

Vilanova THE PATH TO PREHISTORY i Piera



THE MEMORY OF VILANOVA: THE THOUSAND FACES OF A DONATION

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The material legacy of Juan Vilanova

A few days after the death of Juan Vilanova y Piera, his widow, Francisca de Paula Pizcueta, asked the government to purchase various collections that her late husband had gathered together over a period of almost four decades. This private legacy consisted of “minerals, rocks and fossils”, “prehistoric items”, as well as his library of “magnificent books”, all still at the family home in Calle San Vicente in Madrid. The sale agreements were made with the Museum of Natural Sciences of Madrid, establishing sums of 2,939.75 pesetas for the geology collection, 1,500 pesetas for the prehistory collection and 4,493 pesetas for his library. Together, this added up to a considerable amount, bearing in mind that at the end of the nineteenth century the average daily wage of a worker was two and a half pesetas and a kilo of bread cost half a peseta. Manuel Antón, director of the Anthropology Section of the Museum of Natural Sciences, played a key role in the sale of the materials. From Valencia,

like Vilanova, Antón considered the purchase to be essential for the museum, because it was “the first collection of prehistory”. Three years later, however, only the library and the prehistory collection had been passed on to their new owners. In September 1898, Alfonso Vilanova, the professor’s son, was still negotiating the sale, and in fact it was not completed until 1906.

The Museum of Natural Sciences, housed at the Goyeneche palace, was the main destination of this important legacy. In fact, Vilanova’s association with the place had begun when he was 26 years old, after obtaining a post as professor’s assistant at the Royal Cabinet of Natural History. Later, as a professor, he kept up his association with the museum and in fact remained in contact with the institution until the end of his life. The collection sold by his widow joined other legacies that Vilanova himself had donated. The first of these was the collection of rocks, minerals and fossils acquired during his scholarship in Europe, which had lasted several years. The collection comprised more than 1000 specimens catalogued by Vilanova himself in 1851 and given to the museum, formerly known as the Museum of Natural History, although the pieces remained packed in boxes on the museum’s premises until 1873. For several years Vilanova also contributed materials from Castellón, Teruel and Valencia, as a result of his work for

the Geological Map Commission, and continued to do so from 1884 onwards (Montero, 2003).

In 1910, a section of the Museum of Natural Sciences became the Museum of Anthropology, Ethnography and Prehistory, where part of the Vilanova prehistory collection was housed (Fletcher, 1945). In 1942, the collections were moved from there to the National Archaeological Museum, which, created in 1867, had also received notable donations from Vilanova during his lifetime. In fact, Vilanova made his first donation to the National Archaeological Museum (comprising materials from the site of San Isidro, the discovery that had set in motion the study of prehistory in the peninsula) on December 24, 1867 (Martos, 2017). This first batch of 206 objects, which included two axes from San Isidro, was followed by others, mainly between 1868 and 1871. Some of the materials were from the peninsula, excavated and prospected by Vilanova himself, while others he had acquired abroad during his frequent trips (Barril, and Pérez, 2010: 202).

The Athenaeum of Madrid, of which Juan Vilanova was a member and a frequent lecturer, and the Central University, where he taught, were institutions with outstanding historical archives. Vilanova's association with the Athenaeum dated back to 1854, when he was admitted as a member. Over the next 40 years and until shortly

before his death, the professor maintained his links with this institution, offering annual courses such as "The Origin of Man", and attending seminars and conferences. However, hardly any documents from this institution prior to 1939 have come down to us. Although the library and its stocks survived the civil war, the historical archive of the Athenaeum disappeared almost entirely during the occupation of the property by the Falangists in the early 1940s (Herrera et al., 2009).

Vilanova's association with the Central University began in 1852, when he obtained the chair of Geology and Palaeontology, and continued until his death. As a professor, he taught classes, but he was also involved in the administration of the university, and this engagement has left a significant amount of information about his activities there. Today the General Archive of the Complutense University, as the Central University has been known since 1943, preserves a collection of historical documents in a set of 1,893 boxes that span the nineteenth and twentieth centuries – an archive that is likely to shed new light on the professor's academic life during a period of major upheaval for the university. In addition, 1,500 boxes holding nineteenth- and twentieth-century documents from the Rectorate are also preserved (Olivares, 1997).

Other archives in Madrid and its surroundings also contain materials

referring to Juan Vilanova y Piera. The collection entitled "Juan Vilanova y Piera. Personal File", in the General Archive of Alcalá de Henares, includes the handwritten examination that Vilanova presented when he applied for the chair of Zoology at the University in 1847 (Pelayo, 1995). Other documents are held at the Academy of Exact, Physical and Natural Sciences, the Royal Academy of History, and the Royal Spanish Society of Natural History. In Valencia, apart from the collection at the Library of the Museum of Prehistory, documentary sources on Vilanova's life can be found at the Museum of Natural Sciences, the Serrano Morales Library, the Camilo Visedo Moltó Municipal Archaeological Museum of Alcoi, the Nicolau Primitiu Library and the Municipal Newspaper Library, which holds the newspaper articles published by Vilanova in *Las Provincias*.

Vilanova's outstanding academic career can be seen against the background of the timid but steadily growing interest in research in Spain in the second half of the nineteenth century. Vilanova worked together with several pioneers in the discipline of prehistory. Casiano de Prado y Vallo (1797-1866), Francisco María Tubino y Oliva (1833-1888) and Eduardo Boscá Casanoves (1843-1924) were researchers from three different generations with whom Vilanova enjoyed fruitful associations. The description and comparison of the preservation

of his collections allows us to contextualize the Vilanova legacy: his publications in print, the habitual medium of the time, have been preserved in a multitude of archives.

Casiano de Prado is, for many reasons, a key figure in the story of the first steps of prehistory in the peninsula. Although his relationship with Vilanova was competitive (Pelayo, Gozalo, 2012, 105-108), they both participated in state projects at scientific institutions, such as the Geological Mapping Commission of Spain, and were both interested in sites such as San Isidro. The documentation generated by the dealings of this mining engineer with official bodies was kept in the Central General Archive of Alcalá de Henares. However, in August 1939, just after the end of the civil war, the building suffered a devastating fire that destroyed practically all of the 140,000 administrative and historical files from previous centuries, including the documentation of the Mining Corps and the General Directorate of Mining prior to 1873 (González, 2004). Documents referring to Casiano de Prado can be found in a score of national archives, but we have little information of a private or personal nature.

Francisco María Tubino y Oliva, a multifaceted author, journalist, historian and politician, was an active member of the Scientific and Literary Athenaeum of Madrid, where he frequently met Vilanova.

Together with the director of the National Archaeological Museum José Amador de los Ríos, they tried unsuccessfully to found the Prehistoric Society in 1868. Vilanova and Tubino made visits to various peninsular sites, and travelled across Europe together to attend the International Congress of Anthropology and Prehistoric Archaeology in 1869. Their account of the journey, published later, reflects the themes and debates of the sessions, the excursions made during the congress, and their impressions of their trip through Scandinavia. Like Vilanova, Tubino contributed prehistoric objects to the National Archaeological Museum. Many of Tubino's publications, part of his correspondence and various documents resulting from his intense research and dissemination work have been preserved, but his personal archive disappeared in a flood in the province of Jaén.

Finally, the naturalist and professor Eduardo Boscá Casanoves, whom Vilanova considered his "dear friend and pupil", shared many of Vilanova's intellectual interests. In 1866, at the age of 23, he had already surveyed sites such as Cova del Parpalló and Cova Negra with Vilanova; in addition, Vilanova had been his professor in Madrid and a member of his doctorate degree tribunal in 1873. Boscá, committed to Darwinian theories, was appointed head of the Technical Commission entrusted by Valencia City Council with the management of the palaeontological

collection given to the city by Rodrigo Botet in 1889 (Salinas, 2001). This collection, containing the famous human skeleton of Samborondón, which Vilanova studied, generated a large volume of information now preserved in the Municipal Archive of Valencia and in the city's Museum of Natural Sciences. Sadly, the Cabinet of Natural History of the University of Valencia, where Eduardo Boscá worked for years, was destroyed in a fire in 1932, and his outstanding private collection housed in his home on Avenida del Puerto de Valencia has also disappeared (Sánchez, 1998; Català, 2004).

The Vilanova collection in the Library of the Valencia Museum of Prehistory

The documentary and bibliographic collection of Juan Vilanova y Piera in the Library of the Valencia Museum of Prehistory originated from the donation made by Juan Masiá Vilanova, Vilanova's grandson. Since 1986, the legacy has expanded thanks to successive additions. This year, 2021, Natalia Mansilla Masiá, Juan Masiá's granddaughter, has added more unpublished documents and objects connected with the renowned naturalist.

Don Isidro Ballester (1876-1950), the first director of the Prehistoric Research Service and the Museum of Prehistory between 1927 and 1950, already knew that Juan Masiá possessed a wealth of documentation on Vilanova. While

preparing a study on the skulls in the Cueva de les Llometes in Alcoi, he consulted the documents belonging to Masiá, although he would have never thought that all this documentation would eventually become part of the institution that he directed.

Juan Masiá (1902–1998), professor of Geography and History at several institutions in Valencia, had been a student at the Archaeology Laboratory of the University of Valencia (Albelda, Real & Vizcaíno, 2014). He was appointed Provincial Commissioner of Archaeological Excavations, and later Provincial Delegate of Archaeological Excavations. Masiá felt a very special bond with Valencian archaeology and with the Prehistoric Research Service and the Museum of Prehistory (Martí, 2012). Prior to the donation he had already exchanged publications with the museum, although they did not include any editions associated with Juan Vilanova.

Three stages can be established in the donation of documents to the library. Each one involved different kinds of documentation. Thus, the first, made by Juan Masiá in 1986, comprised printed publications, manuscripts and photographs (Goberna, 1990). The second, in 1996, also made by Masiá, basically consisted of diplomas and academic titles, medals and insignia, as well as photographs and a daguerreotype. The third phase, carried out in two periods, 2012 and 2021, comprised

photographs of family and congresses, a map, documents, fossils, lithic products and two fifteenth-century parchments belonging to the family. In this case the donor was Natalia Mansilla; concerned that the collections of the accredited academic might be broken up, she decided to donate the materials and documents that were still in the possession of her family.

Thus, thanks to Juan Masiá and his granddaughter, the personal archive of Juan Vilanova as well as various publications and objects that he himself acquired are now held at the Museum of Prehistory. There are also some documents and books owned by the family. Because of the varied nature of the items contained in the donation, they had to be catalogued in different ways. For instance, the personal library of Juan Vilanova and the first editions of his works have been added to the library of the Museum of Prehistory. Certain titles stand out, such as *Les premiers âges du Métal dans le Sud-est de l'Espagne* by the brothers Henri and Louis Siret, one of the 100 copies published in 1887, *Elements of Geology* by Charles Lyell and *Cours élémentaire de Paléontologie et de Géologie stratigraphiques* by Alcide d'Orbigny. The medals and decorations, incorporated in 1996, have been catalogued and included in the museum's database (Gozalbes, 2012).

Juan Vilanova's personal archive, a set of documents that he wrote

or received throughout his life, contain unique and irreplaceable information regarding his career. It was described and studied by Francisco Pelayo, Vicente Salavert and Rodolfo Gutiérrez (Pelayo and Gozalo, 2012). Thanks to the dedication of these three researchers over many years, the documentary collection of approximately 7,000 pages has now been catalogued. The legacy consists of a great diversity of documents, both personal and official. Seven sets or series have been created for their description: Manuscripts, Correspondence, Printed texts, Documents from official bodies, Illustrations and photographs, Field notebooks and Original texts.

Manuscripts: These comprise notes from excursions, congresses and conferences, drafts for possible future publications, notes for classes and personal use, summaries of articles or books, diagrams and conference drafts, and so on. In many cases they have been underlined to be reused in other manuscripts or are written on the backs of advertisements.

Correspondence: These letters allow us to trace Vilanova's relationships with, among others, Juan Valera, Antonio Cánovas del Castillo, Roque Chabás, Francisco Tubino, Juan de Dios de la Rada, José Joaquín Landerer, José Macpherson and Edouard Verneuil. His communication with the publishers of some of his

works is also recorded through correspondence with Alejandro Gómez Fuentenebro, editor of the *Compendium of Geology* (1872) and of *The scientific journey to Denmark and Sweden...* (1871), with Montaner and Simón, publisher of *The Creation ...* (1872–76), which Vilanova edited, and with Astort Hermanos, with whom he worked on the *Universal Geographical Atlas* (1877).

Printed texts: This section comprises most of the documentation accumulated by Vilanova and, to a lesser extent, by his descendants after his death. It includes advertisements, invoices, delivery notes, press clippings, cards and conference documents.

The items in these three sections are often documents that were reused to become manuscripts or notes: for example, personal letters, draft publications, advertisements, receipts, invoices or calls for meetings. Vilanova was happy to use the back of any old sheet of paper. Thanks to his habit of recycling ephemeral documents, the information contained in the original documents has also been preserved. This means that we know where his sons and daughters studied, or the fees he charged for some of his publications in journals; there are also some obituaries, including Gaudry's. He reused a large part of the printed matter and the correspondence he received, although not documents from official bodies. The study of these documents

will not only allow a reconstruction of his relationships with his family and friends, the administrators of his projects, his publishers, his network of researchers and correspondents or with politicians, but can also tell us a great deal about the late nineteenth century, a time of huge political and social change.

Documents from official bodies: This series includes all the documentation sent to Vilanova by the organizations with which he was linked throughout his life: the Madrid Athenaeum, the Museum of Natural Sciences, the Central University, the Literary University of Valencia, the Royal Academy of History, the Geological Mapping Commission or the Royal Academy of Exact Physical and Natural Sciences, among others. It also includes the titles, awards and recognitions that he received during his lifetime.

Illustrations and photographs: This section comprises more than 100 photographs and postcards, among them a daguerreotype of Vilanova, made in early 1854 at Millet's studio in Paris, shortly before his return to Spain after his stay abroad training as a geologist. Recently, thanks to the use of modern information and documentation technologies, the digitization of many libraries and archives, and an exhaustive study, many of the researchers with whom Juan Vilanova exchanged business cards at international congresses and on his scientific trips have been identified. They include the biologist

and palaeontologist Richard Owen, the anthropologist and biologist Armand de Quatrefages, the physician and anthropologist Paul Pierre Broca, the historian and archaeologist Jens Jacob Asmussen Worsaae, the physician Robert Koch and the bacteriologist Louis Pasteur. Thus, Vilanova's archive contains their visiting cards, so characteristic of the late nineteenth century.

Field notebooks: Thirteen notebooks dated between 1850 and 1889 collect first-hand notes, comments on geological excursions and scientific congresses and trips, some even recording travel expenses. The main interest of these notebooks is the fact that they often contain Vilanova's own impressions of these events.

Original texts: These are mainly manuscripts of speeches given at various academies or societies. Among them it is worth highlighting the manuscript of Vilanova's speeches to mark his admission into the Royal Academy of Exact, Physical and Natural Sciences, and the Royal Academy of History, in addition to the original text of *Iberian History and Protohistory* written in conjunction with Rada. This information is mentioned in the article *Juan Vilanova and the study of prehistory*, in this same catalogue.

Recent additions

Thanks to the donation of almost fifty photographs depicting various moments in the lives of the Vilanova-

Pizcueta family In 2012 and 2021, the Illustrations and Photographs section now sheds light on the more personal side of the prestigious academic. The photos are images of Juan Vilanova at different times in his life, his wife, Francisca Pizcueta, his father-in-law, José Pizcueta Donday, and his children, grandchildren, nephews and nieces. There are also photographs of the participants at the Sixteenth Congress of the Association Française pour l'Avancement des Sciences in Toulouse in 1887, the Ninth International Congress of Anthropology and Prehistoric Archeology held in Lisbon in 1880, and the Second International Congress of Geology in 1881, as well as the business cards of other researchers. Other interesting additions are a draft of the geological map of the province of Valencia by Coello and Vilanova, dating from 1882, and other personal documents.

Likewise, several sets of fossil remains, lithic tools, and fauna have been added. Their origin is unknown, but they may have been samples that Vilanova took with him on his scientific trips. The first set comprises brachiopods, a trilobite, two slates with fern fronds and a calcareous tufa. The lithic products basically comprise arrowheads and flint flakes. Two species make up the fauna group: four shark teeth and an elephant molar with a polished occlusal region.

Two framed parchment notarial documents from Alcalà de Xivert, dated 1420 and 1437, are also included. They are written in Latin and Gothic cursive script, and were in the possession of the Vilanova family.

The future

The Library's plan to digitize and provide online access to the documentary collection will help to preserve the archive, by avoiding the handling of the original documents and minimize its deterioration.

Juan Vilanova y Piera was one of the pioneers of Spanish prehistory and we hope that in the future both his intellectual activity and the more intimate aspects of his life can be explored further. Perhaps their study will be able to produce a sketch of the daily life of a nineteenth-century researcher.

FOR A SPANISH AND UNIVERSAL SCIENCE: JUAN VILANOVA, SCIENTIFIC COLLABORATION AND THE STUDY OF GEOLOGY AS AN INTERNATIONAL PROJECT

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Very often, modern science is defined according to new theoretical concepts that entail a radical change in the way the

natural world is interpreted and explained. Newtonian mechanics, cell theory, the atomic theory of chemical elements and biological evolution are some of those concepts that make up the popular vision of the transition to modernity of the different branches of science. But this oversimplified vision does not help us to understand the complexity of the historical evolution of science, because it ignores the ways in which this new knowledge is achieved and how it becomes accepted and consolidated inside a society. Debates about scientific theory do not emerge in a neutral environment – and only rarely as sudden flashes of genius or the profound thought of great minds – but in complex networks of interaction between people who share intellectual, professional and material interests concerning the issues in question. In this regard, someone like the naturalist Juan Vilanova, reluctant to accept the new concepts of Darwinism, was nevertheless fully aware of the vital role of scientific societies and congresses of specialists in the new ways of practising science that were emerging in his time. In fact, Vilanova was one of the most forward-looking members of that intermediate generation of nineteenth-century scientists who struggled so hard to bring Spain out of its isolation.

Vilanova was a firm believer in cooperation between scientists, and enthusiastically supported

the creation of scientific societies which were beginning to make their mark in the international scientific community. His involvement in international geology congresses, where fundamental agreements for the standardization of nomenclature and cartography were adopted, established his reputation among his colleagues in Europe and America. And in Spain too he was one of the leading proponents of scientific associations, precisely at a time when the country was involved in a process of national construction full of tensions and disputes, in which science was a key player on more than one occasion.

Vilanova and the foundation of the Spanish Society of Natural History

On February 8, 1871, eleven men aged between 20 and 63 years old met in the staff room of the Industrial Institute of Madrid. Some were academics: university professors, their assistants and students, and there were also priests, soldiers and even bankers (Gomis Blanco, 1998). This diverse group, made up of commoners and aristocrats, liberals and conservatives, philo-Krausists and Catholics, was brought together by their common dedication to natural history. At that time, scientific activity was far less professionalized than it is today; nevertheless, to the extent that their respective ways of life allowed them to devote themselves to research, all these men were

outstanding scholars of the fauna, flora and geology of Spain. The aim of their meeting was to lay the foundations for a national scientific society which would provide Spanish naturalists with a forum for debate, and a vehicle for publication, that could publicize the advances being made in the knowledge of the country's natural environment.

Indeed, the rich variety of Spain's flora and fauna attracted many foreign scholars, who enthusiastically explored this corner of south-western Europe in search of new species to add to the catalogue of the continent's biodiversity. Others were interested in the complex geological conformation of Spain, both the peninsula and its archipelagos – in this case not only in the interests of expanding scientific knowledge, but for economic and even political reasons as well. In fact, the knowledge of Spain's natural environment owed more to foreigners than to the Spanish themselves. For those gathered in Calle de Atocha on that day, it was vital to promote science in a country in ferment caused by the political frenzy of the Six Years of Democracy from 1868 to 1874. This political revolution had precipitated a change first in the dynasty and then in the government, and had left many broken dreams behind; but it also led to irreversible changes in the political system which, even after the return of the monarchy under the Bourbons, was unable to re-establish the remnants of absolutism

that had endured until the middle of the century.

As mentioned above, the naturalists were ideologically divided on the way to build Spain at that historical crossroads. They did agree, however, on the importance of assigning science a major role in that construction, and on the condition that this science should be practised by Spaniards. The country had not always been a wasteland in terms of the cultivation of naturalistic knowledge; in ancient times, in fact, it had given the world several prominent figures. Now was the time for collective action, the time to join forces. Evoking the historical past of the country's science was all well and good, but the most urgent task was to promote knowledge of the country's natural environment among the Spanish people themselves and thus encourage them to play a more prominent role in this research. Until then – and quite understandably, given the scant interest shown by the country's inhabitants – the most important contributions to the scientific study of the peninsula had been made by foreigners.

Of all the branches of science, after geography, none was so closely associated with the land as natural history. Its study was a patriotic duty, as knowledge of the natural environment had many obvious practical applications that might help to increase the country's economic prosperity. So

the progress of Spanish natural history had intellectual, material and even moral justifications, at a time when nationalism in Europe was proliferating (Casado de Otaola, 1994).

Juan Vilanova was, of course, one of the eleven naturalists at the meeting. Along with his pupil José María Solano y Eulate (1841-1912), Marquis of Socorro, he represented the field of earth sciences. There were also botanists and zoologists of various specialities, and indeed the main branches of natural history were quite evenly represented. On that day they decided to found the *Sociedad Española de Historia Nacional* (the Spanish Society of Natural History, or SEHN), whose objective would be, according to the minutes, “to promote the study of Natural History in Spain by making the country’s natural products known”; and that the society would do so through a periodical publication, the *Anales de la Sociedad Española de Historia Natural* (the Annals of the Spanish Society of Natural History). From the following year onwards the Annals appeared regularly, a large volume each year containing original studies sent in for publication, and, in an appendix, the minutes of the society’s monthly sessions where both administrative and scientific questions were discussed. The first of those ordinary sessions was held on March 1, although the session of March 15 is taken as the date of the official foundation of the SEHN (Gomis Blanco, 1998).

Vilanova was actively involved in both the foundation and the consolidation of the society. The very first volume of the Annals contained an article of his entitled “Prehistory in Spain” (Vilanova y Piera, 1872). He was a frequent participant at the sessions, as witnessed by his numerous interventions until only a few years before his death, in which he gave first reports of observations and discoveries and reviews of his scientific visits. He also tried to build up social support for the SEHN and bolster its finances by introducing new members, including one lady from the aristocracy. Finally, he became president in 1878, after serving as vice-president the previous year (Pelayo López and Gozalo Gutiérrez, 2012, pp. 54–55).

Although it is doubtful whether the SEHN ever really constituted an integrated project for the promotion of the natural sciences in late nineteenth-century Spain (in fact, the articles in the Annals reported only the personal research conducted by the members) it did manage to establish cooperation among Spanish naturalists. Key elements in this were the fact that, from the very first moment, the society’s endeavours were not limited to the Madrid circles that had brought it into being, and the practice of holding regular meetings to which members from outside Madrid were invited, and which were replicated from 1885 onwards in other cities through the founding of local sections. The proactive

engagement of Vilanova and other veteran naturalists was vital; far from sitting back and enjoying the benefits of their official positions, they understood that natural history could only contribute effectively to the construction of a new Spain if it was able to gather together all the various naturalist projects underway in the different regions of the country – professional or amateur, nationwide or focused locally – and setting aside any ideological differences.

Vilanova and his involvement in other collaborative projects

To this day, the SEHN remains the reference point of non-medical scientific associations in Spain. Before its foundation, however, other scientific societies had been created, including the Spanish Anthropological Society (SAE), founded in 1865, in which Vilanova was also involved. Though created only a few years before the SEHN, the SAE was born in a very different intellectual climate: the legislation on academic and press freedoms was draconian, and any subject that might clash with Catholic dogma would be severely repressed. As a result, for the first years of its existence the SAE recorded barely any activity. After the revolution of 1868, however, the SAE gained a significant public presence and its membership increased notably. In 1874 it launched its own publication, the *Revista de Antropología*, whose appearance marked the most active and successful decade in the short life

of this scientific society. The journal was unable to survive the death of its promoter, the anatomist Pedro González de Velasco (1815-1882) – a figure linked to the *Institución Libre de Enseñanza*, a follower of the positivist currents of physical anthropology, a friend of the French specialist Paul Broca and, as a result, receptive to evolutionary theses (Verde Casanova, 1994). Despite the obvious scientific and ideological distances between them, Vilanova was not deterred from joining the SAE project; indeed, at the beginning, he was one of the members who applied to the government for authorization of the constitution of the society. During his busiest period, he was a member of several of the study commissions that were being set up for specific purposes, and he demonstrated his support for the society's journal by publishing an article in several instalments in its first volume, under the title of "Origin, Antiquity and nature of man" (Vilanova y Piera, 1874).

Vilanova also worked hard to publicize the Bulletin promoted by the Madrid Geographical Society (SGM), of which he was, again, a founding member. According to its main promoter, Francisco Coello de Portugal y Quesada (1822-1898), cartographer and former military engineer, the new society was born with the aim of putting Spain once and for all on a par with other nations which had been promoting geographical studies for decades. At the inaugural meeting of the

SGM in 1876, Coello expressed his displeasure that Spain had not been represented at the Second International Geographical Congress held in Paris the previous year. He was another scientist who was concerned about his country's lack of interest in exploring other lands, in a context in which Spain did the bare minimum to defend what was left of its overseas empire and seemed reluctant to turn its sights to Africa, where the ambitions of the European powers were now firmly centred (Rodríguez Esteban, 1996, pp. 141-142). So the nationalist element was unequivocally present in the form of a kind of colonial yearning, but also, of course, in the insistence on the need for a more comprehensive knowledge of Spain itself. This subject, of course, interested Vilanova a great deal. The study of geography, at that time, was going through a particularly tumultuous period in terms of its definition as a science; also affected by the impact of evolutionism, the overlapping of its interests with those of geology could not be ignored (Livingstone, 1992, chapters 6 and 7). Hence, several naturalists had joined the SGM at the very beginning, among them Vilanova, and he was one of the most vociferous in calling for geography to be grounded in the knowledge of the natural environment. In fact, physical geography accounted for almost 40% of the SGM's publications during its first ten years of existence (Rodríguez Esteban, 1996, p. 172). Many of these were written

by Vilanova, whose "Geological Review of the Province of Valencia" appeared over four years and in twelve instalments in the Bulletin of the SGM (Pelayo López and Gozalo Gutiérrez, 2012, p. 55). Vilanova, therefore, participated in a very conspicuous way in this resurgence of studies on Spanish natural history, from a relatively wide range of scientific perspectives, and with the encouragement of a nationalist sentiment that sought to capitalize on science in order to promote the construction of a Spain that was more in step with the modern world. But science was also beginning to be conceived as an endeavour that crossed national borders. In this regard as well, Vilanova showed himself to be a man of his time.

Not only for Spanish science: Vilanova and the international geological congresses

Vilanova's internationalist vocation owes a great deal to the circumstances of his own life. As one of the few Spanish scientists of his generation officially authorized to study abroad (he spent four years in France between 1849 and 1853), he was not only able to establish fruitful contacts, but also he became aware of the demands of a science that needed to transcend state borders in order to achieve its goals. Considered abstractly, it seems obvious that scientific study should be internationalist, free of political and economic interests, and devoted to the noble task of increasing natural

knowledge for the good of humanity. But the truth is that scientific enterprise is very frequently linked to the centres of political power of a particular moment; and in the specific context of the nineteenth century, a key part of the affirmation of a modern state within clearly defined borders was a knowledge of its natural environment. So the power of the state was projected onto the knowledge of the territory that it administered, the basis of the construction of an identity called the "nation". In fact, the emergence of these complex new entities collided head-on with the internationalist ideal. From the point of view of geological cartography, for example, the problem arose of coordinating the representations of the territory of each country with the ones produced by neighbouring states. Obviously, there would be no discrepancies in the description of stratigraphic formations that crossed borders, but at the same time mapmaking was an exercise of sovereignty; a map could be an instrument of national and international politics, and the data that it contained could be modulated according to the interests of the state. This tension is one of the examples of the paradox of "big science" in the second half of the nineteenth century, when scientific projects that required international collaboration were put under enormous pressure by the increasingly strained relations between countries, which frequently competed with each other to extend their respective areas of influence (Schroeder-Gudehus, 1990). Thus,

politics interfered with the dreams of a genuinely universal science.

Vilanova is acknowledged as one of the first European geologists to propose the organization of an international congress, as early as 1867, with the aim of standardizing the nomenclature of the discipline. The proposal was rather premature, but it bears witness to Vilanova's awareness of the need to provide a science in the process of consolidation with standardized frameworks for communication. For the proposal to bear fruit, contributions were made over the following years by the different European countries, but in fact the main impetus came from the United States, via the American Association for the Advancement of Science. The First International Geological Congress was held in Paris in 1878; it was attended by Vilanova, who, as ever, played a particularly active role.

Apart from nomenclature, another key area for the standardization of geological communication was cartography: a visual code was needed to allow a universal interpretation of maps. This was another of the priorities addressed at the congresses after Paris. Vilanova attended the second meeting, held three years later in Bologna, as vice-president. There, he became one of the most prominent defenders of the internationalist line, supported especially by Italian, French, British and American authors, who called for the formation of a standardized

framework to be complied with by all geologists. They met opposition from their German, Austrian and Russian colleagues, who were reluctant to change the working practices developed in their respective national scientific traditions (Ellenberger, 1999; Vai, 2002). In fact, a great deal of diplomatic work went on behind the scenes at the congresses, but Spain was a country with little weight in the international arena and had little influence on the events, despite Vilanova's efforts and his well-earned prestige. Vilanova himself was much more highly regarded and supported abroad than in his own country. The first international congresses were largely ignored by the Spanish government and official bodies such as the Spanish Geological Map Commission, but Vilanova was commissioned by the congress committee to compile an international dictionary of geological and geographical terms. The first printed version, written in French and Spanish, was presented by the author in Berlin on the occasion of the Third International Geological Congress in 1885 (Pelayo López and Gozalo Gutiérrez, 2012, pp. 64-65).

Vilanova participated in other international and national congresses which we will not mention here. The list of scientific societies of which he was a member is also too long for us to record them all. In any case, this necessarily brief review of Vilanova's contributions to various associations and joint projects in natural history and

earth sciences bears witness to his awareness of the new forms of scientific study required in a world divided into nation states, eager for territorial control but at the same time in urgent need of channels of international cooperation. Certain retrospective judgments based on future developments in geology, which he was in no position to foresee, present him as someone who did not always know how to choose the "correct line" (Julivert, 2014, p. 122); but Vilanova must be understood as a geologist absolutely of his time, involved both in the main theoretical controversies and in the most important lines of practical action that defined the study of the earth sciences in the second half of the nineteenth century.

JUAN VILANOVA AND THE HARMONY BETWEEN SCIENCE AND RELIGION: HIS CREATIONIST CRITIQUE OF DARWINISM

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A devout Catholic, the Valencian naturalist Juan Vilanova believed that there was a harmony between the Biblical account of the creation in Genesis and the data that were emerging from research in the natural sciences, especially in geology, palaeontology and prehistory. This belief in the harmony between science and

religion was a constant feature of his academic career. Vilanova defended creationism; he believed that all species, and most importantly the human race, were created by design, and rejected the evolutionism of both the French transformists and of Darwin.

Already in his first book, the *Manual of Geology applied to agriculture and the industrial Arts* (Madrid, 1860–61), Vilanova annexed 13 pages at the end of volume II, in which he tried to show the concordance between Genesis and the sciences. He would revise the text, with slight modifications, in the *Compendium of Geology* (Madrid, 1872) and in volume VIII of *The Creation...*, published in Barcelona (1872–76). Vilanova maintained and expressed his belief in this harmony in the works that he published throughout his academic life.

Vilanova's belief in creationism and his opposition to Darwinism have been examined in detail in previous work (Pelayo, 1998; Pelayo, 1999; Pelayo and Gozalo, 2012). Here, to discuss his position we will draw on his books and articles, but we also analyse his role at the Spanish Society of Natural History (SEHN), regarding the controversy about the organic character of the *Eozoon canadense*, which Vilanova rejected, and his criticisms of Albert Gaudry, professor of palaeontology at the National Museum of Natural History in Paris, for the latter's defence of the *Protriton petrolei*

as an example confirming the theory of evolution. We discuss the disapproving comments on the evolutionary ideas compiled in *The Creation: Natural History written by a Society of Naturalists...*, which Vilanova, editor of the book, added in notes to the text that Francisco Tubino had written on the works of Darwin and on the current state of knowledge of anthropology. Finally, our description of Vilanova's anti-Darwinian ideas includes his criticisms of the theory of evolution in the comments he made at international congresses on the contributions of authors sympathetic to transformism.

In the section on palaeontology in his *Manual...*, Vilanova presented for the first time his creationist ideas and his criticism of transformism. He stated that the analysis of the palaeontological record showed that the same fossils were found in the same sedimentary layers and, furthermore, that the finding of identical fossils was limited to certain depths. These data seemed to prove that a successive series of creations and extinctions had taken place over the course of geological history.

Vilanova maintained that different creations had taken place over time. The most visible manifestation of this phenomenon was the independence of the fossil fauna and flora that characterized geological periods, which did not come from direct generation from the species that had preceded them. So Vilanova

believed in the immutability of species; he argued that palaeontology showed that there had been many and varied periods characterized by different physical and biological environments, with a flora and fauna entirely different from those that preceded and succeeded them. Vilanova insisted that that palaeontological data did not confirm the transmutation of some species into others. He did not deny the existence of intermediate forms, but limited them to orders and classes and, perhaps, to lower-category types, but certainly not to species, since species had been shown to be independent of one another. Species might suffer deviations in their appearance, producing types which were very different from the original and which, subjected spontaneously or artificially to selection and the multiple and complex action of inheritance, might become a new variety, and even a new race. Depending on whether the external conditions were indifferent, favourable or hostile, the variety was maintained, accentuated or extinguished.

In the 1860s, Vilanova directed his scientific interests towards prehistory, a new discipline that was emerging at that time. His first criticisms of Darwinism appeared in a series of articles dedicated to the origin and age of the human race. In them, he defended the independent creation of species against the positions of Lamarck and Darwin.

He criticized transformism on the grounds that its occurrence would require an immeasurably long time, something that both reason and the Bible opposed. Vilanova argued that the postulates of the Darwinian hypothesis were not borne out by palaeontology, insofar as the theory proposed that organic matter had started at the lowest degree of complexity possible. Darwinian theory required a series of transformations according to the principles of natural selection and the struggle for existence, in addition to time as a necessary condition for the emergence of the variety of organisms recorded.

For Vilanova, the immediate implication of this theory applied to the human race was that “the natural and proper ancestor of humanity should be the most perfect monkey among the living”, be it the orangutan, the chimpanzee, the gorilla or some fossil species from the Tertiary period. He claimed that the human race was represented by a species from a single primitive couple, like the others, from which the different existing races came; this meant that science confirmed what was stated in Genesis.

In later work he defended that the most primitive periods were represented by various types, such as trilobites, cephalopods and brachiopods, organisms of relative organic complexity, and that this refuted the gradual increase advocated by Darwinists. For him,

the various organic types had appeared, not slowly and gradually, but suddenly and instantaneously; this would confirm the principle that primitive organic forms were not the result of a slow and continuous transformation of previous ones, but the direct and immediate work of an omnipotent Creator.

Vilanova rejected the possible influence of environmental agents in the process of speciation and believed that living beings were completely independent of the environment in which they lived. Therefore, the origin of species should be attributed to the action of an “infinite power”, regulating physical forces and organisms and maintaining the necessary harmony and adaptation. Comparing the relative degree of organization of the components of the Silurian fauna with the later ones, he deduced that the simplest forms were predominant in the more modern times, and that this was incompatible with the fundamental principles of Darwinism: namely, natural selection and the struggle for existence.

Vilanova based his defence of creationism and his rejection of evolutionism on the data known to the palaeontology of his time, since the incompleteness of the fossil record was, as Darwin himself acknowledged, the weakest link in the theory of descent with modification. Vilanova capitalized on this weak link to refute Darwinism. He did not accept Darwin’s argument about

the scarcity of fossil materials, because in his opinion the British naturalist used this argument simply to explain why his theory was not confirmed by the facts. Darwin held that the simplest organisms in terms of organic complexity had been lost or had not yet been found, and that this was the only reason for the absence of such specimens in the oldest fossil soils. In Vilanova's opinion the palaeontological data did not bear out these assumptions, which were one of the basic implications of Darwinism. Therefore, if life had not appeared with the degree of organic simplicity assumed by Darwin, most probably it had not developed through an indefinite and uninterrupted series of slow and successive transformations, as evolutionary theory claimed. This is the background to the controversy surrounding the *Eozoon canadense*, "the dawn of life". The discovery of the *Eozoon canadense* in 1858, in Precambrian rocks, triggered a debate on the first appearance of life on Earth, between this supposed fossil and the "primordial fauna" of what Joachim Barrande called Silurian, a fauna composed by trilobites and other fossil invertebrates.

The importance of the *Eozoon* to the debate on Darwinism was that the existence of this organism could confirm Darwin's theory regarding the date of the appearance of life on Earth, as well as the increase in organic complexity developing from a single "primordial form". From the fourth edition of *The Origin of*

Species onwards, Darwin noted that in 1859 he had already suggested the existence of living beings prior to the Cambrian period, and so the finding of the *Eozoon* confirmed this theory. For Vilanova, however, the palaeontological record showed that the *Eozoon* was not the organism that had initiated life and universal fauna on the globe, as evolutionary theory supposed. The beginning of such an extraordinary phenomenon was the primordial fauna, which did not present the simplicity of types that Darwin's supporters were so eager to see.

In another anti-Darwinian intervention, this time at the SEHN, Vilanova discussed a work by Gaudry, which had mentioned the discovery of fossil remains of amphibians in the palaeozoic period that confirmed evolutionary theory (Gaudry 1874-1875). For Vilanova, Gaudry was adapting the facts to fit a theory. Gaudry's position on evolutionism, and whether or not he can be considered Darwinian, has been the subject of several studies and debates; whatever the case, Gaudry is acknowledged as a member of the French transformist school.

Gaudry noted that the modern types of batrachians seemed to be very recent, since only some of their representatives had been found in Tertiary contexts; he was surprised that vertebrates with such a simple organization had appeared so late in the course of time. This was an obstacle to evolutionary theory.

The fossil remains of batrachians discovered in the upper part of the palaeozoic sites of Muse and Autun in France were named *Protriton petrolei* by Gaudry, a name that indicated that they had been the predecessors of salamanders. He noted that "... ces Batraciens sont tels qu'un évolutionniste devait les imaginer dans un terrain ancien: par queue très-courte, leur tronc et leurs membres où dominant les caractères des Salamandres, leur tête où dominant au contraire les caractères des Grenouilles, ils diminuent la distance qui nous semblait séparer les Urodèles des Anoures" (Gaudry, 1874-1875). Vilanova altered this paragraph of Gaudry's by replacing "evolutionist" with "Darwinian"; for Vilanova these were synonyms, although they may not have been for Gaudry. At the end of the paragraph, Vilanova also added the phrase "forming the bond between these two groups of amphibians".

During the course on prehistory that he taught at the Madrid Athenaeum, Vilanova argued with Manuel de la Revilla, who had reproached him for his opposition to Darwinism and for placing science at the same level as revelation; by so doing, said Revilla, all that Vilanova had achieved was to demonstrate an "intelligence as petrified as a fossil" and to defend an "ancient science" and a "dying belief" (Revilla, 1875). Vilanova responded in his article "Darwin's theory", in which he criticized those who, boasting of their independence, challenged the principle of authority

and were ready to accept the doctrines that came from beyond the Pyrenees if they were formulated by a scientific eminence. He regarded this group as the “new inquisitors”, since they dismissed the efforts of scholars who, like him, wanted to study the new theories before subscribing to them. At the opposite extreme, he said, he had also been criticized by others for treating Darwinism too leniently.

Vilanova spoke of Darwinian, evolutionary or transformist theory without differentiating between these three terms, ignoring the importance that Darwin attributed to the mechanism of natural selection and the importance that Lamarck and the French transformists attributed to the inheritance of acquired characters and the influence of the environment. In any case, Vilanova stated that he was reluctant to admit this theory since it did not conform to the facts, or to the unity of creation. According to evolutionism, he said, matter was capable of producing life by itself, starting with the simplest organisms of all which had managed to develop into more sophisticated forms thanks to the action of certain laws termed natural selection and the survival of the fittest; eventually they reached the level of humans, the last link on the zoological scale. Vilanova based his rejection on the same premises that he had expressed in his previous work, that is, that in all the layers of sediment

there were clear and evident traces of the most varied types, from zoophytes and bryozoans to vertebrates, which all coexisted, and that the intermediate types that the evolutionary theory required were conspicuous by their absence. The first monkeys or primates had appeared in relatively modern times and the fossil remains of these mammals belonged to genera and species that could be well determined; to date, no one had proven the transition of these organisms towards what had been called the prelude to humankind, while on the other hand extremely old fossilized human remains had been found that were identical to the bones of modern humans. Finally, he claimed that if the struggle for existence and natural selection were applied in the human species, one would have to consider human beings to be the same as the bulls, sheep and horses that English breeders adapted and modified as they wished, in order to meet particular needs or the whims of fashion (Vilanova, 1876a).

Revilla replied, recalling that he had criticized Vilanova’s efforts to align science with the doctrine of Genesis and to combat Darwinism, and that Vilanova’s attacks on this theory were poorly founded and even less profound. He stated that he had not criticized *The Creation...*, the volumes on natural history compiled by Vilanova: among other things, he noted that in that work Vilanova had accepted a treatise on anthropology

written by the Darwinian Tubino (Revilla, 1876)

Vilanova replied again, protesting that Revilla had called him a new inquisitor for not bowing down to Darwin or Haeckel; for Revilla, he said, these thinkers seemed to be more infallible pontiffs than the Pope. As Revilla had derisively branded him a Darwinist for accepting Tubino’s treatise on anthropology *The Creation...*, Vilanova acknowledged and defended the ideas of his colleague, but insisted that the data from the palaeontological undermined the fundamental principles of Darwinism (Vilanova, 1876b).

On this point Revilla was wrong. In Tubino’s text, Vilanova had systematically noted the questions referring to the theory of evolution with which he did not agree, and which appeared at the bottom of the page as “editor’s notes”. In a dozen cases Vilanova distanced himself from Tubino’s position, criticizing statements such as, for example, that *Monera* were the origin of animals; that the transformist hypothesis was the most reasonable; the expression that it was “better to be a perfected ape than a degenerate Adam”; the claim that for creationists species were established by a special and instantaneous act of providence; that for Darwin species and race were synonyms; the existence of pre-Adamites; or Haeckel’s idea that humankind had arisen in

Lemuria, a hypothetical submerged continent.

Almost at the end of his career, Vilanova returned to the question of the harmony between science and Genesis, writing a highly critical review for the Royal Academy of History of the work by the Jesuit Juan Mir entitled *The Creation as it is contained in the first chapter of Genesis*, published in 1890. Vilanova recalled that in his first book he had tried to demonstrate the perfect conformity and harmony between the history of the Earth and the Cosmos and the narrative of Genesis, showing the slow and gradual appearance of organisms which had led some authors to see it as a kind of foundation of evolutionary theory. With the passage of time, he said, his convictions on this harmony had strengthened rather than weakened (Vilanova, 1891). In this way, and thirty years later, Vilanova closed the circle of his defence of the existence of a harmony between science and religion, which entailed an implicit rejection of Darwinism.

JUAN VILANOVA, A PIONEER IN SPANISH GEOLOGY AND PALAEOLOGY AT THE UNIVERSITY

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In the second half of the nineteenth century, several attempts were made to modernize the Spanish university system, among them the Pidal Plan of 1845 and the Moyano Law of 1852. One of the changes implemented was the introduction of geology as one of the subjects required to obtain the degree of Doctor of Science. As a result, Juan Vilanova would become the first professor of Geology and Palaeontology at the University of Madrid, in 1854.

The courses in geology were to be taught at the Museum of Natural Sciences of Madrid. Mariano Graells, director of the museum, regarded Vilanova as the ideal candidate for the professorship, and urged him to complete his geological training in Paris, where he had been for the best part of four years. During his time in Paris, which had initially been intended to last only two years, he had not just received training as a geologist but had visited numerous sites of geological interest. Finally, Vilanova returned to Spain in early 1854.

On February 24, 1852, the chair of Geology and Palaeontology at the Central University of Madrid

had been created expressly for Vilanova. He took up the chair without having to pass an examination, because it was felt that he had already amply demonstrated his ability, and he took up the post on January 16, 1854. Years later, in 1873, the professorship was divided between Geology and Palaeontology, by Royal Decree; Vilanova, as holder of the chair, chose Palaeontology, and began teaching this subject in 1878.

As a young man he had extended his studies in Europe, arriving in Paris in early November 1849, with letters of recommendation from Graells and Pérez Arcas. From the very first moment he was in contact with the scientific community, and was admitted to several scientific societies.

In Paris he studied and worked with leading geologists and palaeontologists such as Prévost, Dufrenoy, Bayle, Ch. d'Orbigny and Élie de Beaumont. Vilanova interacted with them not only as a student, but also as a colleague on what today would be termed a postdoctoral stay. Thanks to his position, he received advanced theoretical and practical training and was able to make field trips to sites in France, Switzerland and Italy with leading specialists in regional geology. The experience established him as a seasoned field geologist and an expert in the Mesozoic and Cenozoic eras, and the training he received stood him in good stead

when he went on to carry out his regional studies in eastern Spain.

During his stay and his travels, he saw that in both geology and palaeontology French scientists were grouped into two schools. In geology the division was between Prévost's theory of current causes and Élie de Beaumont's theory of mountain formation via vertical uplifts. The supporters of Prévost's actualist or uniformitarian geology maintained that the same physical, chemical and mechanical agents that were at work today had given rise in remote times to all geological phenomena; there was no need for the occurrence of extraordinary events, although it did require an indefinite extent of time. In contrast, the catastrophic school of uplifts, while acknowledging the value of this view, maintained that current phenomena, both geological and physical, were only a weak reflection of phenomena of earlier times and, consequently, that their causes had been of a greater "order" or, at least, of an energy that bore no proportion to the effects that could be observed in the present. For Vilanova, in most of the cases that were observed in nature, Prévost's theory appeared more convincing.

There were also two trends in palaeontology, which Vilanova called the "school of details", led by Deshayes and A. D'Orbigny, and the "school of the broad view", led by Bayle. For the advocates of the "school of details", catastrophists in

palaeontology, the fossil fauna and flora were limited by fixed temporal and geological boundaries, which they could not cross, and which made it possible to recognize the "geological horizons"; they accepted sudden extinctions of fauna and flora, and successive creations, a system that Vilanova fully supported. For Bayle and his school, the disappearance of fauna and flora was gradual and the fossil species passed from one geological period to another, without any catastrophic events. According to Vilanova, however, this was not what one observed in nature; rather, one saw sudden changes in the biota at different levels.

GEOLOGY AND PALAEOLOGY IN VILANOVA'S MANUALS

Vilanova published three manuals on general geology: the *Manual of Geology applied to agriculture and industrial arts* (1860–61), the *Compendium of Geology* (1872) and volume VIII of *The Creation* (1876). A comparison of the three texts shows that their contents are almost identical, varying only in terms of length and in the presence or absence of the chapters on applied geology. Despite the fifteen-year gap between the first text and the last, there are very few modifications at all, and hardly any of the novelties that were recorded during that time period were introduced; at most, Vilanova made slight changes to certain specific aspects. It can be said without

detriment to his work that, although his first book can be considered modern, the later ones were already slightly out of date for his time.

From 1854 to 1877, Vilanova taught the doctoral course "Geology and Palaeontology". The syllabus followed the *Manual of Geology*, a work which was awarded a prize by the Academy of Sciences, and which reflected the geological and palaeontological knowledge that Vilanova had acquired on the field trips during his training. The *Manual of Geology* provided the conceptual framework for Vilanova's teaching of geology, with a catastrophic-actualist conception of stratigraphic and palaeontological aspects, an acceptance of Élie de Beaumont's catastrophist theory of the formation of the mountains, and a belief in the compatibility of science and Genesis. From the methodological point of view, the main feature of the *Manual* is that, despite its catastrophist conception of certain moments in the history of the Earth, for the most part it subscribes to actualism or uniformitarianism; indeed, the book includes a chapter dedicated to current causes

Thanks to the award given by the Academy, the *Manual of Geology* remained a set textbook for ten years. Once this period had passed, Vilanova published the *Compendium of Geology* in 1872, which is a summary of the *Manual*, without the volume on the Atlas. Presumably, it was the book used by

Vilanova and by teachers at other centres of secondary and university education.

Among the few differences between these works, perhaps the most significant was the introduction of the hydrothermal theory for the origin of granite in the *Compendium*, where Vilanova briefly explains this theory and the investigations that led to its formulation. The other important change occurs in the “Table of General Classification of Eras” in the *Compendium*, in which the author modifies the division of materials termed Quaternary and Modern in order to reflect the findings of recent research and also probably due to his growing interest in what he termed “protohistory”.

A detail that shows us that Vilanova was keeping abreast of the advances of geology in all its fields is, for example, the introduction in the chapter entitled “Geognosy” in *The Creation* of the petrographic classifications of rocks presented by Zirkel and von Lassaulx in 1873. Curiously, Vilanova does not accept that the classification of rocks can be independent of the era in which they outcrop and considers that each type of igneous rock is formed in relation to a specific uplift, in accordance with the ideas of Élie de Beaumont; so, in his table he retains a “neptunic series” (i.e., sedimentary rocks) and an “igneous series” – ideas whose popularity was already waning at this time.

From 1874 onwards, Vilanova devoted himself mainly to the study and dissemination of palaeontological and prehistoric issues. To understand his conception of palaeontology, in addition to the three works already mentioned, the syllabus he devised for this course in 1876 and 1878 and his speech on the occasion of his admission to the Academy of Sciences in 1875 are of great interest. For him, palaeontology was not only the cornerstone of historical geology, but also provided the solutions to problems posed by philosophy, botany and zoology and was the “strongest defence” against theories and speculations that were not based on observation of the facts. Basically, the importance of palaeontology was that it aspired “to the knowledge of the origin of life, of the organic species and other groups in the classification of nature and of the distribution of organic beings in time and space”. In addition, he considered that palaeontology demonstrated the unity of the plan of creation and that life had begun with the simplest forms, although not through spontaneous generation. Vilanova maintained that species were fixed; he accepted the possibility of intraspecific variability, but not the unlimited variation posited by Lamarck or Darwin. The conception of organic change in Vilanova’s palaeontology coincides with the conceptions of the French biologists Cuvier and Geoffroy Saint-Hilaire, with a design of creation, the work

of God, which develops over time following a pre-established plan.

For Vilanova, species lived continuously from their creation until their abrupt and sudden extinction, the causes of which were physical. This fact was corroborated by the harmony between the fauna, flora and the terrain in which they were found. These physical causes might be due to the formation of a mountain range, although this formation did not have to be almost instantaneous; in his opinion, slow and continuous geological action could originate a catastrophic phenomenon. With respect to the extinction of species, Vilanova appears to us to be a catastrophist with an actualist method, but he is much less precise when it comes to addressing the issue of their appearance. In his attempts to shed light on this problem, he lists three hypotheses that had been proposed:

1. The transfer of local fauna.
2. A single creation and appearance of new species by slow transformation.
3. Successive creations (the theory that he preferred).

In any case, the most important subject in his work is applied or stratigraphic palaeontology. He first analysed the basic stratigraphic elements on which the studies were based and then presented a detailed description of the different geological eras with the

formations and the fossils they contain, which made it possible to date the materials, and indicated the environmental conditions of each period. As his conclusion on the matter of the appearance of species, Vilanova says: "Let it be concluded, then, that the animals of the various geological faunas do not come, by direct generation, from the species that preceded them but are independent of each other, at least in the well-marked types of both faunas and periods".

THE APPLICATION OF GEOLOGY: ARTESIAN WELLS

Vilanova's profound interest in the application of geology to practical issues, especially to agriculture and groundwater, is amply reflected in both the *Manual* and *The Creation*. Both works end with a chapter on geotechnical engineering, focusing on the most important applications of geology: that is, mining, agriculture and groundwater. Finally, he expanded on these last two topics in two books, *Agricultural geology* and *Theory and practice of artesian wells and the art of finding water* (1880). There is also evidence that Vilanova gave lectures on agricultural issues and artesian wells in many different forums, notably at the Athenaeum, and he also published several more popular works on the subject.

His book *Theory and practice of artesian wells and the art of finding water* was considered by Martínez

Gil (1994) as the first hydrogeology treatise written in Spain, and indeed one of the first in the world. Vilanova was aware of the importance that the exploitation of groundwater might have for the development of agriculture and industry in Spain. This work presents a detailed description of groundwater; how it works, how it is found, and how it is extracted. Given the limited technical knowledge of the time, only wells where the water flowed on the surface (i.e., artesian wells) or was located very close to the surface could be exploited, so it is natural that the title of the book and its contents should refer to artesian wells.

The book presents many new ideas about groundwater and provides interesting information on drilling techniques and the machinery required. It describes the water cycle with great clarity, noting that groundwater is found in permeable soils hemmed in by other impermeable ones, and divides wells into artesian and inverse or absorption. Another point to highlight is that Vilanova was aware that the aquifers had to be recharged, and that this recharging depended on both the geological and meteorological conditions of the region, as occurred with flooding; in this case he proposes some activities related to public works and the need to repopulate the mountains. In conclusion, this is one of the first and most complete treatises on

hydrogeology, which deals with both theoretical and practical aspects and gives us a thorough insight into the understanding of this subject in the last third of the nineteenth century, as well as the hopes and expectations offered by the possibility of exploiting the underground waters.

Vilanova also sought to put these ideas into practice, preparing reports for the creation of artesian wells and participating in several plans for drilling wells in both Alcalá de Xivert and Alcoi. Curiously, after 1880, his interest in groundwater waned and there are no records of his involvement in its study after this date. Perhaps the lack of tangible results of his projects and the significant financial outlay that they must have entailed made him focus on other scientific questions.

THE PROVINCIAL GEOLOGICAL REPORTS

From the point of view of geological and palaeontological research, Vilanova's most important publication were the provincial reports on Castellón (1859), Teruel (1870) and Valencia (1893). He never gave up this line of research, and indeed several authors mention a provincial report of Alicante that was never published, and the Masiá Vilanova Archive contains an extensive draft entitled "Geological and Agricultural Review of El Salar", a report on parts of the provinces of Almería and Granada.

He began this work as soon as he returned from his preparatory trip to Europe. In 1859, he published his geological report of the province of Castellón and shortly afterwards another for Teruel (1863), although it was not published until 1870. An unusual feature of these reports is that they pay great attention to the physical and chemical conditions of the soil and its decomposition, especially in relation to agricultural uses, and they also have a notable palaeontological content. The geological report of the province of Valencia was published in book form in 1893. Previously it had been partially published in the *Boletín de la Sociedad Geográfica* of Madrid, without the chapters on soil, vegetation and prehistory.

The general layout of these works is very similar, with an introduction describing the geographical location and the weather, and the rest divided into five parts:

1. Geognosy (a description of the main geological units and their characteristics)
2. Description of the rocks, their state of decomposition and the causal factors
3. Topsoil (i.e., soil analysis)
4. Agricultural recommendations and precepts, almost all of them describing possible improvements
5. An appendix dedicated to artesian wells and, in the case of Valencia, to "protohistory".

All the reports contained several high-quality plates, mainly depicting

fossils in Castellón and Teruel or archaeological materials in Valencia, in addition to the geological sketch map of the province. In any case, the palaeontological section is limited exclusively to the use of fossils as markers of eras, giving only the indication of their taxonomic name, the author who described the species, the locality, and the age. Despite the scarcity of palaeontological information, the quality of the plates means that these reports contain materials that are useful for modern-day studies.

CONCLUSION

As researchers, we can say that Vilanova was one of the most important Spanish geologists and palaeontologists of his time. Most of his field work involved the collection of new data in different parts of Spain, in an attempt first to create geological maps of the country and its provinces, and then to improve on them. And through his theoretical manuals, he tried to offer Spanish society a foundation for the study of geology comparable to those already existing in neighbouring countries, and to promote the study of some of the discipline's more practical aspects.¹

¹ Most of the information contained here was analysed in Pelayo and Gozalo (2012), where the original references and previous works can be found.

JUAN VILANOVA Y PIERA AND THE STUDY OF PREHISTORY

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From the 1860s until his death in 1893, Juan Vilanova was the main instigator of the study of prehistory in Spain. Between 1849 and 1853 he completed his training in geology and palaeontology abroad, mainly in Paris, at the three institutions that taught these disciplines there: the School of Mining, the Museum of Natural History and the University of the Sorbonne. So he was well aware of the advances being made in Europe in the field of natural history, and of the scientific disputes regarding the immutability of species or the formation of the Earth's surface between the actualist or uniformitarian school and that of the catastrophists, in an environment the question of the origin and antiquity of humanity was attracting increasing attention.

After returning to Spain and taking possession of the chair of Geology and Palaeontology at the University of Madrid in 1854, Vilanova kept abreast of European research. His *Manual of Geology applied to agriculture and the industrial arts* was published in 1860–1861m the first Spanish work to describe the new findings regarding fossil man. When studying the Quaternary period, he noted that the flood levels

of Picardy, in France, contained evidence of stone tools made by humans alongside the remains of extinct fauna. There, Boucher de Perthes had been excavating the terraces of the rivers and his work had been acknowledged by leading naturalists in France and Britain, such as Prestwich, Falconer, Lyell, Buteux, Gaudry and Rigollot. In addition, Vilanova explained that one of the most curious facts in the Earth's history was the coincidence in time between the diluvial formation of the valleys and the sediment that filled the caves containing bones of animals, particularly of mammals now extinct. This means that the diluvial sediment in these caves offered evidence of human activity alongside with the bones of antediluvian animal species, thus confirming the great antiquity of humankind.

Elsewhere in Europe prehistoric research already dated back several decades, but in Spain it faced fierce opposition from the Church. A militant Catholic, Vilanova devoted the last chapter of the *Manual* to the concordance between the account of Genesis and the new evidence emerging from geology and palaeontology regarding the timescale of the history of the earth and the human species – a concordance that had been under intense pressure ever since the publication of Darwin's *Origin of the Species* in 1859, which transformed the conception of the origin of humanity. In the following

decades the theory of the evolution of species became the centre of the controversy between science and religion, a debate on the origin of humankind between creationists and evolutionists that stretched far beyond the scientific domain.

Thus, since 1860, Spanish naturalists had echoed the work carried out in France and the United Kingdom on the origin and early days of humanity. In 1863, the discovery of a human jaw in Moulin Quignon provided direct testimony of the existence of fossil man. Foreign naturalists began to carry out fieldwork in Spain; in 1862, Lartet, Verneuil and Prado had discovered the San Isidro site in Madrid and identified a palaeolithic axe, and in 1864 Prado published the study of this site. For his part, Vilanova made another trip abroad, and on his return to the University of Madrid he spoke of the enthralling question of the age of humankind in the inaugural lecture of the 1864–65 academic year.

In the summer of 1866, Vilanova toured the province of Valencia with the young Eduard Boscà to assemble the geological report on the region. During excavations in the Cova del Parpalló in Gandia, he recovered a remarkable set of bones and utensils made of flint. The same summer, he explored the Cova Negra de Xàtiva, whose surface was covered by a thick layer of grey and yellowish silt caused by flooding; there, Vilanova also found stone knives and fossil

bones, as at Parpalló, suggesting that the two caves corresponded to the *Age of the Reindeer*. In addition, he prospected a very important bone breccia in Tavernes de la Valldigna, and heard reports of the discovery of other prehistoric materials in a cave in Ador and in the caves of Sant Nicolau in l'Olleria, Avellanera in Catadau, and Meravelles in Gandia. Vilanova included these prehistoric caves in the Agricultural Geognosy Report of the province of Valencia, which he presented to the Valencia Economic Society of Friends in the spring of 1867. He continued his prospecting campaigns in that year and in 1868.

Vilanova repeatedly expressed his preference for the term "protohistory". In his view, it makes no sense to speak of prehistory if we agree that "history" covers the whole existence of humanity and that, as a result, nothing could have existed before the first humans. In the same year, 1866, he began to publish a long series of articles on the "Origin of Man" and the "Antiquity of the Human Species". In 1867 he took part for the first time in meetings on these matters abroad, at the assembly of the Geological Society of France and at the second International Congress of Anthropology and Prehistoric Archaeology (CIAAP), both held in Paris. At these meetings he exhibited prehistoric discoveries made in Spain, at San Isidro and at the sites in Valencia. In 1868 he gave an account of his trips in the province of Valencia conducting

geological and prehistoric research in a series of articles he published in *Las Provincias*, where he announced that he had presented the results of his explorations in the Vall d'Albaida and the Marquisate of Llombai at the third session of the CIAAP in Norwich and London. His lecture "Prehistoric remains in Valencia", written in French, gives an account of his fieldwork and the understanding of Valencian prehistory at the time. The caves of Parpalló, Cova Negra, Bolomor, Meravelles, Avellanera, Sant Nicolau and others in Ador, Tavernes de la Vallidigna and Alcalà de Xivert, are recognized as testimony of the two Stone Ages. Castellet del Porquet in l'Olleria, Molló de les Mentires in Aiello de Malferit, two hills in Bellús and other "mounds of earth" on mountain tops were interpreted as Neolithic and early Bronze Age burial mounds. He would later add to this list; in 1869, at the fourth session of the CIAAP in Copenhagen, he described the most important studies of prehistoric archaeology carried out in Spain since 1846, and mentioned the meadow of Torreblanca and the mounds of La Falaguera in Alfarb, and the Ontinyent quarry.

The conferences and articles in which Vilanova disseminated the new science would lead the University of Valencia to set up a commission, led by the naturalist R. Cisternas, to supervise the first prehistoric archaeological excavation campaign in the region, at the mound of the Molló de

les Mentires, in 1869. Prehistoric studies were also carried out by the Valencian Archaeological Society after its creation in 1871 in Orihuela, of which José Vilanova y Piera, N. Ferrer y Julve, and S. Moreno Tovillas were also members.

In 1871, Vilanova and F.M. Tubino published their book *The scientific journey to Denmark and Sweden*, on the occasion of the International Prehistoric Congress held in Copenhagen in 1869. As well as a chronicle of the congress itself, the work is an introduction to prehistoric archaeology, the history of research in the field and the relationship with geology as the foundation of its methodology. Another part was devoted to the description of a large number of sites and museums in Denmark and Sweden, as well as the journey there. On the way back to Spain, in Brussels, Vilanova explored the valleys of the river Meuse and its tributary the Lesse, as well as the series of caves in the area that Schmerling had studied in the 1830s. In Paris, Vilanova was particularly interested in the Quaternary terrains of the Seine and also visited the galleries of the archaeology museum in Saint Germain-en-Laye.

Vilanova's next publication was *The origin, nature and antiquity of man*, in 1872, which can be considered the first textbook of the science of prehistory in Spain. Vilanova defended the unity of the human species, created independently in accordance with the Biblical story,

against the theories of Lamarck and Darwin. The species were fixed and each period contained a set of animal and plant species that differed from the previous and subsequent ones, which were the result of different creations. If we accept the unity of the human species, the conclusion is that the different races and the vast number of languages that exist today took an extremely long time to form, extending perhaps back to the Tertiary period. After the Pliocene and Miocene, the Palaeolithic, Archaeolithic, Mesolithic, Neolithic, Bronze and Iron periods follow on from one another, defined by their geological, palaeontological, archaeological and anthropological features – that is, the sites themselves, the animals that accompanied humans, and the human products and remains. Vilanova considered that it was the geological and palaeontological characteristics that determine the chronology of a site, and not the order suggested by the evolution of the productions, which was particular to each site or region. The appendix, entitled "Spanish Prehistory", is the first essay on peninsular prehistory and includes the most significant sites: San Isidro, Argecilla, the Cueva de los Murciélagos in Albuñol, la Cueva de la Mujer, the lands exploited for bone mining in Palencia and other northern provinces of Castile, Gibraltar, Parpalló and Cova Negra, and so on. In this book Vilanova introduced the term "Mesolithic"

as a synonym for the Age of the Reindeer or Knives; he regarded it as a period of transition, in contrast to the theory of a hiatus between the Palaeolithic and the Neolithic.

Vilanova also attended the seventh session of the CIAAP in Stockholm, in 1874, accompanied by his brother José and other Spanish naturalists, although he did not give a lecture. In the autumn of 1874 he taught a course in prehistoric science at the Madrid Athenaeum and his classes were summarized and published in the *Revista Europea*. In these classes, Vilanova went over the themes discussed at the Stockholm Congress and expressed his opposition to Mortillet's thesis of the existence of a hiatus between the Age of the Reindeer and the Neolithic: according to anthropological criteria, there was no extinction or replacement of human races, nor any phenomena that would have made a large part of Europe uninhabitable, nor any significant alterations of diluvial fauna, except for the fall in the number of large mammal species; nor was there a rupture in the continuous series of stone tools, which ranged from the most rudimentary to others made of polished stone. In contrast, with regard to palaeolithic and mesolithic sites, he did accept Mortillet's proposal that the different periods should be given the names of the sites that were most representative of their archaeological character. This classification divided the Stone Age into five periods, which take their

names from the eponymous sites in France: Acheulean, Mousterian, Solutrean and Magdalenian, and Robenhausian, from the stilt-house settlements of Switzerland. However, sectors open to the new currents of thought regarded Vilanova's support for prehistory to be at odds with the conservative tendency underlying his lectures at the Athenaeum, and this contradiction was publicly criticized by Revilla in the *Revista Contemporánea* in December 1875. Vilanova's status as a naturalist was widely acknowledged, but his fierce opposition to Darwinism and his attempts to harmonize science with revelation were considered serious errors.

In 1876 Vilanova again surveyed a Valencian site, following reports of a cave in Enguera containing dozens of human skeletons. He then visited the Cueva de las Calaveras, de las Maravillas or de los Muertos, as well as the Cueva de la Carrasquilla and the Cueva Santa, accompanied by members of the archaeological society of Valencia. In 1879 he made a small excavation at the stilt-house of Bolbaite, together with his brother José and the discoverer of the site, F. Palop. And in 1880, in a radical change of scenery, he became involved in the defence of the authenticity and importance of the paintings in the Cave of Altamira, discovered in 1879 by Sanz de Sautuola. In September, Vilanova visited Altamira in the company of Sautuola to write a report, and then gave two lectures, in Torrelavega

and Santander. In the first he presented a general overview of prehistoric times and of the most important Spanish sites, and in the second he focused on the Cave of Altamira: the geological structure, the characteristics of the tools made of stone or bone, and especially the wall paintings. The paintings of Altamira correspond to the Age of the Reindeer or the Knives; they are contemporary to the deposit left by the cave-dwellers there and are artistically superior to the ones made on stone, deer horns and ivory in the caves of Massat, La Madeleine and others in France. However, Vilanova warned that these unique creations are bound to "provoke serious and perhaps passionate discussions, not always inspired by the love of truth".

Vilanova then attended the ninth session of the CIAAP in Lisbon, where he was authorized by the ministry to invite the attendees to a visit to the Santillana cave, although finally the visit did not take place. At the congress, Vilanova was a member of the commission given the task of examining the flint utensils from the Otta deposits and deciding whether they should be attributed to the Tertiary period, a hypothesis that he opposed. His lecture suggested the existence of a true Copper Age in Spain. In contrast to Europe, where metallurgy was believed to have begun with bronze and was a consequence of Eastern imports, in Spain the presence in the same site of polished stone

axes and copper axes showed that there was an autonomous transition from the Neolithic to the Age of Metal, and therefore an indigenous manufacture of copper instruments. Examples of this production are the axes, one of diorite and one of copper, found in the dolmen of Olleria. Vilanova interpreted new discoveries like the burials in the Serreta la Vella of Monòver in 1882, and those in the Cave of the Lloletes of Alcoy in 1884, as indicating the same line of continuity between the Neolithic and the Age of Metal. The discovery and subsequent excavation of the Lloletes by E. Vilaplana was reported in detail by the newspapers of Alcoy, which maintained conflicting positions on the meaning and importance of the cave (an early example of the controversy that prehistory in our country still generates today). Vilanova went to Alcoy to support the research led by Vilaplana; they agreed to write a joint report, although finally it was not published.

As for Altamira, in the absence of any objective research the discussion about cave art soon became markedly ideological. By the end of September 1880, the local press in Santander were echoing conservative positions that rejected the antiquity of the paintings and dismissed prehistory, and a report was also being prepared by the *Institución Libre de Enseñanza*. This report, written by Quiroga y

Torres, issued a largely negative verdict regarding the prehistoric antiquity of the wall paintings after comparing them with the paintings found in La Madeleine; the polychromy and aesthetic quality of Altamira, read the report, suggested the involvement of an artistically advanced people of relatively recent times. Likewise, the report of the Frenchman Harlé, who made two visits to Santander to study the paintings at first hand in March and April 1881, rejected their antiquity. Vilanova maintained his active defence of the importance of the prehistoric art of Altamira, and in the summer of 1882 he provided sound arguments to refute Harlé's objections at the session of the French Association for the Advancement of Science in La Rochelle.

In 1883, in fulfilment of the will of F. de Castro, a public competition was organized to offer a prize for a report on the prehistoric times of Spain. In 1885 Vilanova presented his entry, entitled *Protohistory or Primitive History of the Iberian Peninsula*, which was awarded the prize in 1886. *Protohistory* is divided into two parts. The first describes the development and current state of protohistoric studies in general, with a dual focus on the foundation of geological studies and on the state of research in Europe. The second part describes the results obtained in the Iberian Peninsula and the Canary Islands, and the relationship with North Africa. This report was

not immediately published but it appeared in 1890 in the book by Vilanova and Rada to which we will refer later.

In this *Protohistory* of 1885, Vilanova explained the importance of the cave of Altamira within the set of sites from the Magdalenian period, transcribing extensively Sanz de Sautuola's description of the materials and paintings, and repeating the arguments he had used to refute Harlé's report, which had been approved by Cartailhac at the Algiers meeting of the French Association for the Advancement of Science. He also added a note lamenting his compatriots' lack of interest in defending the importance of these paintings. The controversy persisted and grew more intense, and the discussions within the SEHN, at the end of 1886, reflected the profound ideological conflict that existed inside the community of naturalists. The debate did not seek to answer or refine Vilanova's arguments: the refusal to accept the great antiquity of the Altamira paintings was based, above all, on *a priori* considerations about art and art history and about the capabilities of prehistoric humanity. No one paid any attention to the new parallels being discovered in caves in France, or to fundamental issues such as the presence of bison remains in the prehistoric sites of Western Europe. In his book describing the importance of the palaeolithic site of Altamira published in 1887 Cartailhac did not even mention the paintings.

Due to his reputation as a diligent propagator of prehistoric science, and the growing acceptance in the academic world of the importance of the discipline, Vilanova was made a member of the Academy of History in 1888, and entered the institution in 1889. Two key facets qualified him as a reference point for other scientists: his wealth of knowledge of the advances of prehistory in Europe and also in Spain, and his moderate and orthodox Catholicism. The speech he gave on his admission to the academy in 1889 was to be his last on the prehistory or protohistory of the peninsula. The following year, 1890, the *Historia general de España* was published, written by members of the Academy of History, under the direction of A. Cánovas, in weekly instalments. The first volume, *Iberian Geology and Protohistory* was written in conjunction with J. D. de la Rada, and comprised three sections dedicated to the geology of the Iberian peninsula, protohistory in general, and Iberian protohistory. The book does not indicate the contribution of each author, but the contents clearly correspond to Vilanova's work and research. In fact, the second part of the book, "Iberian protohistory" (1890: 415-627), which includes an introduction to the history of the new discipline in Spain and Portugal and the chapters dedicated to each period from the Palaeolithic to the Iron Age, broadly reproduce his report of 1885, with very few modifications.

In the summers of 1889, 1890 and 1891, as was his custom, Vilanova attended meetings and congresses abroad, including the CIAAP session in Paris in 1889. Back home, he reported a new Mesolithic site in the Cova del Moro de Teulada in 1889; in 1890 he reported A. Ibarra's discovery of a deposit of unusual copper axes in Elche, and in 1891 he explored the Cabezo Redondo in Villena. The arrival of Rodrigo Botet's American palaeontological collection in Valencia in the summer of 1889 also caught his attention. The Academy now frequently received reports of new findings. Unfortunately, in 1892 Vilanova became ill; those closest to him reported that he was still working on the notes for the geological report of Alicante, which finally he was unable to finish. He completed the revised version of the geognostic-agricultural report of Valencia, written in 1867, and which had been published between 1881 and 1884 in the bulletin of the Geographic Society. It was published in book form in 1893 along with an appendix on the protohistory of the province.

The report of 1885, Vilanova and Rada's book of 1890 and the speech at the Academy of History, written in the first months of 1889, reflect his belief that prehistoric research is like geological and palaeontological research: that is, that we can link together the *diluvium* of the valleys and the sediment of the caves, and that the variety of the production

of a deposit indicates its belonging to broad cultural stages, just as fossils do for geological periods. Humankind appeared suddenly, with all the distinctive features of its lineage, with very little difference in physique with regard to what it is today. Vilanova accepted that there had been an intellectual and moral development since then, and that, from a stage more or less of savagery, as he writes in the report of 1885, humanity had gone through the successive stages that are reflected in the material culture and in the ways of life of the different ages and periods. The small physical changes that appeared had caused the variety of the human races, of which the first fossil race was that of Canstadt or Neanderthal, to which the skull of Gibraltar belonged. The geological determination of the lands containing the fossils challenged the existence of humankind in the Tertiary period, as he proved in Otta, in 1880. In the Quaternary, possibly starting from Asia, human populations expanded along the route to North Africa, where there was increasing evidence from the Chellian and Mousterian periods, and reached the peninsula via the isthmus of Gibraltar. These human groups, the first settlers in the Quaternary period, are the original Iberians who developed continuously and autonomously until the Iron Age. New population groups arrived in the peninsula, but the impact of their arrival was palliated by those who are already there;

all races survived and coexisted in different areas, and none of them were responsible for the changes in the Neolithic period or the Age of Metals.

The aborigines passed through the cultural stages of the three ages proposed by Scandinavian archaeologists, and also roughly conformed to Mortillet's system for the sites in France. However, Vilanova insisted that the validity of foreign models was only relative, because in each site the process of evolution may differ in terms of chronology, rhythm and mode; for instance, in the peninsula, pottery may have appeared before the Neolithic, and there was no hiatus between the Mesolithic and the Neolithic. The sites he had studied, such as Argecilla, demonstrated the autochthonous nature of the transition processes that crossed the Neolithic, Copper and Bronze Ages.

Reading the books of Cartailhac in 1886 and the Siret brothers in 1887 did not change his thinking. Cartailhac made two important warnings, about the limited value of exhaustive counts of findings without any context, and about the Valencian caves surveyed by Vilanova (Parpalló, Cova Negra, Sant Nicolas, Meravelles and Avellanera), of which he said that Vilanova had provided inaccurate references. In contrast, Vilanova insisted on relativizing the differences between the sites in space and time, while emphasizing the continuity and autonomous

development. In the chapters dedicated to each period, from the Palaeolithic to the Iron Age, Vilanova examined the entire peninsula presenting all the information at his disposal, though without addressing the problems of definition of the four characters on which the periodization of prehistory must be based. Thus, the documentation of so many sites in Spain, against the background of the reflections and problems open in the context of Europe, draws a picture of the continuity of the population from the most distant origins to the present, and is an invitation to pursue its research further.