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Beyond Invasion: the Bāb بَابْ in the دَار Dār, or rather, the Door in the Land. Islam as the Door to the Portuguese Age of Discoveries

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Abstract: Using as a springboard the countless contributions to the sciences brought by Muslims to the Iberian Peninsula—present-day Portugal and Spain—southern France (i.e., Provence), Sardinia, Sicily and the rest of southern Italy, as well as other parts of the Mediterranean basin area, in this paper I concentrate on the key role that Muslim scholars, more often than not assisted by their Sephardic Jewish counterparts,[1] had in training the scientific researchers of the then-burgeoning young Portuguese nation (1143), thus opening the door (*bāb* بَاب) to the Portuguese Age of Discoveries and Expansion Overseas (1415), as well as to the Modern Era (1453-1789).

Keywords *Iberia, Islam, Islamic Sciences, Portugal, Portuguese Jews, Sephardim, Sephardic Jews, Sciences*

I.

> […] it was the small kingdom of Portugal that was the first power to harness Europe's advances in cartography, navigation, finance, and shipbuilding and launch the Age of Discovery. By 1460, Portugal was poised to build on an already impressive record of discovery it had achieved along the west coast of Africa.[2]

Following Muhammad's death (632), four caliphs[3] were chosen among the close companions of the Prophet. Also known as *al-Khulafā' al-Rashīdūna* **الْخُلَفاء الرَّشِيدُون**, the rightly-guided caliphs were: **أَبُو بَكْر** Abū Bakr (ruled: 632-634), **عُمَر** 'Umar (ruled: 634-644), **عُثْمان** 'Uthmān (ruled: 644-656), and **عَلي** 'Alī (ruled: 656-661). During the reign of the first four caliphs, Islam was able to spread and conquer militarily the entire Arabian Peninsula, Southern Mesopotamia, present-day Palestine, present-day Syria, the Sassanid Empire (224-651), Jerusalem, Egypt, parts of Libya, and Cyprus, as well as it challenged the Byzantine Empire (395-1453)

[1] Jews from the Iberian Peninsula (Portugal and Spain) and their descendants in the Diaspora (*Galut*, **גלות** exile) are known as **סְפָרַדִים** Sephardim, whereas Jews from the German-, Baltic-, and Slavic-speaking world, as well as present-day Romania, Moldova, and Hungary are known as **אַשְׁכְּנָזִים** Ashkenazim. Italian and southern French Jews, instead, are known as **האיטלקים** Italkim and Shuadit (Judeo-Provençal, from the Hebrew *Yehūdit* **יהודית**) respectively, Italkian and Shuadic being their respective adjectives.

[2] (Ames, 2008, 24).

[3] Caliph, **خَلِيفَة** *khalīfah*, **خُلَفَاء** pl. *khulafā'*, successor, successors to the Prophet Muhammad.

and its possessions along the Mediterranean basin area, particularly the Arab army of the Byzantine emperor Heraclius (ruled: 610-641).

Though obviously engaged in the political expansion of Islam within and outside the Arabian Peninsula, the first four caliphs were still spiritual leaders; hence, their epithet Rightly-Guided, in contrast with the subsequent Islamic dynasties and empires, more centered on the secular aspect of Islam. In fact, it was during the reign of ‘Uthmān (ruled: 644-656) that the Qur’ān was finally organized in its final form (650), followed by the year 700 edition of Caliph ‘Abd al-Mālik (ruled: 685-ca. 705) of the ‘Umayyad Dynasty (661-750).

During the ‘Umayyad Dynasty (**بَنُو أُمَيَّة**), (661-750), Islam reached the West (**ٱلْغَرْب** *al-Garb*), i.e., the Maghreb,[4] the Iberian Peninsula (**ٱلأَنْدَلُسْ** *al-Andalus*) (711), southern France—defeated in 732 by Charles Martel (ruled: 715-741)—Central Asia, and the Indian sub-continent up to the Indus Valley.

Though not occupying Asia Minor, Muslims carried out frequent raids to the area (e.g., the 670-677 and the 717-718 sieges of Constantinople). In 711, Islam also reached **ٱلسِّنْد** *al-Sind* (India), the bulk of its presence being mainly composed of Muslim, mercantile colonies; however, it was not until 1190, with the establishment of the Sultanate of Delhi (1210-1526), that Islam became dominant in the Indian sub-continent and adjacent areas.

The ‘Umayyad Dynasty mainly adopted a military and political expansion strategy; since conversion to Islam would have reduced the state’s coffers, given that taxes levied on non-Muslims were obviously higher. Arab descendants of one of Muhammad’s uncles, al-Abbās, at the Battle of the Great Zāb (January 25, 750), defeated and killed the last ‘Umayyad Caliph, Marwān II (ruled: 744-750), thus ending the Umayyad Dynasty.

After more than a century of political conquest the Arabicization/Islamization of the Middle East and Central Asia began. Being overextended, the ‘Umayyads could thus not rely solely on Arab soldiers; hence, the need to enlist other ethnic groups—Muslim, semi-Islamized, or otherwise religiously affiliated.

Non-Muslims subjects paid the **جِزْيَة** *jizyah* (tax), and in return Muslim rulers did not interfere with their religious and secular customs, provided that they were not in contrast with the monotheistic faith of Islam. Gradually, though, conversions to Islam of non-Arabs increased; hence, the Arabic aristocracy, tracing an alleged, direct link with the Prophet Muhammad, began mixing with other ethnic groups who, though not ethnically Arabic, were Muslim nevertheless, as in the case of Berber, Persian, Slavic, Turkic, and Mongolic peoples.

With the ‘Abbāsid dynasty **ٱلْعَبَّاسِيُّونَ** (749-1258), Persian influence was prevalent, later added by Turkic and Mongolic presence. The caliph, **خَلِيفَة** *khalīfah*, was now an absolute sovereign; the vizier (**وَزِير** *wazīr*), originally a personal aide to the caliph, was the chief deputy, minister, and adviser, acting on behalf of the caliph, militarily as well as in other civil matters.

The capital of the Islamic empire was also moved from Damascus to Baghdad; hence, the axis of the Muslim world moved from the Mediterranean Sea basin area to the East: Central Asia, India, China, and Southeast Asia. The new Islamic capital was thus central to most of the western Asian empire as well as Mesopotamia.

[4] Maghreb: **مَغْرِب**, i.e., “west” of Egypt, encompassing Algeria, Libya, Morocco, and Tunisia. In the Iberian Peninsula, instead, Garb: […] era o território ocidental do Andaluz (Espanha muçulmana), o qual abarcou o território ocupado hoje por Portugal e ainda as cidades de Badajoz e Mérida.” (Coelho, 1989, 1: 47). “[…] it was the Western territory of al-Andalus (Iberian Peninsula under Islamic Rule), which comprised present-day Portugal as well as Badajoz and Mérida, now part of Spain.” [translation provided by the author].

Hence, the first two centuries of ‘Abbāsid rule were characterized by a great cultural and scientific growth. The practice of hiring mercenaries and armies from peripheral regions, mainly of Turkic origin, eventually proved fatal to the ‘Abbāsids, as in the case of the Aghālibs, Būyids, and Tūlūnids.[5] The Islamic empire of the ‘Abbāsids ultimately fell when the Mongols invaded Baghdad in 1258.

II

> For centuries, Muslims, Mozarabs, and Jews coexisted in al-Andaluz under Islamic rule. The Christians prayed discretely in their churches and convents, maintaining and upholding their clergy, language, and customs; the Muslims prayed and taught in the mosques; the Jews prayed and gave guidance in their synagogues. […] Once it came under Christian rule, the Islamic religion persisted up through the end of the 15th century, in Lisbon’s Moorish quarters and in town throughout Portugal’s central and southern regions.[6]

In the Muslim world, as well as elsewhere, Islamic Iberia was then known as **اَلْأَنْدَلُسُ** *al-Andalus*, (711-1492), al-*Andalūs* **اَلْأَنْدَلُوسُ**, and/or *Isbāniyāh* **إِسْبَانِيَا**. There is much controversy over the origin of the Arabic word *Andalus*, given that not all scholars are happy with the idea that it came from **وَنْدَلُوسِية** *Wandalusiyyah*, a Berber corruption of the expression “Land of the Vandals,” the latter being one of the Germanic tribes that in 409 invaded the Iberian Peninsula. In Modern Standard Arabic the word for Vandals is **أَلْوَنْدَلْ** *al-Wandalu*. As for its synonym, *Isbāniyāh*, it is a clear calque from the Latin *Hispania*, in itself a calque from the Phoenician quadrilateral root HSPM (*Hispamia*), which meant “land of rabbits.”

The words listed above were the terms used to denote the Iberian Peninsula during the Muslim occupation (711-1492) as well as present-day Spain; whereas **بُرْتُغَالْ** *Burtuqāl* was used and is used today to denote Portugal and the city of Porto,[7] since the latter country became an independent nation in 1139, though only in 1249 were the Portuguese able to “reconquer” the southernmost region of the newly-formed kingdom, known as the Algarve, until then still in Muslim hands: “The cities of al-Andalusian Gharb were probably little different from Muslim Lisbon at the time of its conquest in 1147. There also, the three religions coexisted openly.”[8]

In 755, an exiled ‘Umayyad, ‘Abd al-Rahmām ibn Mu‘āwiya (ruled: 756-788), later known as al-Dākhil, the incomer, reached *al-Andalus*, soon starting the al-Andalusian ‘Umayyad Dynasty (756-1031) at Córdoba, its capital. In 1031, the ‘Umayyad Caliphate was abolished and *al-Andalus* fragmented into numerous small kingdoms, known as the **طَائِفَة** *Tā‘ifah* or **مُلُوك الطَّوَاف** *mulūk al-Tawā’if*, Taifa kingdoms, party realms, (1031-1086), gradually losing power and land to the Christian Reconquest(s). Though divided into many,

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[5] The Aghālibs **أَغَالِبة** (800-909) were rulers of *Ifrīqiyyah* (**إِفْرِيقِيَّة**, present-day Tunisia, eastern Algeria, and western Libya), Sicily, the southern Italian Peninsula, and Malta. Though they were not Turkic, the Aghālibs set the example of (semi) independence within the ‘Abbāsid Empire. The Būyids **آل بويه** (Buwayhids), were Shiite Persians who ruled over western Iran and Iraq (934-1055). The Turkic Tūlūnids **طولُونِيون**, who controlled Egypt and later the entire eastern Mediterranean coast, from Egypt to southern Turkey (868-905), were the first, independent Islamic dynasty to secede from the ‘Abbāsid Empire. Other recruits were the Janissaries (**يكيچرى** Yeniçeri) from the Balkans (ca. 1365-1828), the Circassians, from the Caucasus, the al-Qaitis, from Yemen, and the South Atlas men, the latter from the South Atlas Mountains.

[6] (Coelho, 1994, 93).

[7] From the Latin *Portus Cale*, or rather, Port of Cale, what later came to be known as Porto. The first name of the future, independent nation of Portugal was *Condado de Portu Cale*, i.e., County of Porto (formed in 1093; independent in 1139; recognized as a sovereign nation in 1143).

[8] (Coelho, 1994, 93).

fragmented Muslim kingdoms, with their own capitals throughout most of southern, present-day Portugal and Spain, these small Muslim empires on the Iberian Empire "became centers of literature and of culture, and their rulers, ministers, or rich inhabitants sponsored major works of art."[9]

The Almoravids **الْمُرَابِطُون** (1040-1147), and the Almohads **الْمُوَحِدُّون** (1121-1269) after them, also occupied parts of the southern half of the Iberian Peninsula. The Emirate of Granada, **إِمَارَة غَرْنَاطَة** *Imārat Gharnātah*, (1228-1492) was the last Islamic presence in the Iberian Peninsula until it was defeated by and annexed to the newly-born Kingdom of Spain (1469).

III

> Portuguese diplomatic documents refer to the complete freedom the Muslims continued to enjoy, even after the Portuguese had taken possession of the western part of Andalusia.[10]

Al-Andalus is where the coming together of Islam, Sephardic Judaism, and Christianity[11] produced a unique body of cultural and scientific works unequaled in human history. Though oftentimes idealized, this peaceful, and (almost always) tolerant, cooperation among the **أَهْل الْكِتَاب** *Ahl al-Kitāb*, People of the Book, (711-11th century), was able to foster the flourishing of the arts and sciences (e.g., agriculture, architecture, arithmetic, arts, chemistry, cosmography, geography, mathematics, medicine, music, philosophy, and all other sciences), thus opening the doors to the Portuguese Age of Exploration (1415-1543). Africa, Asia, South East Asia and surrounding areas in Oceania, as well as the Americas were now within reach of the Portuguese:

> In the 15th and 16th centuries, the Portuguese met and took on Islam in Morocco, on Africa's west and east coasts, in the Red Sea and the Persian Gulf, in India and the Malay archipelagos. In this meeting/confrontation, they put to use the Muslims' centuries of experience with navigation in the Indian Ocean.[12]

Though officially begun in 1415 with the siege of Ceuta—Portuguese territory (1415-1668) and later a Spanish enclave in present-day Morocco (1668-to present)—the Portuguese Age of Exploration was preceded by centuries of timid explorations of the Atlantic sea (north and south). Between 1307-1312, King Dinis (ruled: 1279-1325), promoted the organization of the Portuguese navy and in 1317 he appointed the Genoese Emmanuele di Pezagna,[13] known in Portugal as Manoel (de) Peçanha, as Admiral of Portugal. During the reign of King Afonso IV (ruled: 1325-1357), the Portuguese undertook their first expedition to the Canary Islands (1335-1341). King Fernando I (ruled: 1367-1383), instead, founded the Grower of Ships Company in Lisbon and Porto. In 1413, a Prior of the Knights Hospitaller, Frei Lourenço Esteves de Góis (in office: 1400-1419), advised King João I (ruled: 1385-1433), to capture Ceuta.[14] Two years later, in 1415, King João I and his sons, Duarte I (ruled: 1433-1438) and Prince Henrique (1394-1460),[15] eventually seized the North African city, thus officially starting the Portuguese Era of Discoveries and Expansion:

[9] (Grabar, 1992, 6).
[10] (Tazi, 1994, 62).
[11] This period is known as *convivência*/*convivencia* (Portuguese/Spanish for living together).
[12] (Coelho, 1994, 93).
[13] Also spelled Passagna or Pessagno, corresponding to the Italianized form Passano. Cf. (Peragallo, 1882).
[14] (Lopes, 1967, 2.ª parte).
[15] King João I had nine children with his wife, Filipa de Lencastre, (1359-1415), and two children with his mistress, Inês Pires. A poet and a writer, Prince Duarte succeed his father as King Duarte I (ruled: 1433-1438); whereas Henrique, Duke of Viseu, known in English as Prince Henry the Navigator (1394-1460), dedicated his

> Ceuta had become wealthy because it was the outlet for caravan routes that delivered sub-Saharan gold, melegueta pepper, and slaves to the Mediterranean coast. These were the slaves sold to Arab, Genoan, and Catalan merchants, who exchanged them from grain but also for Asian spices brought in from the Levant.[16]

Yet, there are documents attesting to Portuguese presence in the Northern Sea as early as the last decades of the 12th century, oftentimes with the precious help of the Genoese and Catalans who, in their turn, were also heirs of, thus they were benefitting from, the Jewish—mainly Sephardic, Shuadic, and Italkian—and Islamic cultures of the Mediterranean basin area:

> Lisbon merchantmen had long been sailing the rough Atlantic waters north to Flanders and the Baltic ports with cargoes of olive oil, salt, and oranges. To the south, Portuguese fishermen had traced the African shore for hundreds of miles.[17]

As People of the Book, the status and role of the Iberian Jews (Sephardim) living under Muslim rule proved to be instrumental for the transmission of scientific knowledge and advancement in technology to Portugal and the rest of the then in-the-making world.

Like other geographical areas under Islamic rule, *al-Andalus* was thus considered as دَار الإِسْلام *Dār al-Islām*, or rather, an Islamic land. After the final Portuguese (1249) and Spanish Reconquests (1492), *al-Andalus* inevitably became دَار الْحَرْب *Dār al-Harb*, namely, Land of the Enemy, where the majority of its inhabitants was/is made of non-Muslims.

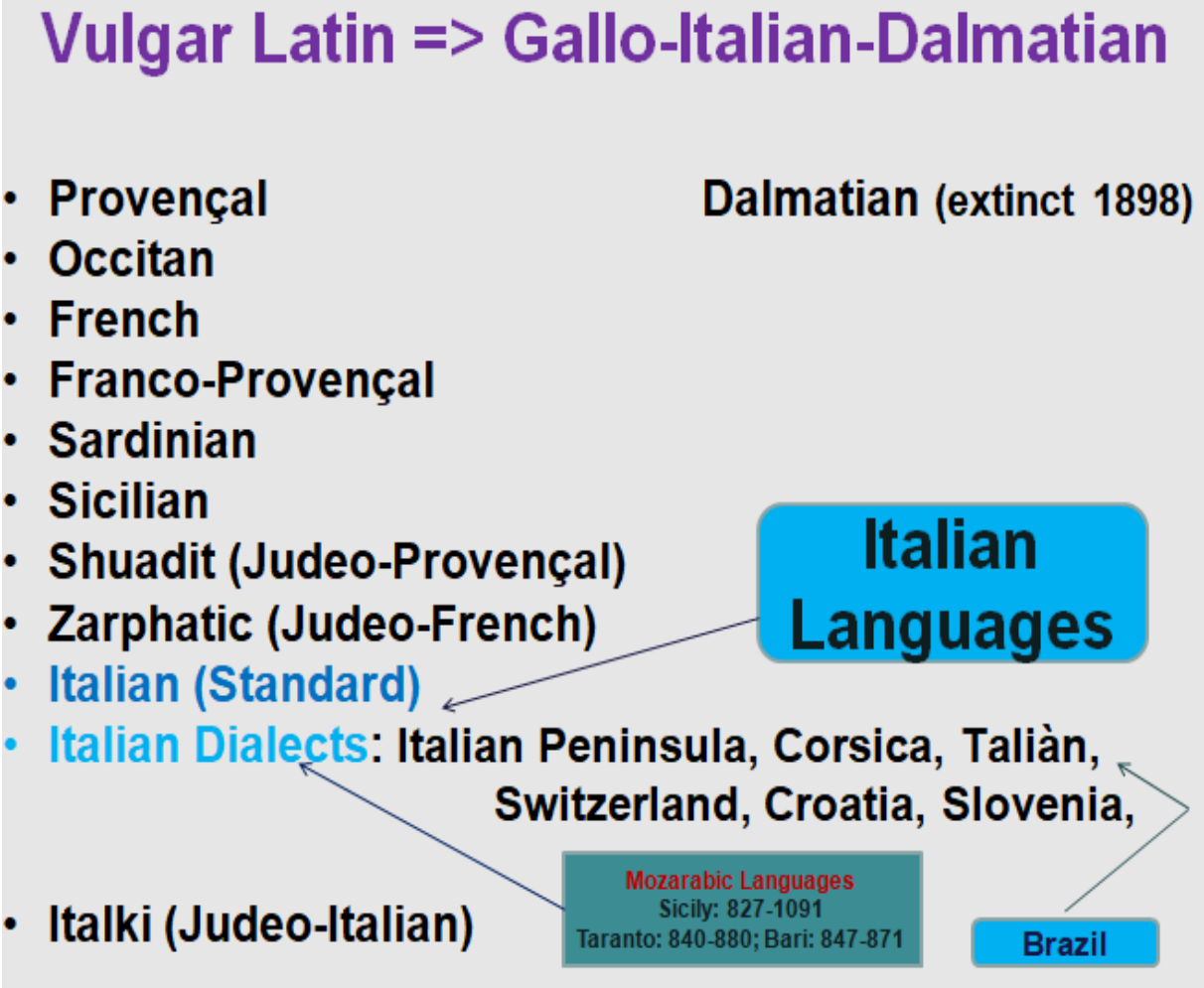
entire life and fortune investigating the nautical sciences that allowed the Portuguese to eventually circumnavigate the African continent and reach the much sought-after spices of India and the rest of the East/Far East. At his death in 1460 the Portuguese had reached as far south as present-day Sierra Leone in West Africa.

[16] (Krondl, 2007, 115).

[17] (Krondl, 2007, 115).

IV


Vulgar Latin => Ibero-Romance
Hispano-Romance
Luso-Hispano-Romance
• Galician-Portuguese: Galician, Portuguese
• Spanish (Castilian)
• Catalan
• Mirandese
• Asturian
• Leonese
• Aragonese
• Andalusian
• Mozarabic Languages اللُّغَةِ مُسْتَعْرَبِة
Judezmo
• Judeo-Arabic
Judeo-Andalusian
Judeo-Aragonese
Judeo-Asturian
Judeo-Catalan
Judeo-Spanish
Judeo-Galician
Judeo-Leonese
Judeo-Portuguese
Haquetia



The Mozarabic languages were Vulgar Latin-based languages spoken in Iberia and parts of present-day Italy with numerous lexical borrowings from Arabic and, through Arabic, other languages which Arabic had adopted during contacts with other peoples and cultures, as in the case of Farsi. Mozarabic languages were divided among many different regional dialects or variants. The term Mozarabic derives from the Arabic مُسْتَعْرَب *musta'arab*, in itself derived from the 10th verbal form اِسْتَعْرَبَ *ista'araba*, or rather, to behave/live as an Arab and/or a Muslim; hence, by extension, it meant to be/become an Arabicized/Islamized person or thing. The term was used to refer to people who, despite their Christian faith, felt more comfortable speaking, reading, and writing in Arabic, including using Muslim attire. Given that the Mozarabs knew how to read and write in Arabic—i.e., they had access to the مَدْرَسَة *madrasa*, Qur'ānic school—they also developed a form of writing their own vernacular using Arabic script, known in Portuguese and Spanish as *aljamia* and *aljamiado* respectively.

The *Mudéjares*, instead—a Portuguese and Spanish rendering of the Arabic مُدَجَّنُون *Mudajjanūn* (those who were allowed to stay; hence, those who were "domesticated")—were the people who remained Muslim after their land was retaken by the Christians during the Portuguese and Spanish Reconquests (ca. 722-1492).

Iberian *Aljamia/Aljamiado* literature is thus a rich corpus of written documents where amidst Vulgar Latin-based words—as in the case of Portuguese, Castilian Spanish, and Catalan—lexical and cultural borrowings from Arabic and, through Arabic, other languages appear. In order to compensate the lack of sounds not found in the Arabic language the Mozarabs had to create new letters and other symbols in order to accurately pronounce their language.

Hence, *al-'ajamiyyah* **عَجَمِيّ** was and still is a language used in the former or present Muslim world with lexical and, at times, morpho-syntactical interferences from Arabic. All languages that have had a direct or indirect contact with the Islamic world thus show a varying degree of lexical borrowing form Arabic and, through Arabic, of other languages, as in the case of Farsi and *Osmanli*[18] that, owing to their sociopolitical and cultural status, were able to lexically influence Arabic.

عَجَمِي *'Ajami* script[19] is common to most areas of the world where the Arabic alphabet was or is still used to express other non-Arabic languages or dialects (Semitic or non-Semitic), as in the case of Albanian, Arwi, Azeri, Baluchi, Banjar, Bashkir, Bedawi, Beja, Belarusian, Berber languages/dialects, Bosnian, Catalan, Chaghatai, Chechen, Comorian, Dari, Dhivehi, English,[20] Farsi, Fula, Greek, Harari, Hausa, Hebrew, Italian, Javanese, Jawi, Kashmiri, Kazakh, Kurdish, Kirgiz, Malay, Malgasy (Sorabe), Maltese, Mandinka, Maguindanaon, Minangkabau, Mozarabic (Iberian Romance), Nogai Tatar, *Osmanli*, Pashto, Portuguese, Punjabi, Romanian, Sardinian, Sicilian, Sindhi, the Sino-Tibetan languages (as in the case of Mandarin Chinese),[21] Somali, Songhai, Spanish, Sundanese, Swahili, Tajik, Tatar, Tausung, Turkmen, Uighur, Urdu, Uzbek, Yoruba, and Wolof.

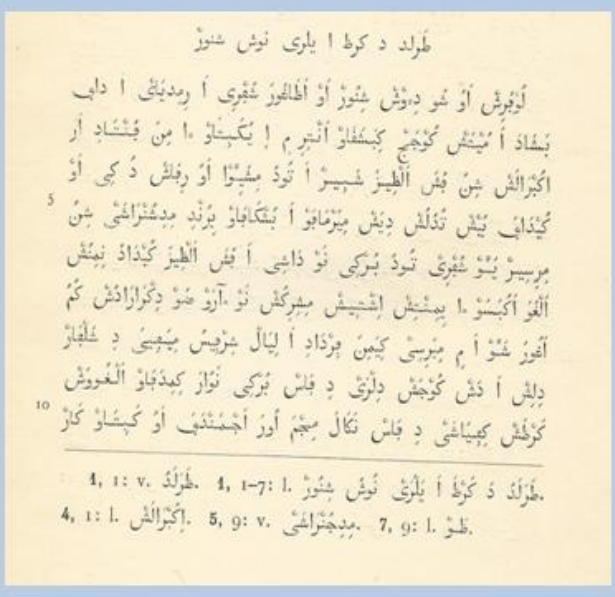
[18] From the Arabic **عُثْمَانِيَّ** '*Uthmāniyyah*, i.e., Ottoman Turkish spoken/written (in *'Ajami* script) throughout most of the Ottoman Empire (ca. 1288-1922).

[19] From *'Ajamiyyah* **عَجَمِيّ**, "Persian," or "foreigner," the term soon meant "gibberish," or rather, "unintelligible language," much like the Greek term *barbarós* (barbarian) applied to the "unintelligible" language spoken by people eventually encountered, particularly in North Africa; hence the term Berbers applied to autochthonous tribes of the Maghreb. In fact, in the Greco-Roman world, the term Berber came to designate different ethnic groups originally found in parts of present-day Algeria, Burkina Faso, Libya, Mali, Mauritania, and Niger, but now scattered all across the Maghreb, the Sahara, and sub-Saharan region. Amazigh, pl. Imazigh (free men), is the preferred term over "Berber." Some of the major Amazigh tribes/ethnic groups are the: Kabytes, Chawis, Rifains, Touaregs, Amazighs (Tamazight), Saharan Berbers, Chenwa, and Shleuhs. (Levi, 2011).

[20] (Levi, 2020a).

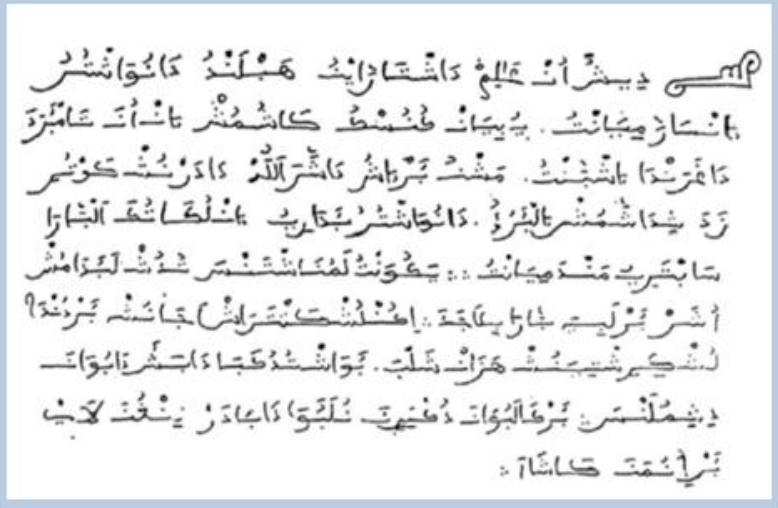
[21] The practice of writing Sino-Tibetan languages in Arabic script is also known as **شِيَوْعَرِدِ** *Xiao'erjing*, or rather, "Children's Script." (Levi, 2019a).

Sample of Portuguese Aljamia العَجَمِي



David Lopes. *Textos em Aljamia Portuguesa. Estudo filológico e histórico*. Lisbon: Imprensa Nacional, 1940. 27.

Sample of Portuguese Aljamia العَجَمِي



Frederico Mendes Paula. "A Escrita Aljamiada," in *Histórias de Portugal em Marrocos sobre Património, História e outras histórias. Blogue de Frederico Mendes Paula*. February 21 2014. <https://historiasdeportugalemarrocos.com/2014/02/21/aljamia/>.

V

> Barely a hundred years after the Prophet's death, the Muslims had made it their task to master the then-known sciences. Founding institutes of advanced study (*Bait-ul-Hikmas*), they acquired an absolute ascendancy in the sciences that lasted for the next 350 years.[22]

On the Iberian Peninsula, the Islamic House of Knowledge, **بَيْت الْحِكْمَة** *Bait al-Hikma*, was also known as **الْمَدْرَس الْمُشْتَرَك** *al-Madrasah al-Mushatarak*, or rather, the Common Teaching Establishment, a unique place in the then-Muslim world, where Sephardic Jews, Christians, and Muslims assembled to talk about different topics, religious as well as secular, among the latter Philosophy and Science. Yet, science was the key to all sciences and through which Humankind could reach all levels of Knowledge: "Dois são os deleites que a ciência necessariamente produz. Um deles é o que vem atrás do desejo de saber; como consequência sua."[23]

Usually, Islamic Philosophy is divided into three main parts or branches, namely:

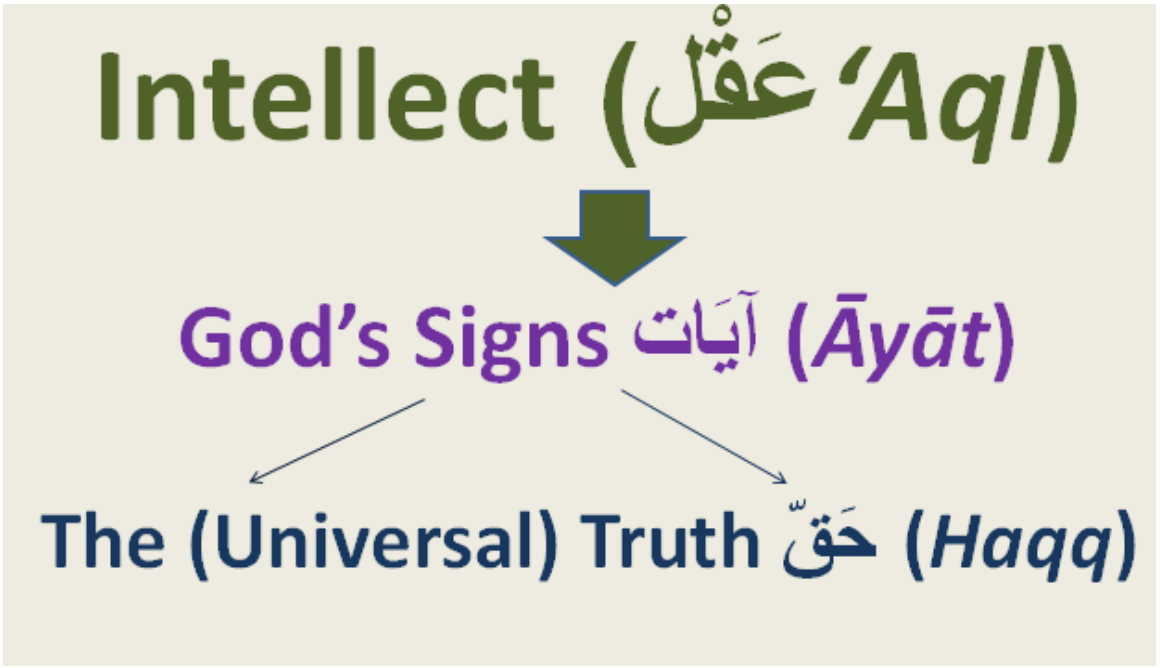
(1.) **عِلْم الْفَلْسَفَة** *'Ilm al-Falsafah*, Islamic Philosophy per se, a "'marginal' discipline", second to the "'religious sciences'," as well as the "'foreign sciences'."[24]

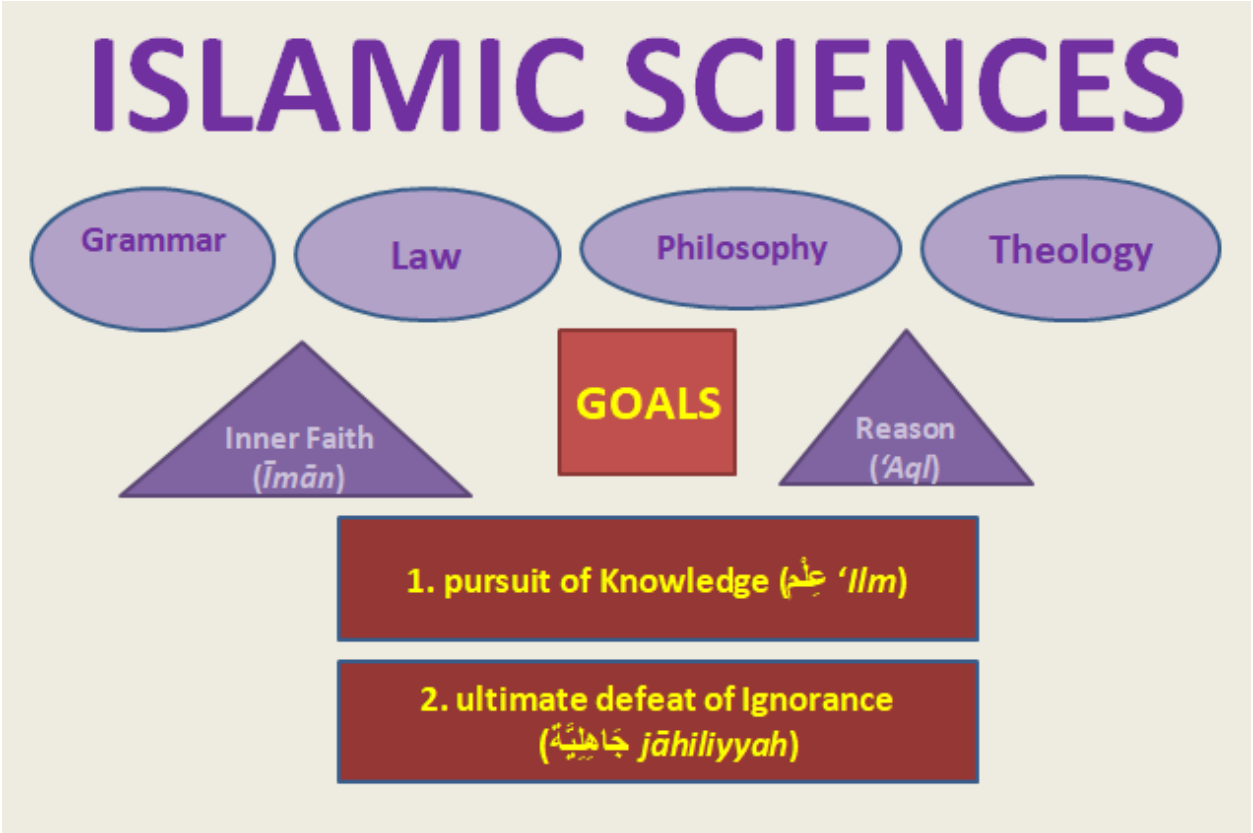
(2.) **عِلْم الْكلاَم** *'Ilm al-Kalām*,[25] (the Science of the Word), universally known as **كَلاَم** *Kalām*, or simply *Kalam*: it is the philosophical, dialectical, and theological speculation within Islam, mainly based upon Human Reason (**عَقْل** '*Aql*, Intellect), and Rational Examination,

(3.) Islamic Mysticism (**تَسَوُّف** *Tasawwuf*), as in the case of Sufism (**صُوفِيَّة** *Sūfiyyah*).

Considered at best as "'marginal' sciences,"[26] *'Ilm al-Falsafah*, *'Ilm al-Kalām*, and *Tasawwuf*, all aimed at attaining the same ultimate goal, i.e., enhancing human Knowledge and deep understanding of God's Signs (**آيَات** *Āyāt*) or, better yet, becoming One with Him, as in the case of (Sufi) mystics/ascetics, in addition to decoding the signs of His creation (**خَلْق** *Khalq*), as a way of eventually identifying with Him.

[22] (Salam, 1987, 180).
[23] (Coelho, 1989, 1: 122). This quote, translated into Portuguese by the author, is from the renowned Islamic theologian al-Ghazāli (1058-1111). "The gift of science to Humankind is twofold: one of them is Knowledge, followed by Science itself, a logic consequence of the first." [Translation provided by the author].
[24] (Gardet, 1970, 2B: 569-603. 2B: 598).
[25] *'Ilm al-Kalām*, literally, "Science of the Word (Speech)," also translated as "Scholastic Theology." In sense, it is a distinctively Islamic religious field of study, though "for the treatises and the schools to be organized it required an external stimulus: discussions at Damascus with Christian theologians, the influence of Greek science and thought at Baghdād, and the defence of the values of faith against this influence." (Gardet, 1970. 2B: 569-603. 2B: 592-593).
[26] (Gardet, 1970, 2B: 597).


Intellect (عَقْل ‘Aql)
God’s Signs آيَات (Āyāt)
The (Universal) Truth حَقّ (Haqq)


ISLAMIC SCIENCES
Grammar
Law
Philosophy
Theology
Inner Faith (Īmān)
GOALS
Reason (‘Aql)
1. pursuit of Knowledge (عِلْم ‘Ilm)
2. ultimate defeat of Ignorance (جَاهِلِيَّة jāhiliyyah)

VI

Seek Knowledge Even if You Have to Go to China

طلب الْعِلْم حَتّى إِذَا كَان لديك للذهَاب إِلىَ الصِّينِ

حَدِيث *Hadīth* attributed to the Prophet Mohammad.[27]

Given the usefulness of the **الْمَدَارِس الْمُشْتَرَك** *al-Madāris al-Mushatarak*, (Common Teaching Establishments), these centers in fact:

> […] continued to function even after a number of Andalusian cities had been reconquered by Castile and Portugal. Their educational and scientific approach, which was truly unique among institutions of their kind, is described in various Arabic reference works on the history of the Peninsula.[28]

Sephardic Jews, Christians, and Muslims also met at the **الْقُدْس** *al-Quds*, sanctuary, (pl. **الْأَقْدَاس** *al-aqdās*), where "each member of each faith" carried out "the duties that his own faith required of him."[29] For over two centuries then, between the 9th century and the end of the 11th century, Sephardic Jews and Muslims in present-day Portugal and Spain "had an allegiance to centers or to issues outside of" the Iberian Peninsula. Indeed, Iberian Jews "consulted the rabbis and learned men of Iraq in matters of faith. Moreover, they were connected through marriage with their coreligionists in North Africa, Sicily, Egypt, and even India."[30]

VII

The men responsible for the sociopolitical and religious welfare of the Muslim community, the **أُمَّة** *Ummah*,[31] were the **عُلَمَاء** *'Ulamā'* (singular: **عَالِم** *'Ālim*), literally "the learned men," or better yet, "those who possessed the **عِلْم** *'Ilm*," i.e., Knowledge:

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[27] By many considered a forgery, this **حَدِيث** *Hadīth* (tradition, narrative, guide), is still used today to encourage Muslims to seek knowledge and wisdom, at all costs; hence, the metaphor of going as far as China in order to achieve this goal. A *hadīth* is a story (or rather, account) or a phrase uttered by the Prophet Muhammad or at least transmitted by one of his closest companions, first conveyed orally and then written (the *Ahādīth* **أَحَادِيث**). If it does not have an **إِسْنَاد** *isnād*, i.e., an uninterrupted chain of eyewitnesses that have seen or heard the Prophet Muhammad say the *hadīth*, then the latter should be considered a forgery. Even though it is not **اِتِّصَال** *ittisāl*, or rather, it does not belong to an uninterrupted chain of eyewitnesses, the China *hadīth* is frequently cited by Muslims (clerics as well as laypeople) to underscore the importance of studying and seeking knowledge at all costs.

[28] (Tazi, 1994, 62).

[29] (Tazi, 1994, 62).

[30] (Grabar, 1992, 7).

[31] Though generally applied to the "Muslim community," *ummah* is a Qur'ānic term that refers to any group of people and/or to all the (then known) nations of the world. In fact the *Qur'ān* says that, throughout the centuries, God has sent a messenger/prophet to every *ummah* so that it can worship Him accordingly, thus ending its **جَاهِلِيَّة** *jāhiliyyah*, "state of ignorance," and corrupt ways. The word "ignorance" is found in the Qur'ān as *jāhiliyyah* (3:154; 5:50; 33:33; and 48:26), as well as **جَهْل** *jahl*, **جَهَلَة** *jahalah*, **جَاهِلُ** *jāhil*, **جَهِلِينَ** *jahilīna*, and **جَهِلُونَ** *jahilūna* (2:273; 4:17; 6:35; 7:199; 11:46; 12:33; and 39:64). For further information on the theory of *jāhiliyyah*, see: (Khatab, 2006).

> […] of things as they are in themselves, a knowledge in which everything is given its proper place because everything is seen in relation to God, and the relations between things are understood on the basis of their relationship to God.[32]

Hence, the *'Ulamā'* were the (religious) teachers, the learned instructors; whereas the **فُقَهَاء** *Fuqahā'* were the lawmakers, at the service and for the benefit of the entire Muslim community, once again, the *Ummah*.

Together, these scholars and religious learned men alike were in charge of the Divine Law (**شَريعة** *Sharī'ah*). Given the complete absence of priesthood and the accompanying religious hierarchy in Islam, the *'Ulamāh* and *Fuqahā'* were the custodians, in a sense, of both the secular and religious aspect of the Divine Law (*Sharī'ah*).

Together, logic, mathematics, metaphysics, and natural science form the **عَقْلي** *'Aqlī*, i.e., the philosophical and intellectual sciences than can be acquired easily by any Muslim through the use of instinctive reason and intellect. However, believers cannot learn any of these sciences by themselves, since they entail deep understanding and extensive training.

Conversely, the opposite can be said for the **نَقْلي** *Naqlī*, the "transmitted sciences," which all Muslims can acquire through "transmission" (simply put, "teaching"), or rather, investigating the original sources, and, as for the religious sciences, studying the Divine Revelation (**وَحِي** *Wahy*).

The *Naqlī* comprise many sources, though their three pillars are the **ٱلْقُرْآن** *Qur'ān*,[33] the **ٱلْأَحَادِيث** *Ahādīth* of the Prophet (the **سُنَّة** *Sunnah*), and **ٱلصَّرْفُ** *al-Sarf*, Grammar, obviously, the grammar of the Arabic language, the language of the uncreated and eternal Holy Qur'ān, and the language of God; hence, the need to truly understand the exact meaning of all words contained in the Holy Qur'ān. By studying Arabic grammar, believers are able to understand the spiritual and socio-religious messages and signs (*Āyāt*) contained in the sacred text:

> Since the grammar of the Arabic language is the grammar of the language which God used in transmitting his final revelation, it was taken to represent formally the structure of what can be said and how it can be said.[34]

VIII

> In the eleventh and twelfth centuries Arab astronomy was in a flourishing condition in [the Iberian Peninsula]: it was for long afterwards studied in the East and continued to retain the interest of scholars of medieval Europe.[35]

As Islam was growing in numbers of believers, as Islam was physically and geopolitically progressing, leaving the Arabian Peninsula behind and expanding from South to North, from East to West (including Europe), from East to South- and North-East Asia, and beyond, Islam eventually absorbed and forged new ideas/ideals

[32] (Lumbard, 2004, 44).

[33] **تَجْوِيد** *Tajwīd*, from **جَوَّدَ** *Jawwada*, literally, to "make things excellent," is the memorization of the Qur'ān learned at the Qur'ānic school, the **مَدْرَسَة** *madrasah*. As for its revelation, or rather, the timeframe and content of its chapters, the Qur'ān is divided into four periods, Meccan I (ca. 612-615), Mecann II (ca. 615-619), Meccan III (ca. 619-622), and Medinan (ca. 622-632).

[34] (Leaman, 1985, 6).

[35] (Vaux, 1931, 394).

and new models upon which to construct and reshape its sociopolitical organization as well as its scientific and philosophical-theological discourse. Needless to say, Greek/Hellenic, Sanskrit, and Hindu, as well as Old and Middle (Pahlavi) Iranian thinking had a profound and everlasting impact on the formative years of Islamic Philosophy and Science.

Islam in former Sassanid Persia (224-651) and present-day Iraq, was per force influenced by Zoroastrian (Mazdaism) **دِين زَرْدُشْت** and Manichean trends, as long as these views did not outwardly contradict the fundamental Islamic tenets; hence, the 779-786 persecution of the followers of Dualism (Manichaeism), who were eventually seen as heretics, or rather, worshippers of more than one god, practicing **شِرْك** *shirk*,[36] "association," thus falling outside the category of the "protected people" (**ذِمّي** *dhimmi*). In other words, they did not belong to the **أَهْل الْكِتَاب** *Ahl al-Kitāb*, "the people of the book"[37] who, by virtue of their monotheistic faith, automatically enjoyed the **ذِمَّة** *dhimmah*, "protection," as Jews, Christians, and Zoroastrians normally did/do:

> When Islam came to Iraq it encountered a whole variety of religious and philosophical movements: Greek [Hellenic] philosophy, Gnostic pursuit of wisdom, Manichaean theories of a cosmic battle between good and evil, and Christianity.[38]

One way for the newly-converted and/or somewhat syncretic, non-Arab population of the former Sassanid Persia (205-641) and present-day Iraq to include their pre-Islamic customs and beliefs was to divert their heterodox and not-completely-accepted Muslim mores to another branch of human investigation, i.e., Philosophy, which at this time was well grounded in the entire region.

Of obvious Greek/Hellenic origin, Western philosophy—most of the times linked with the study of Astrology, Astronomy, Chemistry, Mathematics, and Medicine—had deep roots in this geographic area, being practiced and taught typically by (heterodox) Christian and Jewish scholars:

> Science and Mathematics, which are the backbone of the Modern World, invites for a good reflection on how they came to the state they are now. The universality of Western Science and Mathematics is a direct result of the globalization initiated in the 15th century with the great navigation. This was possible thanks to the most developed technology available in that period.[39]

[36] Associating something or someone to God is practically stating that God has associates; hence, it implies the tacit acceptance or the conscious belief in polytheism which is a grave apostasy in a monotheistic faith such as Islam.
[37] *Ahl al-Kitabi*, "people of the Book," which include Jews and Christians, are those who believe in a sacred book, or rather, the Bible, the Torah, (*al-Tawrah*), the New Testament (*al-Inǰīl*), and the Psalms (*al-Zabūr*). However, the *Ahl Al-kitabi* also includes Zoroastrians, Sabaeans, Mineans, and any other group of people with whom Islam had contact during its territorial expansion outside the Arabian Peninsula, who believe(d) in only one god and who base(d) their religion on a holy book, as in the case of the Hindus. The ancient Sabean and Minean pre-Islamic religions, though containing a few polytheistic elements, were not condemned by Islam. The kingdoms of Sheba, (930-115), and Mina (1200-650), the former in the South, the latter in the Southeast of the Arabian Peninsula, were civilizations that were deeply involved with the spice trade between Asia/Middle East and the Mediterranean.
[38] (Ruf, 2007, 250).
[39] (D'Ambrosio, 1998). [document accessed: August 6, 2020].

As a result, translations from ancient and not-so-ancient works from a wide spectrum of languages and fields were ordered to be made into Arabic, including philosophical treatises. As time passed revisions were required, since they had to reflect the latest academic improvements, discoveries, translations, and theories in the field.

In *al-Andalus*, works were first translated into Latin and later into the local vernacular languages: e.g., Portuguese, Castilian Spanish, Aragonese, and Catalan. Yet, Latin was the first step to introduce these new works to Europe, particularly during the 12th century, i.e., a time in which Islamic sciences were declining and European interest in sciences was increasing: "[w]hen Islamic medicine and science came to a standstill, about 1100, they began to be transmitted to Europe in Latin translations."[40] Portugal and what later came to be known as the Kingdom of Spain were the birth of learning centers that proved to be instrumental for the future awakening of Europe:

> But the Muslims did not only introduce a civilization or a culture; they also were the means by which a Europe living in the darkness of ignorance experienced a renewal of intellectual activity, based on knowledge brought by the Muslims. Under [Muslim] rule, [the Iberian Peninsula] became Europe's centre of learning and culture. […] Scholars and scientists explained the Orient to the Occident, in this way sowing those seeds which later gave rise to the Renaissance. […] Education was available to almost everyone. A great majority of Muslims living in [the Iberian Peninsula] knew how to read and write. Teachers were highly respected within the society. All the principal cities had universities […]; the areas studied included theology, philosophy, grammar, Arabic, poetry, and lexicography, history, geography, law, astronomy, mathematics, botany, and medicine.[41]

During the 'Abbāsid caliphate (750-1258) the physical place where scholars met and translated works of "knowledge" into Arabic was in fact called **بَيْت الْحِكْم** *Bayt al-Hikmah*, "house of knowledge" which, of course, also included a **مَكْتَبَة** *maktabah*, "library," or better yet, a **دَارُ كُتُب** *dār kutub*, "dwelling of books."

[40] (Meyerhof, 1931, 345).
[41] (Minr, 1994, 140).

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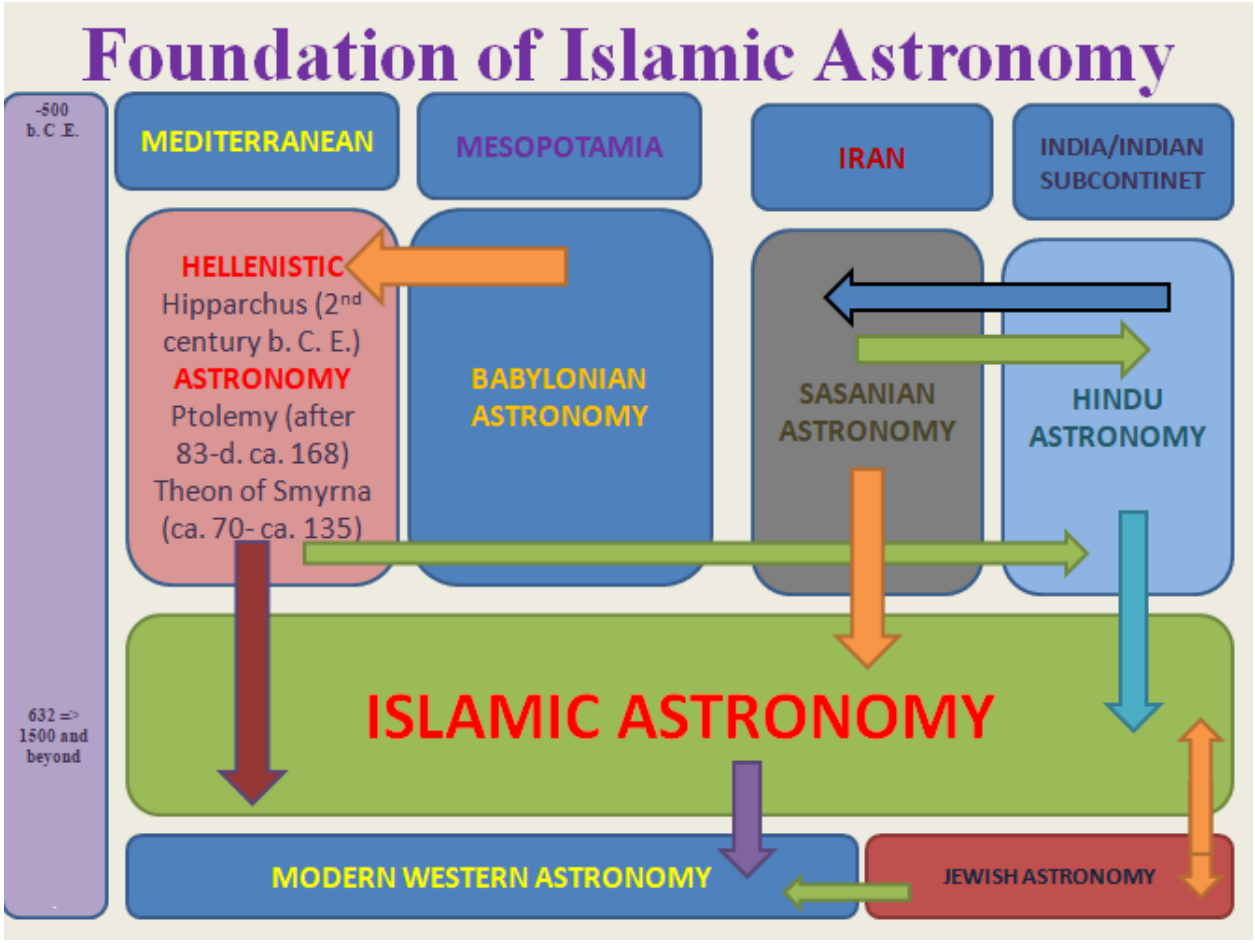

IX

> Sciences other than medicine were mostly taught in mosques. In the early centuries of Islam these were liberally placed at the disposal of scholars. There are also records of academic libraries founded by caliphs, princes, and other prominent men. […] Every important mosque had and still has its library not only of theological, but also of philosophical and scientific works.[42]

Indeed, this "new emphasis on learning" opened the doors to other disciplines, as in the case of Science and Arabic, as well as "the philosophical discourse on reason and faith that had been a focus of the intellectual life of Iraq in the ninth century." It was actually from the southern area of the Iberian Peninsula that "these great accomplishments were transmitted"[43] everywhere else in 11th century *al-Andalus* as well as elsewhere of the then-known world.

The *Qur'ān* encourages believers to travel, since this is yet another way of learning, thus opening up the heart in order to discover and appreciate new cultures, including different religions. From a state of mere translation, particularly from the late-Hellenic period then, Muslim scholars passed to a phase of revision, amelioration, and eventually full-blown, independent thinking and prolific production. Hence, the Greco-

[42] (Meyerhof, 1931, 336).
[43] (Grabar, 1992, 7).

Hellenic tradition was very much impregnated with Eastern traditions. Needless to say, trying to distinguish the two was practically impossible:

> What mainly concerned them were scientific and philosophical treatises and technical descriptions of how things worked. This corpus of learning was translated into Arabic between c. 750 and c. 900. In certain directions, for example astronomical and medical, it was also enlarged and refined, becoming more comprehensive and more accurate through the observations of Islamic scientists themselves or through their becoming acquainted with the yet more distant learning of India and China.[44]

Among the first translations worth mentioning are the works by famous cartographers and geographers Marinus of Tyre (ca. 70-130) and Claudius Ptolemy (ca. 90-168). Scientific, medical, mathematical, astrological, astronomical, and musical treatises produced in Greek, Syriac, Pahlavi (Middle Iranian), and Sanskrit were then translated into Arabic and, at the same time, revised and improved according to the newest theories in the field. Most often the translators also created pandects, or rather, compendiums where they recapitulated the entire treatise and its main points.

> In the Atlantic the Arabs came to know familiarly the Western seaboard of **اَلأَنْدَلُس** *al-Andalus* (the Iberian Peninsula) with the important port of **اَلأُشْبُونَة** *al-Ushbūna* (Lisbon) on the **تَاجُه** *Tājuh* (Tagus), and Muslim ships at least upon occasion operated at Oporto (**بُرْتُقَال** *Burtuqāl*).[45]

In *al-Andalus*, Taranto (840-880), Bari (847-871), and Sicily (*Siqiliyyah* **صِقِلِيَّةْ**, 827-1091; Emirate of Sicily, 965-1072), Muslims were thus the only leaders in astrology, astronomy, arithmetic, algebra, medicine, music, pottery, faience, glassware, tapestry, and irrigation. For instance, it was through *al-Andalus* that Europeans became acquainted with the compass, the sextant, and the astrolabe:

> In Islam, the astrolabe was useful, not only in astrology, but also for the determination of the astronomically-defined Muslim prayer-times; in Europe, though occasionally used for serious astronomical observations, its main function must have been astrological. In both cultures, the instrument was employed didactically, and it was highly prized as a clever and complex device, a prestigious instrument, a 'mathematical jewel', as a medieval nun called it.[46]

The big bulk of the translations of these texts from the pre-Islamic Middle East and East was performed during the second half of the 8th century, or rather, only one hundred years after the Hegira. The oral tradition of the newly-converted Muslims of the Islamic empire(s)—as in the case of Syrians and Aramaics—also played a key role in the literary and scientific corpora then being forged by Muslim scholars.[47] Jewish (mainly Sephardic) contribution to Islamic science is particularly visible during its early stages, or rather, during the 2nd and 3rd centuries of the Hegira.

[44] (Fletcher, 1992, 147-148).
[45] (Dunlop, 1944, 1: 441).
[46] (King, 1979, 244-257).
[47] (Nallino, 1944, 5: 7-8).

Renowned Italian scholar Carlo Alfonso Nallino (1872-1938)[48] listed quite a few prominent names, among whom are worth mentioning the following intellectuals: Mā Shā' Allah (d. ca. 815-820), Abū 'Uthmān Sahl ibn Bishr bin Habīb ibn Hāni, or Haya, (ca. first half 9th century), Rabban Sahl al-Tabāri (ca. first half 9th century), and Abū al-Taiyib Sanad ibn 'Aly (d. ca. 864).[49]

The presence and active participation of Jewish scholars in this transfer of knowledge is first noticeable in the Muslim East and then in the Muslim West, the latter covering the Maghreb and the Iberian Peninsula, or rather *al-Andalus*:

> The intellectual dependency of Muslim Iberia on the Levant made inevitable the reception of such advances in the west and the peculiar social configuration of *al-Andalus* facilitated their transmission to the Jewish and Christian worlds.[50]

For instance, Ptolemy's *Almagest*[51] was first translated into Syriac and then in Arabic. The *Almagest* is a complete and detailed exposition of Mathematical Astronomy, one of the most important scientific treaties in History, not only for its theories and its technical and practical observations, but also for its influence in the future development of Astronomy. The West and the Islamic world were both influenced and transformed by this work. One of its Arabic translations was prepared by al-Hajjāj ibn Yusuf ibn Matar[52] (Baghdad, ca. 786-833), perhaps based upon a Syriac version. Most likely al-Hajjāj was the one who gave the work the title *Almagest*.[53] During the 12th century there were still five copies extant, in Europe and the Muslim world, e.g., the Maghreb and *al-Andalus*.[54]

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[48] (Nallino, 1944, 5: 8).

[49] Mā Shā' Allah, or rather, "That which we wanted to know, *Allah* suggested it," (d. ca. 815-820), was a Judeo-Arab, most likely hailing from Egypt. Mā Sha' Allah was one of the first Muslim astronomers/astrologers. Of his many works, extant today is a treatise in Arabic, whereas the rest of what is extant today is made of posthumous translations of his work in Hebrew and Latin, as the famous *De scientia motus orbis*, translated by Gherardo da Cremona, (ca. 1114-1187). Rabban Sahl al-Tabāri, or rather, the Rabbi from Tabaristan (ca. first half of the 9th century), was a Jewish physician and astronomer. Most likely he was the first scholar to translate into Arabic the *Almagest.* Abū al-Taiyib Sanad ibn 'Aly (d. ca. 864), was a renowned astronomer and mathematician famed for his astronomical tables. Abū 'Uthmān Sahl ibn Bishr ibn Habīb ibn Hāni, or Haya (ca. first half 9th century), was a Jewish astrologer from Khorasan, best known for his treatises on Astrology and Algebra. Cf. (Sarton, 1927-1947, 1: 531; 1: 565-566; 1: 569).

[50] (Reilly, 1993, 123).

[51] Claudius Ptolemy, (Alexandria, d. after 161).

[52] Al-Hajjāj ibn Yūsuf ibn Matar, perhaps from Baghdad, where he lived between ca. 786- 833, was the first Muslim scholar to translate in Arabic the *Elements* of Euclid and the *Almagest* (*Kitab Al-Mijisti*). The Arabic translation of the *Almagest* was composed in 829-830 from a Syriac version prepared by Sergio de Resaina (d. 536) during the first half of the 6th century. Sergio de Resaina was a Monophysite Syriac who lived in Alexandria and Ra's al-'Ain, in Mesopotamia, where he eventually died in 536. Sergio de Resaina was a physician and philosopher, known for his translations from Greek into Syriac. Extant today is a 10th century, Arabic translation by Abū al-Wafa' al-Mubashshir. For more information on the *Almagest*, please see: (Sarton, 1927-1947, 423-424; 1: 562; Suter, 1900, 208).

[53] This work was titled *Kitāb al-Majisti*, or rather, "The Greatest Book." The word *Majisti* appears to be a corrupted form of the Greek superlative *megiste*: big => greatest. *Megiste* was the common abbreviation of *Megale Syntaxis*, i.e., "Great Collection," thus referring to its longer title*:* "*The Thirteen Books of the Collections of Mathematics.*" The Arabic definite article *al* (the), together with *Megiste*, thus gave origin to the new title *al-Megiste*, hence the Latin rendering *Almagest*. Cf. (Brockelmann, 1943, 1: 363; Watt, 1967, 30-43; Kunitzsch, 1974. 115-125).

[54] Among the many translations available, perhaps the most faithful and authoritative is the translation from Arabic into Latin made by Gherardo da Cremona, (ca. 1114-1187), which was copied in Toledo, and later completed in 1175.

In *al-Andalus*, Astronomy reached its peak during the second half of the 10th century. Abū al-Qāsim Maslamah ibn Ahmād al-Majriti (d. ca. 1007), Andaluzi philosopher and mathematician, after studying in the Muslim East for a while, was able to reedit and ameliorate the Arabic translation of Ptolemy's *Planisphærium*.[55] Al-Majriti is also well-known for his edition of the *Astrological Tables* arranged by Abū 'Abdallah Muhammad ibn Mūsa al-Khwarizmi (d. ca. 850), and al-Battāni (ca. 858-929),[56] where he substituted the ancient Persian chronology with its Arabic/Muslim counterpart. Another prominent name was Ibn al-Samh from Granada (d. 1035) who, using as a springboard the *al-Sindhind*,[57] composed very useful astronomical tables. Yet, Ibn al-Samh's most important work is a small treatise where he describes an astronomical instrument with seven blades, useful for calculating the movements of the Sun, the Moon, and the five planets.[58] Towards the end of the 10th century, or perhaps the beginning of the 11th century, Abū 'Abd Allah Muhammad ibn Yūsuf ibn Ahmad Mu'adh al-Jaihāni, also known as al-Juhāni, compiled astronomical tables for the city of Xaén, in today's Andaluzia. Gherardo da Cremona, (ca. 1114-1187), later translated this work into Latin with the title *Liber tabularum iahen cum regulis suis*.[59] Yet, the most important Andaluzian astronomer was Abū Ishāq

[55] Abū al-Qāsim Maslāma ibn Ahmād al-Majriti, from Madrid, composed most of his work in Córbova where he died in ca. 1007. He was a prominent astronomer, mathematician, and physician. Al-Majriti is perhaps one of the best Andaluzi scientists of all times. He edited and amended al-Kkwarizmi's *Astronomic Tables*. Al-Majriti also composed the following works: a treatise on the Astrolabe, translated into Latin by Joannes Hispalensis; a commentary to Ptolemy's *Planisphærium*, translated into Latin by Rudolph of Bruges; a treatise on Commercial Arithmetic: *al-Mu'amalāt*; and a book on animals. Al-Majriti was also interested in the erotic power of Amicable Numbers (220, 284). Most likely he was also the author of two treatises on Alchemy: the *Sage's Walk*, *Rutbat al-Hakim*; the *Sage's Desire*, *Ghayat al-Hakim*, the latter known for its Latin edition ordered by King Alfonso X, and titled: *Picatrix*. The original Arabic text was composed during the middle of the 11th century. Cf. (Sarton, 1927-1947, 1: 668; R. Goldstein, 1985; Amador de los Ríos, 1848, 275-279; Amador de los Ríos, 1861-1865, 3: 613-654).

[56] Abū 'Abdallah Muhammad ibn Mūsa al-Khwarizmi: Muslim mathematician, astrologer, geographer, and chronographer. He lived in Baghdad during the caliphate of al-Ma'mun, (ruled: 813-833). Most likely he died after 846 or 857. He wrote in Arabic on Indian decimal calculus. The original manuscript is lost; yet, a Latin translation is extant today. Al-Kwarizmi also wrote different treaties on astronomical instruments and Muslim chronology of which only some fragments are extant today. Yet, al-Khwarizmi is better known for the following works: a new edition of Ptolemy's *Atlas* and *Geography*, based on the Greek and not the Syriac text; and a treatise on *Practical Algebra*, most likely the oldest Arabic edition. In the 12th century it was translated twice into Latin by Rodolfo Chester and Gherardo da Cremona; the *Astronomical Tables*, accompanied by notes and modeled upon the *Siddhanta*—an astronomical treatise known in Arabic as *al-Sindhind*. Maslamh al-Magriti, (d. 1007 or 1008), reedited al-Khwarizmi's *Astronomical Tables*. In 1126, Adelbard of Bath translated al-Magriti's work into Latin. Al-Battani (ca. 858-929), one of the best Muslim astronomers of all times, wrote a commentary to Ptolemy's *Tetrabiblon*; two treatises on mathematical solutions to astrological problems; *al-Zij*, his opus magnum, also known as *Zij al-Sabi*, i.e., *Zij al-Battani*. Alas, almost all of al-Battani's works are lost, except for two versions (in Arabic and Latin) of *Zij al-Sabi*. The Latin version was printed in Nuremberg in 1537 and in Bologna in 1645. The Spanish translation of *Zij al-Sabi* was ordered by King Alfonso X; yet, only the Arabic version (composed during the 11th or the 12th century) is extant today and held at the *Biblioteca do Escorial* in Madrid. It was translated into Latin by Carlo Alfonso Nallino. Cf.: (Nallino, 1969; Nallino, 1944, 5: 330-347; Sarton, 1927-1947, 2: 177-179; Kritzeck, 1964; Toomer, 1968, 5-174).

[57] Abū al-Qāsim Asbagh ibn Muhammad ibn al-Samh, (Granada 979-1035). Al-Samh was a mathematician and an astronomer who wrote treatises on Commercial Astronomy, *al-Mu'amalāt*; Mental Calculus, *Hisāb al-Hawa'i*; Numbers; Geometry; as well as the use and the making of the Astrolabe. Al-Samh's major publication was a compilation of Astronomical Tables following the *Siddhanta* accompanied by theoretical explanations.

[58] The Castilian version of this text is the *Libros del saber de astronomia*. Following Muslim astrological/astronomical tradition, the Arabic names of the five planets, the Sun, and the Moon are: *al-Zuhal*, (Saturn); *al-Mushtari*, (Jupiter); *al-Mirrikh*, (Mars); *al-Shams*, (the Sun); *al-Zuhara*, (Venus); *'Utarid*, (Mercury), and *al-Qamar*, (the Moon). Cf. (Holt, Lambton, and Lewis, 1970, 2: 761).

[59] Gherardo Cremonese, or da Cremona, in Latin Gerardus Cremonensis (1114-1187), was a very prolific translator, perhaps the most productive translator of Arabic manuscripts in the Middle Ages. He studied Arabic in Toledo where he spent the rest of his life translating more than eighty treaties on Philosophy, Mathematics,

Ibrahim ibn Yahya al-Naqqash ibn al-Zarqalah, Azarchel (ca. 1029-1087), or Auzarchel in Medieval Latin, and Azarquiel de Toledo in Portuguese and Spanish,[60] For the Emir of Seville al-Mu'tamid ibn 'Abbad (1068-1091), al-Zarqalah invented the universal astrolabe, adaptable to any latitude.[61] Indeed, it is important to remember that until the 19th century, Islamic Astronomy and Astrology were considered as being part of the same science:

> […] (Knowledge of the) positions of the stars in the spheres is the necessary basis for astrological judgments, that is, knowledge of the various kinds of influence over the world of man that are exercised by the stars depending on their positions and that affect religious groups, dynasties, human activities, and all events. We shall explain this later on, and we shall clarify the evidence adduced by astrologers, if God, He is exalted, wills.[62]

Rediscovered by the Muslims, the Greek astrolabe thus became the **أَسْطُرْلاب** *asturlab*. In the Iberian Peninsula, al-Zarkālī (ca. 1029-1087) devised a different kind of astrolabe, the **صَفيحَة** *safīha*, eventually composing a very useful treatise that soon became the archetype of many other works composed in the Islamic world.

Al-Zarkālī's work was translated into Latin by a Shuadic Jew of Montpellier. King Alfonso X of Castile, known as the Wise (ruled: 1252-1284), ordered that two translations be made into Castilian Spanish.

Astronomy, Physics, Mechanics, Medicine, Alchemy, and Geomancy. For a detailed list, please see: (Sarton, 1927-1947). The *Liber tabularum iahen cum regulis suis*, the *Tabulæ Jæn*, and the *Tabulæ Gebri al-Jaihani* are all based on original Arabic sources perhaps composed by Abū 'Abd Allah Muhammad ibn Yūsuf ibn Ahmad ibn Mu'adh al-Juhāni (also spelled al-Jaihāni), from Córdova, (ca. 989), also known as Vizier and Qadi Abū 'Abd Allah Muhammad ibn M''adh of Seville, author of a treatise on the July 3, 1079 solar aurora and eclipse. Cf. (Dreyer, 1920; Sarton, 1927-1947, 2: 338-344; Hermelink, 1964).

[60] Also known as ibn al-Zarqiyal, Azarquiel spent most of his time in Toledo where in 1061, 1080, and 1081 he performed astronomical observations. Indeed, for the longitude of Toledo he composed the *Canons* and the *Toledan tables*, both on celestial movements. Azarquiel's works were translated into Latin and Spanish. Azarquiel is also known for being the creator of new type of astrolabe, the *safihah zarqaliyyah* (Zarqali's blade), known in the Iberian Peninsula as *açafeha* and in Latin *saphæa*. The astrolabe was first built for al-Ma'mun of Toledo (1043-1075) and revised in Seville during the reign of Mu`tamid ibn `Abbad (1068-1091). Al-Zarqali completely changed the astrolabe by substituting the horizontal stereographic projection with a polar projection. This simplified astrolabe had only one lamina and two additional parts of lesser dimension. Al-Zarqali's treatise, where he explained how he built the astrolabe and its usage, was translated into Latin, by Gherardo da Cremona, in Hebrew, and in 1277, in Spanish by order of King Afonso X. The Spanish translation was later inserted into the *Libros del saber de astronomia*. This edition, as well as its Italian translation, is the only surviving document of all al-Zarqali's works. Cf. (Rico y Sinobas, 1863-1867, 3: 135-237; 3: 272-284; Nallino, 1944, 5: 341-342; Levi, 1993a; Levi, 1993b; Sarton, 1927-1947, 1: 758-759; Pedersen, 1987).

[61] (Nallino, 1944, 5: 345-347). As for the use and the usefulness of the astrolabe in both cultures, it should be noted that:

> [i]n Islam, the astrolabe was useful, not only in astrology, but also for the determination of the astronomically-defined Muslim prayer-times; in Europe, though occasionally used for serious astronomical observations, its main function must have been astrological. In both cultures, the instrument was employed didactically, and it was highly prized as a clever and complex device, a prestigious instrument, a 'mathematical jewel', as a medieval nun called it.

(King, 1979, 244-257; King, 1981; Maddison, 1992, 71-110; 78; 95; Samsó, 1980; Wright, 1923).

[62] (Khaldûn, 2015, 3: 137).

German astronomer and mathematician Johannes Müller von Königsberg, better known as Johannes de Monte Regio, and later simply as Regiomontanus (1436-1476), composed works related to the *safīha*, as the celebrated *De triangulis planais et sphaericis libris quinque*, published posthumously in 1533 by Dutch astronomer and mathematician Daniel Santbech (fl. 1561).

Among its many functions, al-Zarkālī's *Universal Astrolabe* was based upon the stereographic projections. In the *safiah*, al-Zarkālī describes the instrument, its construction, and its use. Given its great utility, his work was translated into many languages, namely: Hebrew, Latin, Castilian Spanish, and Italian (translated by Gherardo da Cremona). Al-Zarkālī performed almost all his scientific research in Toledo (1061; 1080-1081), under the aegis of Emir Yahya ibn Ismail al-Ma'mūn (d. 1075). His observations were recorded in the *Toledan Tables*, translated into Latin by Gherardo da Cremona as *Tabulae toletanae iahen cum regulis suis*.

X

> The Portuguese State was born and developed through the bonding together of two major regions: the Christian region of León, which came down as far as the Serra da Estrela and the Mondego River; and the Muslim, Mozarab, and Jewish regions, which corresponded to Mediterranean Portugal.[63]

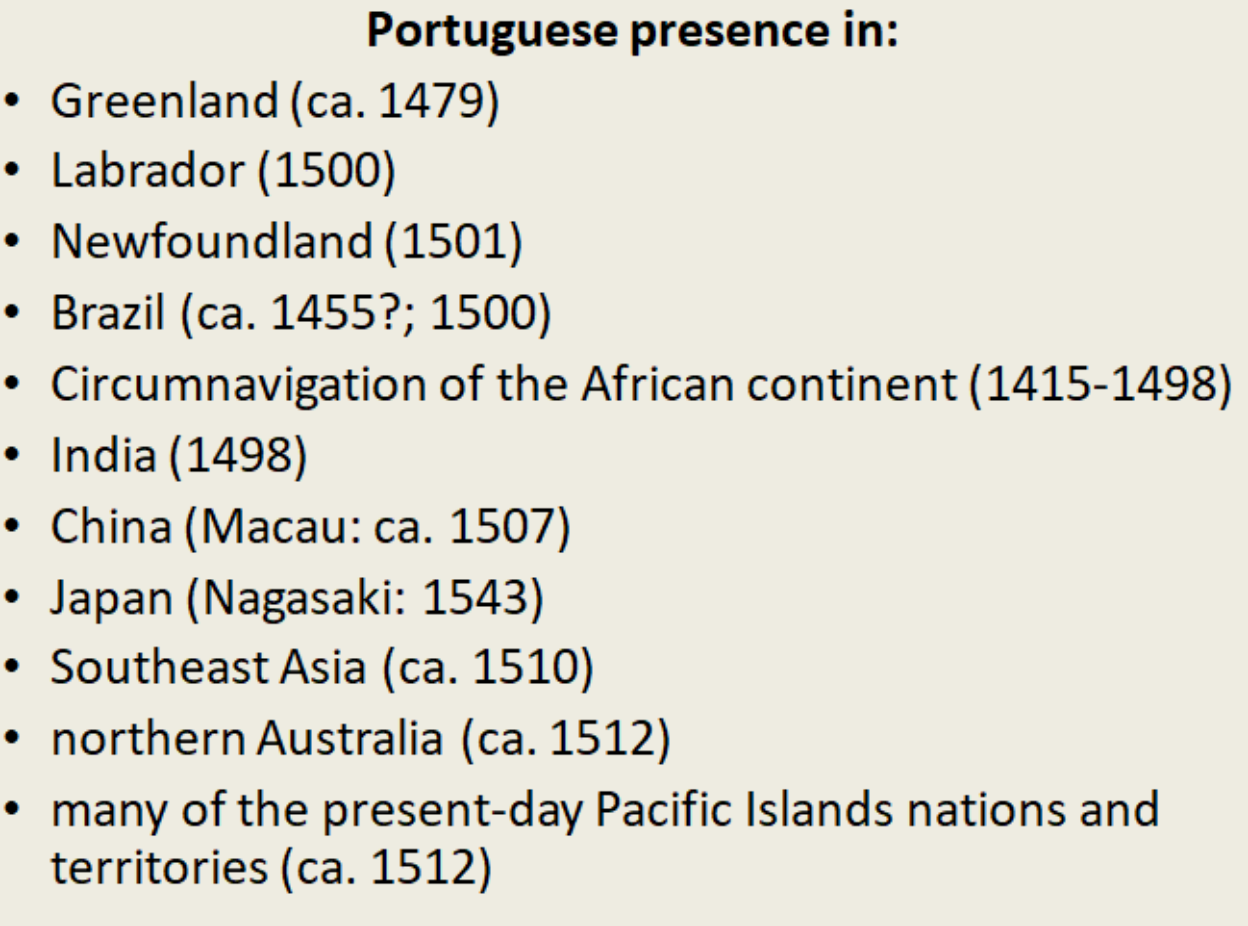
Yet, despite their religious and sociopolitical differences, in the newly-formed Portuguese kingdom Muslim scholars were an indispensable element in setting the ground for the enterprise of a lifetime, one that changed the course of Humankind forever: the encounter of other peoples and lands. Without the knowledge of Islamic sciences and the assistance of Muslim, Sephardic Jews, and Christian scholars trained in the field, Portugal and, through it, the rest of Europe, would never have had the information and the technology that would have allowed them in a little over one hundred years to navigate and encompass the entire world, thus reaching their economic goals: "The Jewish communities preserved the heritage of the Muslim-Mozarab-Jewish culture, and some of their members took part in the navigational experiments of João II's time."[64]

There are documents attesting to Muslim familiarity with or at least knowledge of the Madeira Archipelago and the Cape Verde Archipelago, right before or during the Portuguese first explorations in the area:

> "[…] the Canaries and the Cape Verde islands or perhaps the Madeira group were also known (**أَلْجَزَ ائِر الْخَالِدَات** *al-Jazā'ir al-Khālidāt*, literally the Eternal Isles, and **أَلْجَزَ ائِر السَّعَادَة** *Jazā'ir al-Sa'āda* (Isles of Happiness)."[65]

Even though the Portuguese were the first Europeans who accomplished the unachievable, it was thanks to their Islamic legacy, with a solid background in sciences and navigational sciences, that they were able to reach Greenland (ca. 1479), Labrador (1500), Newfoundland (1501), and Brazil (1500), as well as circumnavigate the African continent (1415-1498), and thence travel to India (1498), China (ca. 1507), Japan (1543), Southeast Asia (ca. 1510), northern Australia (ca. 1512), and many of the present-day Pacific Islands nations and territories (ca. 1512).

[63] (Coelho, 1994, 93).
[64] (Coelho, 1994, 93).
[65] (Dunlop, 1985, 160).



In the 13th century, the cultural ferment that *al-Andalus* had been enjoying for more than three hundred years began to decline and with it also the scientific research in the sciences. Gradually, though, a new society began to resurface, increasingly supplanting and benefitting from the experience of the Islamic civilization. The Iberian Peninsula was progressively changing from *Dār al-Islam*, land where Islam was dominant, to *Dār al-Harb*, land where the majority of the inhabitants is made of nonbelievers, in this case, Christians and Sephardic Jews.

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