cultural perspectives, I encourage other associations in other countries to develop fact-based educational resources of any kind and for any level, and to make this information widely available. This will allow students and teachers, local communities, journalists, politicians, public servants, and society in general to be reached with the facts that are essential to make informed decisions and choices. 

***Editor's note: The AIMMGM has agreed to make a PDF of the 3rd edition of *Mi México es Minero* widely available at the link below:**

<http://gaia.geologia.uson.mx/academicos/monreal/MiMexicoesMinero/MiMexicoesMinero.htm>