Spain celebrates its Year of Science honouring Mendeleev

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The winter of 1907 was particularly cold in St. Petersburg. Mendeleev suffered a strong flu since last December. Despite this, he had to go to the Office of Weights and Measures, as the Minister of Trade and Industry had a visit scheduled for that day. That was a bad decision, which further deteriorated his precarious health. Shortly thereafter, on February 2, Mendeleev died at his home while his wife, Ana Popova, was reading to him a passage from one of his favourite books, *A Journey to the North Pole* by Jules Verne. A few days later, he was buried at the Volkovo cemetery, next to the tomb of his mother, Maria Dimitrievna. Those days, the cold was so intense that the workers could only write his name on the tombstone. There, even today, is only his name. Someone commented "on a tomb as it could not be put otherwise." His former students of the University of St. Pertersburg carried a large banner at his funeral with the Periodic Table in which Dmitri Ivanovich Mendeleev lives forever.[1]

A hundred years later, Spain celebrated the Year of Science with a large number of activities. This was an excellent opportunity to raise public awareness and promote Chemistry on the occasion of the centenary of Mendeleev´s death. Now we share some of those activities with the readers of Chemistry International.

The Periodic Table as a Tool to Promote Chemistry

The Periodic Table is perhaps one of the most popular icons of Science. It is hung in our Chemistry classrooms, found in many Science books, in most laboratories throughout the world, and even in advertisements, logos, and T-shirts. It summarizes, not in an equation, but, in a powerful image the order and periodicity in which all matter is organized. Its construction, still going on, is a team effort and one of the best examples of international collaboration, since at least thirteen countries have contributed with the discovery of elements. The Periodic Table is also one of the best known activities of IUPAC which standardizes and organizes it as new elements are discovered. We had very little doubt when we decided that the Periodic Table, the great legacy of

Mendeleev to future generations, was the official image of the activities organized to promote Chemistry this year in Spain.

A Stamp to Celebrate Mendeleev Great Legacy

The Mendeleev´s Year began formally on February 2, 2007 with the launch of a very special stamp entitled "Tabla periódica de elementos de Mendeléiev" (Mendeleev's Periodic Table of Elements), shown in Figure 1. This is surprisingly the only stamp that has been dedicated to the Periodic Table to date and the second ever devoted to Mendeleev by a non Soviet country.[2]

When the Spanish General Post Office (Correos) proposed me to design this stamp, through my friend Prof. Roman Polo, I was writing a review article about philately dedicated to Mendeleev, recently published in *Anales de Química* - the official journal of the Spanish Royal Society of Chemistry - (cover page shown in Figure 2).[2] Spain has relatively few stamps on Science and Technology. In fact, until the emission of the stamp dedicated to Mendeleev´s Periodic Table herein described, there was only one Spanish stamp clearly related to Chemistry, although at least other fifteen stamps are devoted to related subjects. This is the 1983 stamp "Bicentenario del descubrimiento del wolframio" that celebrates the two hundred years of the discovery of the element wolfram by Juan José Delhuyar (1754 - 1796) and his brother Fausto (1755 -1833).[3]

From the beginning, it was clear to me that this would be a great opportunity to give a modern and positive image of Chemistry. I wanted my design to be radically different to the more traditional stamps previously issued, shown in Figure 2. Piet Mondrian (1872–1944) Neo-Plasticism served me as inspiration. The colourful box-like designs of his paintings are very suitable to design a new version of the Periodic Table with bright plain colours, black thick borders, and simplified forms. I choose the colours of each block from the ones shown at the webelements webpage,[4] as a tribute to an icon of a modern, online Peridic Table with thousands of hits per day. The main feature of this new version of the Periodic Table are four void spaces corresponding to the elements predicted by Mendeleev: ekaboron (scandium), ekaaluminum (gallium), ekasilicon (germanium) and ekamanganese (technetium). These have been included to celebrate Mendeleev´s genius who not only ordered the known elements, but predicted the existence of new elements, and even their properties with amazing accuracy; something that allowed for an early confirmation of his Periodic Law. A recent issue of *Philatelia Chimica et Physica*, which has on its cover this new stamp, includes an article in which I described with some detail some relevant aspects related to this stamp. For those interested this is a good source of additional information.[5]

Although the Periodic Table (or same portions of it) is shown in some stamps, as the ones related to Mendeleev,[2] the stamp herein described is probably the only one ever dedicated to the Periodic Table. Including a stamp issued Djibouti on 2006, this is only the second stamp ever dedicated to Mendeleev by a non Soviet country. Although, the large number of stamps on famous chemists issued by countries like Germany, UK, France, Sweden, and USA, only URSS (1934, 1951, 1957 and 1969), Poland (1959) Bulgaria (1984), and the The Democratic People's Republic of Korea (1984) issued stamps on Mendeleev until 2007, before the fall of the Berlin wall (November 9, 1989). Although Mendeleev died well before the October Revolution (October 25, 1917), politics excluded him from the Western philatelia until one hundreds years of his dead.

The General Post Office of Spain issued the first 45,725,000 copies of the stamp "Tabla periódica de elementos de Mendeléiev" on February 2, 2007 exactly a century after Mendeleev´s death, at the price of 0.30 euros (first class) in a limitless edition. On the eve of its emission, the stamp was officially presented at the *Residencia de Estudiantes* (Madrid, Spain) on February 1, 2007. The Minister of Home Affairs (*Ministro del Interior*), Dr. Alfredo Pérez Rubalcaba; the President of the General Post Office, Dr. José Damián Santiago Martín; and the President of the Spanish Royal Society of Chemistry, Prof. Nazario Martín León, attended the crowded presentation of the Mendeleev stamp. For this occasion, the Spanish General Post Office issued a special postmark (emission eve postmark) that was used during the ceremony to cancel 3.000 first day envelopes. The day after, February 2, exactly 100 years after Mendeleev´s death, the 5 million 40.9 x 28.8 mm Periodic Tables were issued. This is probably the larger dissemination of the Periodic Table ever done and an efficient and smart way to promote Chemistry.

Recently, Daniel Rabinovich wrote an excellent note about this stamp in his section of this journal, *Stamps International*.[6] The stamp contains also hidden codes to be discovered, teaching lessons, and above of a profound tribute to Mendeleev. The use of this stamp as a didactic tool to introduce students to the Periodic Table, Mendeleev´s life, and the History of Chemistry has been nicely highlighted by Prof. Gabriel Pinto in *Education in Chemistry* and the *Journal of Chemical Education*.[7,8] He uses this stamp in the activities described in those articles in his classes at the Polytechnic University of Madrid. Many other media, more of less related to Chemistry and/or Philatelia, has covered the emision of this new stamp higlighing different aspects such as its modern design, being the first one dedicated to the Periodic Table or its connection to Mendeleev´s centenary. Some cover pages, and articles describing the stamp are shown as a collage in Figure 3.

A few months ago, the University of Jaén decided to decorate the wall of its Experimental Science Department (*Facultad de Ciencias Experimentales*) with a large version of the Periodic Table of this stamp. Figure 4 shows this beautiful Periodic Table made of ceramic tiles on its inauguration day on November 22, 2007. We were impressed to see such a large version of the periodic table (3.80 x 2.70 m) that is usually only a few centimeters long on the stamp.

Design your own Periodic Table: First Periodic Table Design Competition

The Periodic Table is not the fixed organization of elements hanging on the Chemistry classroom, but a living creature that grows and changes over time. There are literally hundreds of versions of the Periodic Table, each one emphasises a different aspect of the Periodic Law. So, why not giving to everybody the opportunity to have their own version of the Periodic Table? With this objective, the First Periodic Table Design Competition was launched in June 2007, to promote Science and Arts especially among the youth. The Periodic Tables received from various countries are organized accordingly to their various properties, electronic configuration, dates of discovery, or even their names. Once again, young people proved to be full of creativity and excitement about Chemistry when they get the opportunity.

All the Periodic Tables received were put on display at the University of La Rioja, were students, faculty and public in general were amazed by their beauty and creativity. The awards were presented on July 13, in the closing ceremony of the History of Chemistry Summer School in Logroño, Spain (Figure 5). The first prize went to Luis Otaño. He designed a beautiful and very original Periodic Table in which each element was represented by a portrait of its discover. Some elements shared the same person, like elements 94-98 have Seaborg as their discover; others did not have anybody to represent them, as they are known from antiquity, such as copper, silver, and gold, for example. Jorge García received the second prize for a Periodic Table organized by the electronic configuration of each element, and the third was for Alberto Soldevilla.

RSEQ Prize for the best comic on Mendeleev

On October 2007, the Spanish Royal Society of Chemistry (RSEQ, Real Sociedad Española de Química) launched a competition on the best comic about Mendeleev´s life for high school and college students. Twenty-four comics were received from Spain, Mexico and Argentina from students with ages ranging from 14 to 25 years old. The comics show some of the best known moments of Mendeleev´s life. We were amazed by the beauty and detail of the comics received, as it can be observed in the vignettes shown in Figure 6. So, we decided to make them available, as well as selected periodic tables from the First Periodic Table Design Competition, at the official RSEQ website at: http://www.rseq.es/comics to be used for teachers and students to learn more about Mendeleev and the Periodic Table.

Three prizes were presented on November 23, 2007 by the President of the Spanish Royal Society of Chemistry (RSEQ) in Madrid at the RSEQ Council meeting to the high school student María de la Cueva León Merino for her comic: “Mendeléiev (1834-1907)”, Aysha Zreika for “Vida y Obra de Dimitri Mendeleyev”, and finally to Sergi Segura Font who presented a very original black and white comic entitled “Dimitri Mendeleyev”.

First Summer School of the History of Chemistry dedicated to Mendeleev

In many occasions, our Chemistry students get the impression from their well organized text books and planned lessons that Chemistry has been developed in the same way, from its solids principles to the complexity of the modern branches of Chemistry. The History of Chemistry helps them (and us) to discover the creativity, intuition and effort of the great chemists of all times to unfold a relatively new Science hidden between layers of magic and secrecy. On July 11, 2007, the students of the First Summer School of the History of Chemistry gathered at the University of La Rioja to take what they were most likely their first lessons on principles and techniques of medieval alchemy. In the next days they discovered how Chemistry grown as and independent Science, how some theories were discarded whereas others, thanks to the use of the careful observation, measure, and the scientific method could be confirmed (Figure 7).

Still at the middle of the XIX century there was not a clear understanding of how chemical elements were organized, although some similarities among some of them were known a long time ago. Prof. Fernández Garbayo described how the chemical elements were discovered, emphasizing those isolated by Spaniards (platinum: Antonio

de Ulloa, 1735; wolfram: Juan José and Fausto Delhuyar, 1783; vanadium: Andrés Manuel del Río, 1801). Finally, Prof. Román Polo presented the great contributions of Mendeleev in the organization of the chemical elements, his Periodic Law and some relevant moments of his fascinating life. The students were amazed to learn about the details of Mendeleev´s great love, and second wife (in the Imperial Russia), Ana Popova, or his solo ascent using a balloon without previous experience to measure a solar eclipse. The whole summer school was dedicated to Mendeleev on the centenary of its death to celebrate his contributions to put order and organize the growing complexity of Chemistry by the means of his Periodic Law. This Summer School showed once again how useful History of Chemistry is to better understand the born and grown of this Science, to engaged the students, and rise public awareness and appreciation about a usually considered difficult subject.

Unfortunatelly, the History of Chemistry is not sufficiently present within IUPAC. It is time to include this important area of Chemistry, as many national chemistry societies have already done, in an international organization that aim to serves to advance the worldwide aspects of the chemical sciences. Virtually all Divisions and Standing Committes will benefit and will be able to contribute. This will provide a forum for experts and those interested to discuss relevant issues, develop projects, and make recommendations, as well as a fantastic way to promote Chemistry.

Mendeleev: Main Character at the Science Week

Every fall, around the first week on November, the towns of Spain, as it happen in many other countries, get full with activities to promote Science, especially among the youth. At that time of the year, it is common to see Science Fair in the parks, hands-on exhibitions in museums, and lectures by famous scientists to children. During the last years, many people, who usually are not exposed to Science, actively participate in literally hundreds of activities. Science Week is one of the most successful initiatives to raise public awareness and appreciation about Science and Technology.

Being 2007 the National Year of Science, last Science Week (this year extended over several weeks of November) has been especially extensive and ambitious. Almost all the major scientific institutions have taken part in an attractive and wide program. Many of these activities, especially those organize to promote Chemistry, had Mendeleev as their main character. He has an attractive image, easy to recognize, with his long disorganized hair and beard, holding his Periodic Table, as his actual size cardboard model shown in Figure 8 surrounded by students and the activity organizers.

At least twenty lectures were organized last year at high schools, universities, parks, and museums about Mendeleev, his life, and the Periodic Table. Local and national newspapers echoed these activities. For example, EL PAIS, with almost half a million copies sold per day, included an extensive article on June 27, 2007 about Mendeleev.[9] He was the main character of the Spanish Science Week over the whole year.

One of us had the opportunity to attend the XVIII Mendeleev´s Congress on General and Applied Chemistry held in Moscow (September 23-28, 2007) to celebrate the 100th anniversary of these conferences and share with some of our Russian colleges, the activities that we have been carrying out in Spain regarding their great chemist on the

centenary of his death. Some of them were surprised about the number of activities that Spain organized to celebrate one of the greatest Russian chemists and to learn that Mendeleev was actually in Spain. He visited Toledo, Madrid, and Seville during his (second) honeymoon after (finally) getting married with the love of his life, Ana Popova. Probably, one of the happiest times of his life.

Looking back to 2007, we have to admit that it was a lot of hard work that took much of our time, but also an extraordinary year. Not only because the personal fulfillment of organizing so many activities to promote a great chemist, but mainly because of their impact of those activities in others people lives. Now we received stamps dedicated to famous chemists from all around the World. People that knew of the stamp want to share with us some from their respective countries. We keep the comics that students drew about one of the Chemistry heroes and the Periodic Tables that we received from many countries. Chemistry is usually defined as the study of matter, their properties and transformations. Last year, we learned that it is much more. It is also History -as there are stories behind every discovery and the men and women that make them-, Arts -as we use graphical schemes to represent molecules, chemical reactions, and even the periodic law in a table-, and even a great way to make new lasting friends with similar interests. We wish our experience will be useful to others organizing analogous initiatives, such as the Year of Chemistry in Russia in 2009 and the International Year of Chemistry which is being promoted by IUPAC for 2011.

Acknowledgement:

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[4] a) Webelements webpage <http://www.webelements.com/>.

b) A note on this stamp in the news site of the webelements webpage <http://www.webelements.com/nexus/node/1169>.

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More information:

Correos (General Post Office in Spain) <http://www.correos.es/>.

Philatelia Chimica et Physica <http://www.cpossu.org>.

Spanish Year of Science webpage <http://www.ciencia2007.es/WebAC2007/>.

Figure 1. Stamp “Tabla Periódica de elementos de Mendeléiev” issued by the Spanish General Post Office on the February 2, 2007, exactly 100 years after Mendeleev´s death in Saint Petersburg.

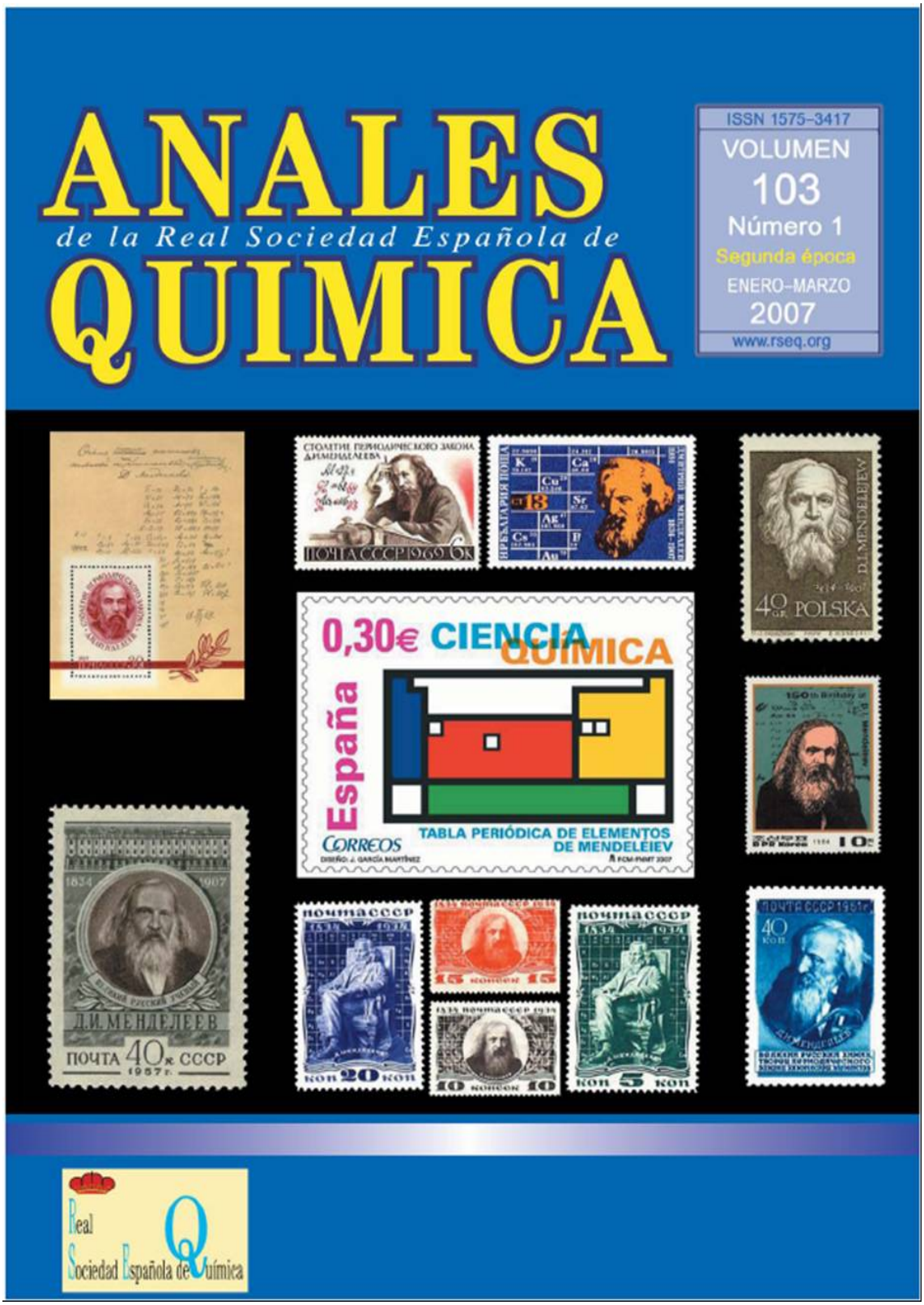

Figure 2. Cover of *Anales de Química* oficial journal of the Real Sociedad Española de Química dedicated to Mendeleev displaying all the stamps issued to the date to Mendeleev.

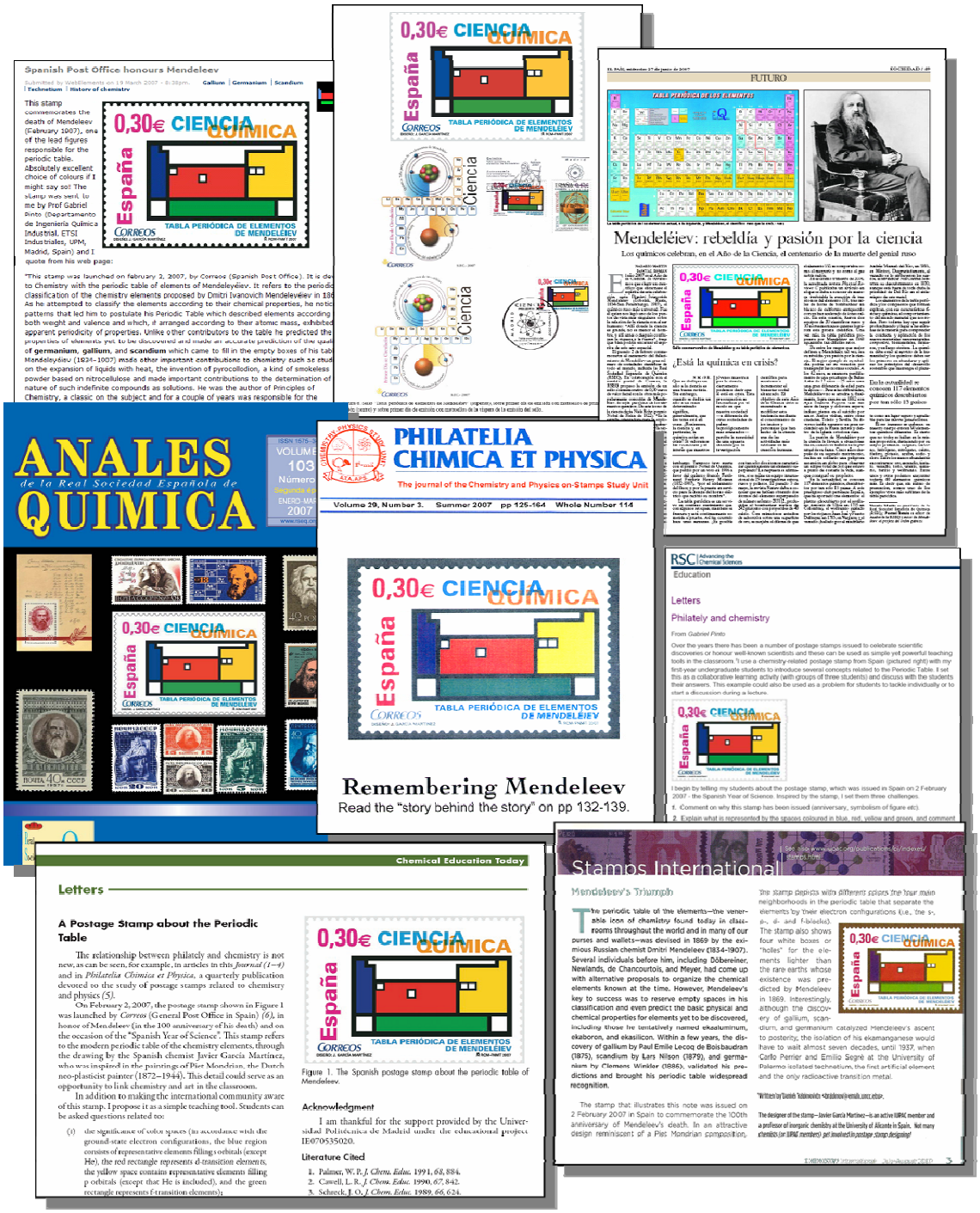

Figure 3. Some cover pages and articles which show the media attention received by the new stamp on the Periodic Table.

Figure 4. Large version of the Periodic Table shown in stamp "Tabla Periódica de elementos de Mendeléiev" on the wall of the Experimental Science Department (*Facultad de Ciencias Experimentales*) at the University of Jaén, Spain, on the day of inauguration, the 22nd of November of 2007. Each element is made of an individual ceramic tiles (20 x 30 cm).

Figure 5. Students and faculty at the display of the Periodic Tables received for the First Periodic Table Design Competition at the University of La Rioja, Spain on July 2007.

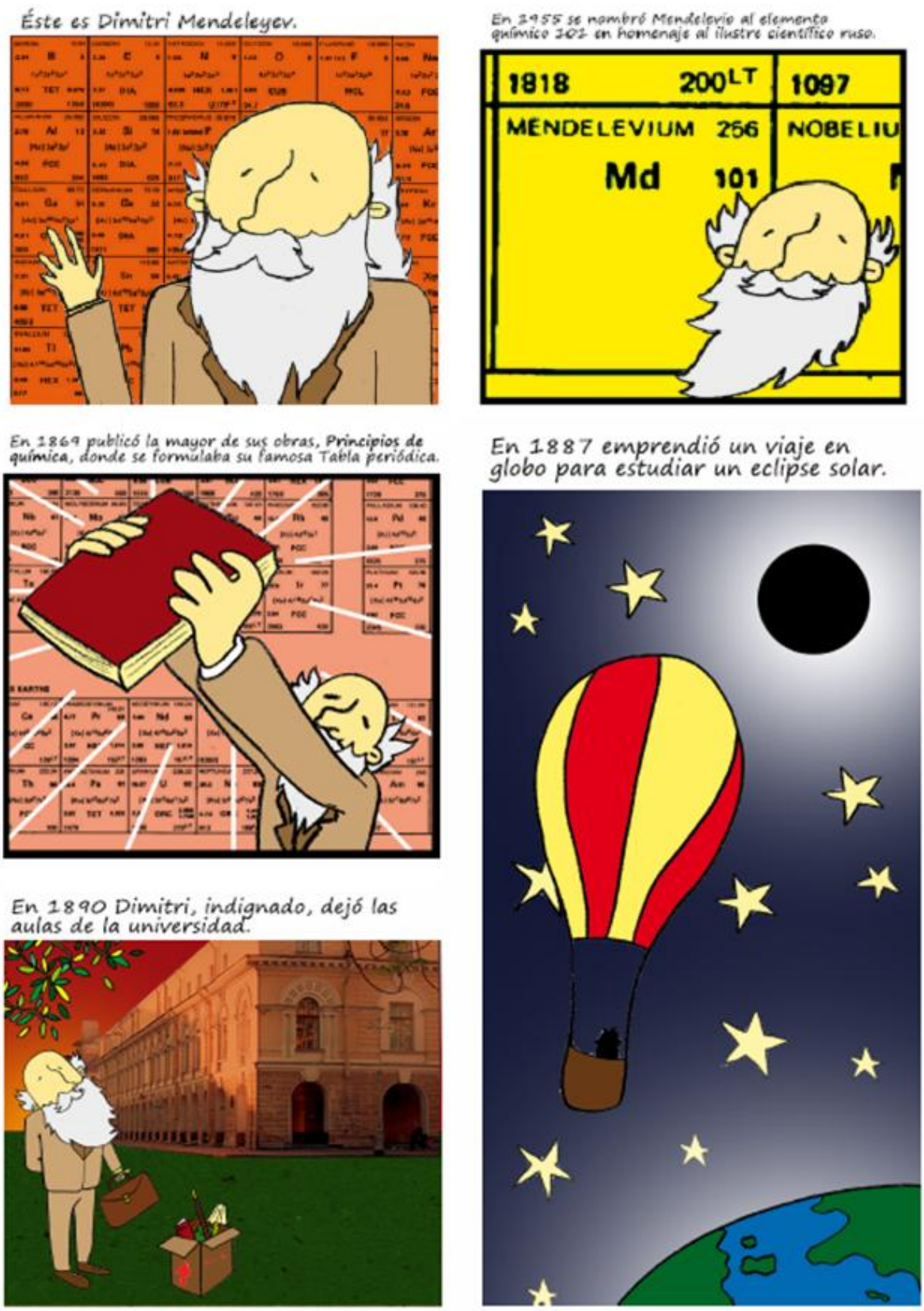

Figure 6. Some vignettes of the comics presented to the RSEQ Prize for the best comic on Mendeleev.

Figure 7. Participants of the First Summer School on the History of Chemistry held at the University of La Rioja, Logroño (July 11–13, 2007).

Figure 8. Mendeleev actual size cardboard model with some participants of the Science Week at Murcia, Spain, during the presentation of the stamp “Tabla Periódica de elementos de Mendeléiev” on November 2007.