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History of Arab-Muslim Science in Spanish scholarship: The balanced approach of Juan Vernet Ginés

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Abstract: The presence of Islam in the Iberian Peninsula and its contributions to the Spanish nation has given rise to the emergence of two schools of thought: one is highly ideological which denies the positive impact of Islam and the Arabs in Spain and the other emphasises the significant contributions of the Islamic polity, its cultural and scientific achievements and its influence on European thought. Juan Vernet belongs to the latter school of thought. Vernet wrote extensively on Islam in Spain and particularly on the history of the Arab-Muslim and Spanish science. He wrote on the history of the exact sciences in Muslim Spain, especially on the contribution of Muslim astronomers in the thirteenth century. Vernet argues that Islam is a foundational element in the Spanish history, culture and identity. This paper attempts to explore the moderate and balanced views of Juan Vernet on Islam, particularly with regard to the history of Arab-Muslim science in Spain, focusing on two of his works: *"Historia de la Ciencia Espanola"* (History of the Spanish Science) and *"Islam y Europa"* (Islam and Europe). One of Vernet's ideas is that of the centrality of the Arab-Muslim science in Spain, even during the last Muslim kingdom. He also emphasizes in his works the consistent scientific exchanges and the social cooperation between Muslims and non-Muslims in philosophical and scientific matters. Vernet's ideas represent an example of a balanced approach to Islam, in the context of dominant Spanish views of Islam which emphasizes the political antagonisms among religious communities.

Keywords: Juan Vernet, Muslim Spain, Spanish science, school of Spanish Arabists, Islam & Europe.

Introduction

20th century Spanish scholarship on Islam in al-Andalus[1] and particularly the *Escuela de Estudios Árabes* (School of Arabic Studies) played a significant role in

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1 The Islamic polity in the Iberian Peninsula from 711 to 1492. The fall of Granada in 1492 represents the end of the Islamic domination in Medieval Spain, however, the influences of the Arab-Muslim culture continued after the expulsion of the Spanish Muslims two centuries later.

promoting a better understanding of the Muslim contributions to the development of science in medieval Spain. This school of thought of Arabic Studies pointed out the importance of studying the Islamic presence in Spain from 711 to 1492 CE in the Iberian Peninsula as an intrinsic element of the Spanish's culture and its past. Particularly in the field of Arab-Muslim science, Islamic civilization made major contribution and left a profound impact in the field of Spanish Science and culture. Juan Vernet Ginés is considered one of the most prominent scholars belonging to the School of Spanish Arabists, of which he is the most authoritative figure with regard to the study of Arab Muslim Science in al-Andalus. He has written extensively producing 22 books and 325 articles on a wide variety of subjects including Arabic science, the impact of Islam on the West, cooperation between Arabic culture and European culture, and the like. Vernet argues that within three centuries the Arabs achieved the almost complete mastery of all the disciplines cultivated at that time. In response, the nationalist, racist and anti-Arab theorists in Spain attempted to explain the Arab rapid cultural splendour as the product of the linguistic Arabization of the Indo-Europeans, meaning the Arabized Christians rather than Muslims. In contrast, Vernet and the Spanish school of Arabic Studies showed that the Arabs with regard to scientific matters tended to recognize the values of diverse cultures. In fact, according to Vernet, this is one of the most prominent characteristic of the Arab-Muslim culture in Spain: the great capacity of assimilation of the knowledge from civilizations under their rule as well as the cultures with which they had direct or indirect interaction. These ideals of respect and acceptance of the plurality of cultures, religions and civilization was one of the central values of the Islamic civilization in al-Andalus and the main factor for its cultural and scientific splendour. Vernet and the Spanish School of Arabic Studies were committed to promote this Islamic principle within the framework of the contemporary Spanish nation. It is important to note that the scholarship produced by Spanish Arabists influenced positively the intellectual circles and modified the prevailing conceptions on Spanish history and culture. In fact, as James Monroe stressed, Spanish intellectuals who were not Arabists used the results of their colleagues' investigations to elaborate new theories, polemics and a great deal of scholarly activity about the Spanish past. The most important debate took place between two Spanish Scholars, Claudio Sanchez Albornoz and Américo Castro. For Sanchez Albornoz, the Arab influence made Spain deviate from its normal course as a European nation, creating economic stagnation and religious intolerance. In other words, for him, the Arab influence on Spain was a negative and unfortunate episode in the history of Spain. On the contrary, Américo Castro rejected many of the negative ideas; instead, he attributed a

decisive and positive role to the interaction between Jews, Christian and Muslims in Spain.

The first section of this study discusses the biography of JuanVernet and his important works on History of Arab-Muslim science in particular and Islam in general. This sections highlights that Vernet is a member of a school of thought initiated by Codera, Ribera and Asin and continued by Garcia Gomez, Millas Vallicrosa and Vernet. The legacy of Vernet continues in the works of his most prominent follower Julio Samso. The second section presents Vernet's ideas on the development of Arab-Muslim science during the 11th century and its appreciation of knowledge regardless of his provenance, in other words, its appreciation for cultural diversity. The subsequent sections deals with the subject of the scientific transmission from the East to al-Andalus and to the West, the scientific splendour of al-Andalus in the 12th century and the decline of science in Al-Andalus according to Vernet' thought. The paper concludes with remarks on the relationship between moderate policies toward scientific enterprise and cultural flourishment.

Juan Vernet Ginés

Juan Vernet Ginés (1923-2011), the 20th century Spanish Arabist, dedicated his life to the study of the Islamic exact sciences in medieval Spain, especially in the field of Arab-Muslim and Spanish science. His works on medieval science covers astronomy, mathematics, nautical science, general history of science, history of medicine and geography, Spanish Science in the reign of Isabel II, etc. Vernet had also studied the Qur'an, the biography of prophet Muhammad (SAW) and Arabic literature. He was a prolific writer and his most important works include: *La Cultura Hispanoárabe en Oriente y Occidente* (The Hispano-Arab Culture in the East and the West), *Estudios Sobre la Historia de la Ciencia Medieval* (Studies on the History of Medieval Science), *Historia de la Ciencia Española* (History of the Spanish Science), *Contribución al Estudio de la labor Astronómica de Ibn al-Banna* (Contribution to the Study of the Astronomical Works of Ibn al-Banna), *Astrología y Astronomía en el Renacimiento: La Revolucion Copernicana* (Astrology and Astronomy in the Renaissance: the Copernican Revolution). The first two works are considered to be of seminal importance in the international and Spanish scholarly world. According to Monroe, among the group of Arabists working on scientific development in Barcelona, mention should be made of Juan Vernet, whose works have been praised by specialists in maritime cartography and astronomy (Monroe, 1970: 240).

Estudios sobre la Historia de la Ciencia Medieval (Studies on the History of Medieval Science) is a unique compilation of Vernet's Works. Published in 1975, it is divided in five parts: the first part contains 5 articles on the Qur'an, especially *moriscas* ("Moorish") versions written by peninsular Muslims and Muslim converts[2], which Vernet compared with the contemporary Spanish translations. In this regard, it is important to mention that Vernet considered that the versions of the Qur'an written by converts are intellectually superior (Mercedez, 1990: 577). The second part contains 3 articles on Arabic onomastics. The third part is on science, technology and medicine and contains 23 articles on Arabic science in general. This part is the most extensive and complete, and is the focus of present article. It also includes articles on alchemy, mathematics, astronomy, mechanics, geography, etc. The fourth part is on Arabic literature, one article explores the oriental influences and sources on the Spanish writer Lope de Vega and finally the last part contains 11 articles on history.

Juan Vernet Gines was a professor at the University of Barcelona and the first professor of Arabic at the Autonomous University of Barcelona. His direct master was Millas Vallicrosa[3]. Vernet also belongs to the group of Arabists formed under the leadership of Emilio Garcia Gomez[4] who was the direct disciple of Miguel Asin Palacios[5] and Julian Ribera[6], who are considered the founders of

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[2] *Moriscos* refers to Spanish Muslims forced to convert to Catholicism under the pressures or death sentence or expulsion under the Spanish Inquisition. Many of them continued to practice Islam clandestinely. That is why, Vernet was interested in translating their versions of the Qur'an.

[3] Jose Maria Millas Vallicrosa was a member of the group of Orientalists who conducted research on the history of Arab science at the University of Barcelona. He is well known for his work on Hebraic and Arabic studies. His book *Estudios sobre Azarquiel* (Studies on Azarquiel) a Muslim astronomer whose work was decisive in the development of European astronomy. He was a disciple of Miguel Asin Palacios, the author of *Islam and the Divine Comedy*.

[4] Emilio Garcia Gomez was a direct disciple of Julian Ribera and Miguel Asin Palacios. He continued the tradition of Arabic studies in the University of Madrid and later the University of Granada. His inspiration came directly from Asin Palacios during his classes of Arabic. He changed his studies for law and letter and became an Orientist. Garcia Gomez is well known internationally for his studies on Hispano-Arabic, Andalusian and Arabic Literature. His impressive works on Muslim scholars, namely, Ibn Hazm, Ibn al-Khatib, Ibn Zamrak should be mentioned. He was the director of the prestigious journal *al-Andalus*, amongst the international collaborators were the Dutch Dozy and Levi Provencal. Garcia Gomez was particularly critical of Dozy. Vernet belong to the group of Arabists grouped around Garcia Gomez.

[5] Miguel Asin Palacios was a disciple of Julian Ribera. He devoted his life to the investigations of Islamic spirituality and philosophical ideas in al-Andalus. The central focus of his studies

the school of thought of 1888 and successor to the father of Spanish Arabism, Codera.[7]

Vernet was an Arabist, unlike his master Millas Vallicrosa who was an orientalist and a medievalist who could work with Hebrew, Arabic, Latin, Medieval Spanish and Catalan. One of his main concerns was the Qur'an which he translated twice into Spanish, in 1953 and 1963. His contemporary follower, Julio Samso[8] wrote:

> Vernet knew the Qur'an almost by heart. Many years ago, the Imam of the Islamic Centre in Barcelona, an extremely cultured Syrian gentleman who presented his PhD at the University of Barcelona, was the only student in Vernet's course on History of Arabic Astronomy and Samso. He said that he is afraid to say that the topic of the classes had nothing to do with astronomy, but became a discussion on different passages of the Qur'an (Samso, 2011: 146).

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was occupied by two of the most important figures in Andalusian thought: Ibn Hazm and Ibn al-Arabi. He was a Spanish Catholic priest who recognized the Islamic-Arabic influence on European civilization; he is a controversial figure in the history of Spanish Arabism for entertaining a suggestion that the most eminent catholic poet of Medieval Europe, Dante Alighjeri used Islamic Arabic sources. In his book *Islam and the Divine Comedy* offers detail comparison and document arguments about the parallels between the nocturnal journey and ascension to Heaven by Prophet Muhammad and Dante's portrayal of the heaven and Hell.

6 Julian Ribera and Tarrago initiated in Spain a serious school of Arabic studies, which maintained a living traditions and perfect continuity. Prove of this are the works of Asin, Garcia Gomez, Millas Vallicrosa and Juan Vernet, among others. Ribera devoted his life to the study of how Europe had adapted important cultural institutions from the Arab Wold. With his works he extended the scope of Spanish Arabism into fields dealing with Arab culture in the Middle East.

7 Francisco Codera y Zaidin is considered the precursor of Spanish Arabic studies. With Codera Spanish Arabism won international fame and became respectable. Though profoundly Catholic, he had a deep admiration for Arabic culture, and was able to instill this feeling into his disciples: Ribera, Asin, etc. He was able to create a Spanish Arabism belonging to a well defined school with its own tradition, which made possible a vigorous tradition, the Arabist School of the Beni Codera.

8 Julio Samso is a professor in the Department of Arabic at the University Autonoma de Barcelona and the University of Barcelona. He has published widely on Andalusi science. He has, together with Professor Juan Vernet, organized two exhibitions: *"Astronomical Instruments in Medieval Spain and their Influence in Europe* (1985)" and *"The Scientific Legacy of Al-Andalus (1992)*."

Vernet was regarded as a crypto-Muslim.[9] In this regard, he used to say he was a *hanif*, which, for him, meant a monotheist without ascription to any particular religion. During his last years of life, he spent his time reading Islamic journals which reproduced *fatwas* by Eastern Muslim muftis related to problems of everyday life and expressed his desire to translate the Qur'an for the third time using these materials as a commentary.

Arab-Muslim science in the 11th century and its appreciation of cultural diversity

Juan Vernet in his *Estudios sobre Historia de la Ciencia Medieval* (Studies on the History of the Medieval Science), defines the term "science" as the disciplines belonging to the exact sciences, natural sciences and technical sciences. In this book his focus is on the evolution of the scientific knowledge during the year 1091, the year the Almoravids (North African Berber Tribe) took over Seville and established their domination in al-Andalus. Vernet is interested in the polemical issues and specific debates with regard to this subject.

According to Vernet, the first issue with regard to Muslim Science, which he defines as scientific works exclusively written in Arabic, regardless of the race of the authors, is the celerity with which it reached its zenith. Initiated by the Arab expansion in the early 7th century, it may be said that three centuries later the Islamic civilization had reached its zenith. Also, it is necessary to consider that even though the first translations of scientific works were not undertaken until the mid to late 8th century, we can see that in the short period of one hundred and fifty to two hundred years the Arabs managed to transit from illiteracy to an almost full mastery of the cultivated disciples at that time.

This fact is considered by Vernet as one of the controversial issues which generated a number of responses from the nationalistic and racist theorists who tried to explain this rapid splendour of the Islamic science as the product of the linguistic Arabization of the Indo-Europeans. Vernet opposed this argument, saying that the statics are not conclusive. This contemporary racist response to the Arab-Muslim scientific development in al-Andalus, he argues, was initiated in the Middle Ages by the non-Arabs, which at that time, according to Vernet, felt an

[9] Word used in reference to Spanish Muslims or *Moriscos* during the Inquisition. Morisco's use of Aljamiado or secret script to produce books on Islamic subjects while in public professing the Catholic faith. Cripto-Muslims are the people who practiced cripto-Islam. In other words, the terms mean the secret adherence to Islam.

inferiority complex. On the contrary, the Arabs in the scientific matters and up to the 11th century tended to recognize the values of various diverse peoples. In this regard, Vernet mentions Ibn Said in his book on the History of Science (*Book of the Categories of Nations)* written in Toledo in the 11th century. Ibn Said says:

> We have observed that the people with their multiple divisions and the diversity of faith can be classified into two categories. The first those who are interested in knowledge and the second those who are not interested. The first category comprises eight nations: Hindus, Persian, Caldee, Hebrew, Greek, Rum, Egyptians and Arabs. In the second category are the rest of nations which have not been mentioned. However, Ibn Said adds that there is an intermediate zone between these two categories occupied by the Chinese and Turks, the former excels in Arts and the latter in the techniques of war. With regard to the Celts, Berbers and others their lack of interest in knowledge is attributed to their tyranny, ignorance and enmity and violence (Vernet, 1979: 539).

In short, Vernet's argument is that one of the most notable characteristics of the Arab-Muslim culture is its great capacity of assimilation of the knowledge from the people under their rule as well as the people who had direct or indirect interaction. In addition, Arab culture showed enormous appreciation for the literary traditions of other people.

Vernet mentions as an example the interactions with Byzantium, Syrian, Indian, Chinese, etc. In this regard, Vernet describes the beginning of Arabic astronomy in Baghdad, when a learned Hindu name Manka visited the city and gave lectures to the astronomers of the Caliph al-Mansur. Biruni mentioned that Manka knew no Arabic and so the lectures were delivered through an interpreter. From Manka the Arabs learned of the work of the great Hindu astronomers Siddanta and Aryabhata, and from India they adopted the use of the astrolabe. Later the Caliph Ma'mun founded two observatories and had his astronomers measure the circumference of the earth, which measurements reached Columbus in a modified version (Monroe, 1970: 240-241).

Later in al-Andalus, Vernet mentions that the emir 'Abd al-Rahman I, a member of the Ummayyad family (of Damascus), managed to reach Cordoba and thus saved his life. He declared himself to be independent of Baghdad and he introduced certain Eastern customs and tastes, but he continued to depend upon Christian professional advisers, except in matters connected with warfare and the Muslim religion: military and civil engineers might be charged with the task of excavating a mine, building a bridge or a water channel, or determining,

approximately, the direction of Mecca, so that the faithful might be able to turn their faces towards it at the time of prayer (Vernet, 2000: 937).

Similarly, Ibn Juljul mentions six doctors who were practising medicine during the reigns of the amirs Muhammad I, al-Mundhir and ʻAbd Allah. Five were Christians. One of them, Jawad, invented a medicine which must have been famous, for it was known as "the monk's medicine." Judging by the testimony of Ibn Juljul, who was writing in the second half of the 10th century, doctors at this time studied the aphorisms of Christian doctors which had been translated into Arabic. In the middle of the 10th century the situation began to change in favour of the Muslim doctors, but even so, when ʻAbd al-Rahman III fell ill with an inflammation of the ear, he was treated by Yahya b. Ishaq, the son of a Christian doctor (Vernet, 2000: 938).

Scientific transmission from the East to al-Andalus and the West

The first scientific and technical influences of Eastern origin were introduced into Muslim Spain in the middle of the 9th century. First thing to note is the arrival in Cordoba of the doctor al-Harrani, who soon became the chief physician to the amir ʻAbd al-Rahman II. Ibn Juljul mentions al-Harrani's two nephews, Ahmad and ʻUmar b. Yunus al-Harrani, who studied in Baghdad between 941 and 962. As mentioned above, the spirit of moderation allowed Muslim scholars and rulers in al-Andalus to benefit from the Christian knowledge in medicine and other fields, with the exception of religion and war affairs, Christians enjoyed notable status as advisors and especially as physicians for the emirs.

One of the major ideas of Vernet in explaining the rapid scientific development of al-Andalus from the 11th century onwards was the moderate policies adopted to gather information and knowledge regardless of its provenance, for the purpose of enlightenment. This policy was especially prominent during the period of the Cordoban caliphate. According to him, the abandonment of the moderate policy for knowledge and learning is one of the main factors for the decline of al-Andalus.

In Spain, the ancient and unsatisfactory theories of popular pharmacology, of late Roman origin, were displaced by Eastern theories; these were likewise inspired by classical Greco-Roman and Indian texts, but they had passed through the filter of the East. The most interesting work which reached Cordoba was the *Materia Medica by Dioscorides*, translated into Arabic by Istifan b. Basil. In about the year 948, the Byzantine Emperor presented the caliph ʻAbd al-Rahman III

with a magnificent copy of *Dioscorides* in Greek. The readers - some of whom must have known colloquial Greek - could not understand the text. Since the Caliph did not have any Hellenists on hand, he urged the Emperor to send him a specialist who could teach Greek science to physicians. His petition was heeded, and it was thus that monk Nicholas arrived in Cordoba. This is of some importance, since henceforth scientific Greek became part of the legacy of a group of scholars, such as Hasday b. Shaprut, Ibn Juljul and Maslama of Madrid (Vernet, 2000: 939).

During the 11th century the transmission from the East to al-Andalus was a prominent trend and later on from al-Andalus to the West. Vernet gives the example of the use in the East of snow and ice. It is well know that Nicolas Monardes in his book of the Snow studied Aviccena's recipes which included this ingredient. Snow was considered a luxury product up to the 20th century, the usage of snow and ice for refreshment in summer, is recorded in the Arabic literature, as well as it is mentioned that the Banu Sassan used it for the preparation of drinks. For Vernet, the evidence shows that the transmission from the East to the "Islamic West" (al-Andalus) was constant and continuous especially during the 11th century. However, with respect to the transmission from al-Andalus to the East, this transmission could not be traced before the 10th century, considering that the Andalusi cultural development was initiated later with respect to the East.

However, Vernet indicates that one of the first contributions of al-Andalus to the Eastern science is the knowledge of certain types of luminescence of the sea. The anonymous author of the *Ahbar al-sin wa-l-Hind* tells us in the year 851: *and the sea when the waves curl seems to be blazing*, in other words the offshore waters become luminescent due to Noctiluca miliaris (mollusk). In contrast, the *Kitab 'aya' ib al-Hind* refers to another type of luminescence produced by the waves crashing against the coast, that is, to that produced by the mollusk Pholas dactylus whose habitat extends from the Atlantic to the Indian Ocean. In addition, the figure who in Philippine discloses the phenomenon of Indian seafarers happens to be a native of Cadiz (Spain), who had observed the same phenomenon in the Atlantic Ocean.

Likewise the process of the manufacture of glass, which was discovered by the Andalusian 'Abbas b. Firnas or the discovery of Azarquiel which is reported by Ibn al-Qifti (1248). Azarquiel invented the Azafea, an invention of small size, which contained all the things related to the science of the movement of the celestial spheres. In this regard, Vernet argues that the examples of the knowledge

about snow, ice, luminescence of the sea and movement of celestial spheres proves that the science in al-Andalus in the 11th century could be compared with the Eastern science in some fields. It is in the 12th century that the transmission of Islamic Western discoveries to the East was more frequent. That is why, Vernet quoted the 12th century Andalusi poet Ibn Quzman (1160) who says that his poetry (Zejel) was well known in Iraq, what a wonderful fact, poetry itself is not worth compared to the cultural exchanges between al-Andalus and the East (Vernet, 1979: 564).

A precursor to all those who have hitherto been mentioned was ‘Abbas b. Firnas (887). Not only was he a poet and an astrologer, but he attempted to fly by leaping from the Rusafa palace in Cordoba – a feat reminiscent of the latter attempts made in this direction by the English monk Aylmer of Malmesbury. Unfortunately, Ibn Firnas could not understand the role played by the tail when birds alight on the ground, and he injured himself. He modified and perfected the technique of cutting rock crystal (quartz); in one room of his house he built a kind of planetarium; and he invented the water clock capable of indicating the times of prayer, albeit without a high degree of accuracy. This machine (*minqana* in the Arabic text) may perhaps be regarded as the prototype of those machines that were invented in the 11th century (Vernet, 2000: 939).

The first signs of a native Andalusi art of medicine began to appear in about 964. ‘Arib b. Sa’id wrote a treatise on obstetrics and paediatrics, which contains some information of and astrological king, but which nonetheless offers evidence that a portion of Aristotle’s writings was already known in Cordoba. A more important author is Abu ‘l-Qasim al-Zahrawi (d.ca.1013). He wrote a medical encyclopaedia in which there were prominent sections devoted to surgery and pharmacology. Vernet stresses that we are equally indebted to these scholars for some of the first good clinical descriptions of leprosy and haemophilia; the introduction of cauterisation and numerous surgical instruments such as one frequently finds represented in the engravings of Renaissance doctors; and the stitching of wounds by means of ants (Vernet, 2000: 940).

How science was exported to Egypt from Muslim Spain? There was a Jew of Saragossa named Abu ‘l-Fadl b. Hasday. He wrote well in Arabic and already in about 1065, when he was still a young man, he was familiar with two books of Aristotle: the *Physic* and *On Heavens*. He converted to Islam and, some years later immigrated to Egypt. A person with the same name is cited in that country as a correspondent of Ibn Bajja (Avempace). He was a friend and disciple of Ibn Bajja.

Another example – and which is more significant- is that of Ibn Rushd and Maimonides. Both were born in Cordoba, the first in 1126, the second 1140. Ibn Rushd wrote his first commentary on Aristotle in 1159. At that time Maimonides was in Fez on his way to Cairo, where he reached in 1165. One may deduce from this that Maimonides had not read the works of his fellow-citizen Ibn Rushd while he was in the West. These reached him in the hands of learned merchants, such as the Jew Josef ben Yehuda ben Ishaq ben ʻAqrun.

It would be very interesting to know whether, as is generally said, Ibn Rushd had no disciples in the Muslim world. Since his name was missing in almost all subsequent biographical dictionaries. This, however, is not surprising since the biographical dictionaries failed to mention the names of other important mathematicians, doctors and astronomers. Officially, Ibn Rushd only had two Arab disciples: his son Abu Muhammad b. ʻAbd Allah (who was a physician to the Almohad sultan al-Nasir) and Ibn Tumlus of Azila. But if one accepts the definition of "disciple" given by the alchemist Abu ʻl-Qasim Maslama of Madrid in his *Rubat al-hakim* with reference to Jabir b. Hayyan, we might find another. Abu Maslama says that "one hundred and fifty years separate me from Jabir b. Hayyan, but, despite that, I regard myself a true disciple of his because of the great esteem in which I hold his work." By this criterion, Ibn Rushd had a magnificent disciple in the figure of Ibn al-Khaldun. Al-Maqqari, who in this instance is faithfully copying Ibn al-Khatib's *Ihata* informs us that Ibn Khaldun explained and summarised a large number of books by Ibn Rushd. Since Ibn Khaldun finished his *Muqaddima* three years after the assassination of Ibn Khatib, it would seem that he went on gathering together materials from Ibn Rushd, whom he cites ten times. Similarly, Ibn Rushd himself did not always agree with Aristotle. To conclude, Ibn Khaldun regarded himself as a disciple of Ibn Rushd full two hundred years after the latter's death.

The scientific splendour of al-Andalus in the 12th century

Vernet emphasizes that within the Muslim world the cultural communication was exercised freely without obstacles and in all directions, with the exception of difficulties imposed by religious and political matters. It was the fall of Granada in the 15th century that facilitated the transformation of the Maghrib in a cultural province of the East, taking place until the 16th century. The Islamic West, al-Andalus, influenced the Eastern science from 11th to the 15th century. The existence of the Christian Western science at that time compared to the Andalusi and Eastern science was practically insignificant. It is important to mention that in

Vernet's thought there is a confrontation of two worldviews, that is the West and the East, the West refers to Christian culture and the East non-Christian cultures. Vernet is extremely interested in the scientific and cultural interactions between Christian Europe and Islam.

It is a little misleading to call this age as "Time of Bede". To be sure, Bede was a great personality, one who commands full respect and affection, but it is a lonely one; he represents the monastic learning of Christian Europe, but does not represent any original and progressive movement. However, Bede was the standard bearer of this time, because he was, all considered, the most prominent writer on scientific subjects. The time of Bede is one of intellectual stagnation. The relaxation which set in the second half of the seventh century continued until about the middle of the eighth century. From the middle of the eighth century until the twelfth century, Latin culture would be almost entirely overshadowed by Muslim culture (Vernet, 1979: 941).

The beginning of the political decline of a country often occurs before it has attained its cultural pinnacle. This is what happened in Muslim Spain: the political and military hegemony of the caliphs was succeeded by the impotence of the "petty kings." The Muslims of the Iberian Peninsula were now grouped within ten or twelve independent states. Unable to fend off the attacks of the Christians of the North, they purchased peace in exchange for the payment of an annual tribute. They were sometimes encouraged to offer their patronage to specialist in different branches of learning.

Vernet indicates that we are quite well informed about the development of science during this period thanks to the writings of the qadi of Toledo, sometimes called Ibn Sa'id (d. 1070), usually translated as the "Book of the Categories of Nations", but which is really a Universal History of the Sciences. There are obviously some inaccuracies, but, even in the state and condition in which it has survived, it constitutes a veritable archive of information, giving us the names of those young men who, at the time of the work's compilation, seemed to have the most promising future.

Traditionally it used to be thought (possibly through the influence of Dozy) that the landing of African Berber tribes on the Iberian Peninsula – the Almoravids and the Almohads – was the direct cause of the cultural decline of Muslim Spain from the apex attained during the Taifa period. This may be true with regard to literature, but it is obviously not true as regards the development of science. Whereas in the 11th century, the century of the Taifa kings, there were some outstanding astronomers, in the 12th and 13th centuries, when philosophers

such as Ibn Bajja (Avempace) and Ibn Rushd were prominent, scientists also played an important role, since the former did not merely cultivate philosophy in the sense in which that word is understood nowadays: at that time the term comprised everything which until the 18th century was known as natural philosophy, including those sciences – such as mathematics and astronomy – which had still not become separated from the Aristotelian concept of science (Vernet, 1979: 945).

It should be noted that it was during this century of philosophy (12th century) that Muslim Spain exported most of its ideas to the East (Egypt, Syria, Persia and China) and to Europe (France, Italy, Germany and England). These invisible exports, which had started unobtrusively at the end of the 10th century, now grew as a result of the scientific progress achieved in the Iberian Peninsula during the 11th century. The scholars who emigrated eastwards personally conveyed their knowledge to those parts, or else their works reached Cairo and Damascus in the hands of merchants, many of whom were Jewish. A contributory factor in this whole process was the expansion of maritime trade, which, by the 13th century, had reached all the coasts of the Mediterranean, leading to growing competition between the Italian city-states-Venice, Genoa, Pisa- and the chiefs "autonomous" ports –Barcelona and Marseilles (Vernet, 2000: 946).

The decline of science in al-Andalus

The last bastion of Islam in Spain, the Nasrid kingdom, attained its final moment of splendour in the 14th century during the reign of Muhammad V. From 1348 to 1351, it had to endure the scourge of plague, so well described by two polymath writers. Ibn Khatima and Ibn al-Khatib, who give information on how the epidemic spread from the East to the West. It is to this period that one must assign the start of the transition from clepsydras to mechanical clocks, which according to textual accounts, were operating up to the point in Granada, Fez, Tlemcen, etc. It is also certain that during this period scientific contacts with the Near East remained strong and there was still a keen interest in agriculture and medicine. Ibn Luyun (1282-1349), for example, wrote a didactic poem on agriculture. With regard to medicine, it is known that one doctor from al-Andalus emigrated to serve in Christian lands and that others, such as Muhammad b. Al-Shafra (d. 1360), had non-Muslim pupils in their classes (Vernet, 2000: 951).

Conclusion

Juan Vernet Gines had tried during his academic life to investigate in depth the history of Arabic and Spanish science. This subject is understood by him as a

transcendental issue in order to reconstruct Spanish's past and identity. Nationalistic and racist theorists had attempted to erase the history of Islam and the Arabs in Spain, as part of an artificial revivalism of the Catholic Church and nationalistic movements.

Vernet had proven that Arabic and Spanish science are interrelated and the importance of recognizing the contributions of Andalusi science and Islamic civilization to Spanish identity. Vernet as well as the School of Arabic Studies and its members were aware of the fundamentalist ideologies which promoted a confrontation between Spanish "true" identity and Islam as a negative presence in the Iberian Peninsula. Instead, through a balanced approach they tried to promote bridges between Islam and Spanish history, not as two entities in confrontation rather two worldviews with a shared past. Vernet and Spanish scholarship have the merit to familiarize the Spanish youth with the Andalusian culture, literature, history and society. With regard to the subject matter, the history of the Arabic and Spanish science, Vernet had argued that the root of their decline was the abandonment of the cultural policy of interreligious and intercultural cooperation in scientific matters.

This moderate policy according to Vernet brought about the golden age of Arabic science in al-Andalus, the Islamic civilization in the West, in the Iberian Peninsula, which extended, approximately from 711 to 1492, witnessed no scientific development in the field of the exact sciences until the reign of the *amir* ʻAbd al-Rahman II (821 – 852), who, according to one Maghribi source, was the first to introduce astronomical tables in al-Andalus.

The middle of the 9th century saw the beginning of a period of Easternisation in Andalusi culture, favoured both by the common practice of the *rihla* to the East designed to complete the education of young men from any family which could afford it, and, also, by the cultural policy of the Umayyad *amirs*, who encouraged Eastern scholars to establish themselves in Cordoba and did their best to buy the new books published in the great capitals of the East. This period lasted at least until the fall of the Ummayyad caliphate (1031), which entailed the loss of political unity, but was followed by a subsequent period of fifty years (1031 – 1086) which may be regarded as the Golden Age of the exact sciences and of all the other manifestations of Andalusi cultural life. Sovereigns of the "petty Kingdoms" encouraged the development of science, and one of them, Yusuf al-Mu'taman of Saragossa (1081-1085), was probably the most important mathematician in the history of al-Andalus. This fact highlighted by Vernet, indicates that political history, particularly the political disintegration in al-

Andalus, did not necessarily produced the collapse of the scientific traditions. Cultural history and political narratives tell different stories with regard to the interreligious and intercultural cooperation among the Andalusi communities.

On the other hand, this golden half-century also entailed a progressive slowing down in contacts with the East, which meant that the development of the exact sciences in al-Andalus from the middle of the 11th century on became somewhat original and independent of the East. This loss of contact with a cultural area which, especially from the 13th century onwards, was producing new ideas in the field of astronomy was also one of the main reasons for the decay of Andalusi science, the first symptoms of which appeared during the 12th century. In short, the history of the Andalusi science tell us that, moderate policies promoting interreligious and intercultural exchanges between East and West brought about the golden age of Andalusi science and its impact on Christian Europe.

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