China and Islamic Civilization: Exchange of Techniques and Scientific Ideas

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Whether by land, along the famous ancient Silk Route, or by sea, along the age-old routes of antiquity through the Persian Gulf (once called the China Sea) [Fig. 1], China seems to have been in continuous contact with the other two ancient and contemporary civilizations of the Indus Valley and Mesopotamia. On the whole those contacts were conditioned by trading exchanges, and yielded a very rich travel literature describing China, its customs, rulers, religions, wonders, etc., that must have entertained the urban centers around what is today the Persian Gulf and all the way up the river to the medieval city of Baghdad and, before it, Ctesiphon. The earliest recorded lore of this type comes from travel accounts, mostly legendary, as all seamen's records are, from that same area around the Persian Gulf and dating as early as the ninth and tenth centuries CE [Fig. 2, next page]. In almost all of them, China was a land of wonders, far away, and definitely worth visiting. This literature that brought these contemporary civilizations into the imaginary world of the story tellers, rarely developed into more systematic appropriations of scientific or technological ideas from one culture to the other. And yet much of science, technology, medicine and alchemy, to name only

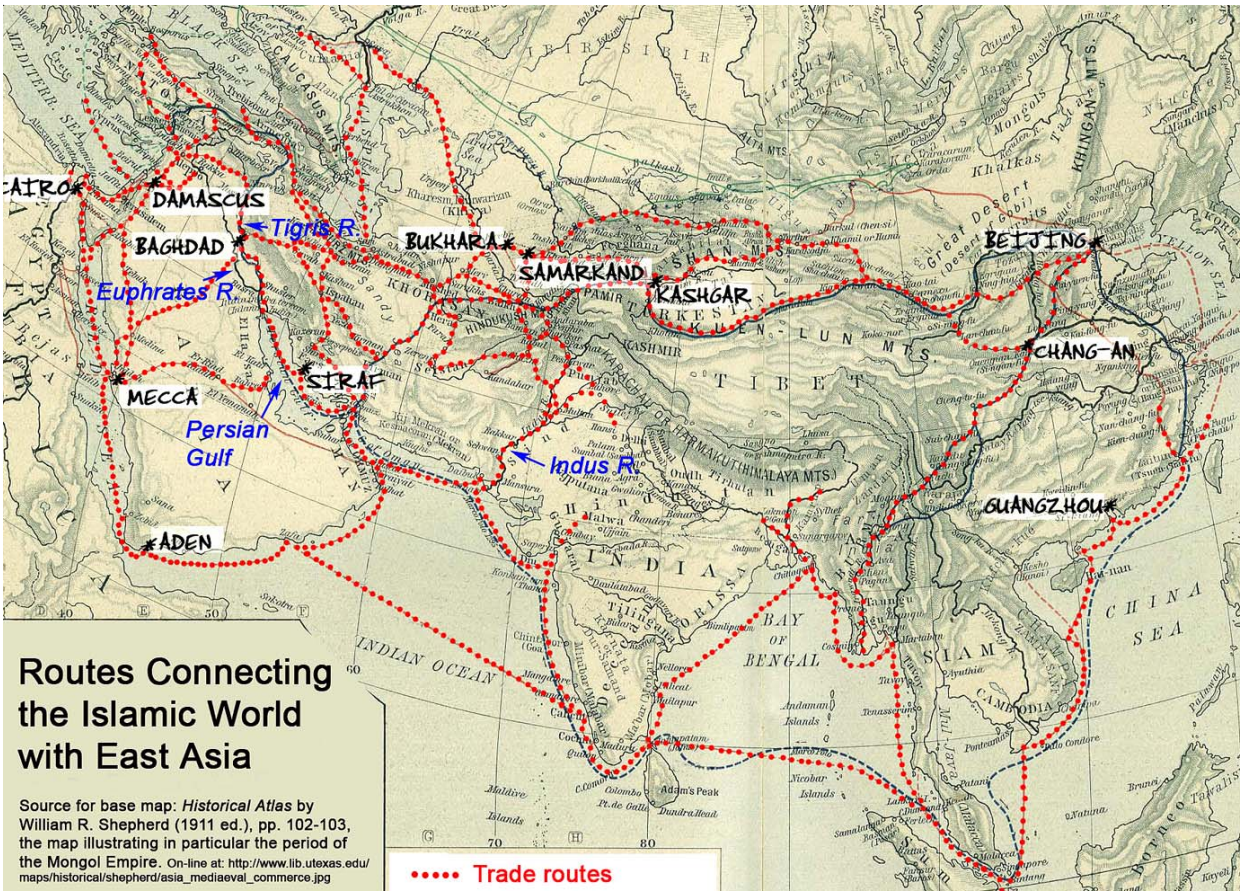

Fig. 1. Routes Connecting the Islamic World with East Asia.

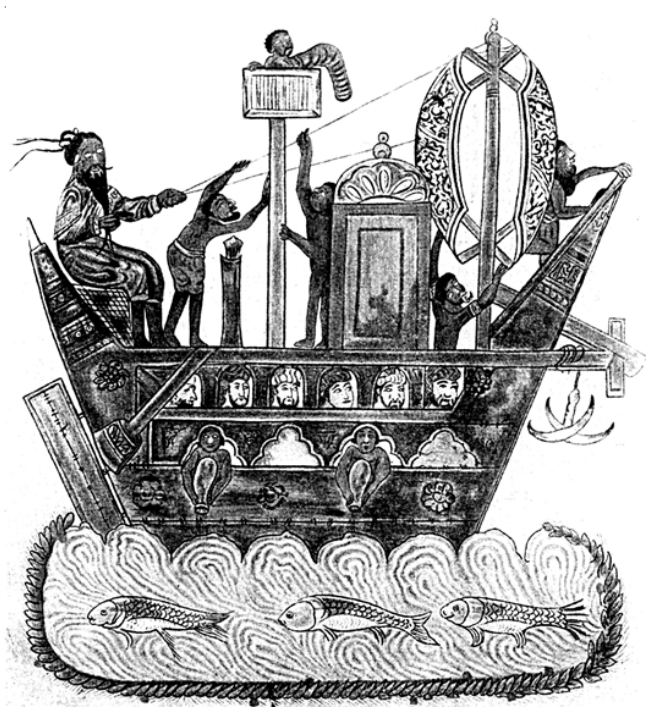

*Fig. 2. A sailing ship at sea, illustration to Buzurg ibn Shahriyar's 10th-century "Book of the Marvels of India" (*Kitab `Aja`ib al-Hind*). After I. Iu. Krachkovskii,* Izbrannye sochineniia*, Vol. 4 (1957), Fig. 13 facing p. 145.*

a few, eventually crossed the same borders as did the merchants.

Even earlier, around the time of the advent of Islam in the first half of the seventh century CE, China's image was already invading the imagination of people inhabiting the maritime ports and urban centers all around what is today's Middle East. The image was that of a distant land; yet it must have made a powerful impression on people who were witnesses to the rise of the great civilization of Islam which was destined to become today's world civilization. Once a civilization carves a niche for itself in people's imagination, it will stay there forever, and only grows with the change of historical circumstances that govern civilizational dialogue. As evidence of this conquest of the imagination, one could find, for example, in the very heart of Arabia and within the lifetime of Islam's prophet, statements preserved in the prophetic traditions themselves, urging the Muslim believers to "seek knowledge even if it takes you as far away as China." About two centuries later, one could still hear of someone saying that a specific book is so valuable "that it is worth a trip to China to get it." All these traditions and references seem to stress the immense remoteness of the distant land of China. But they say very little about what one would find once he got there. That information was to come later on.

In Islam's holy book, the Qur'an, the mythical lands of Gog and Magog were also supposed to be located in China, at the farthest edge of the East, that is, at the ambiguous semi-legendary frontier of the known world just before it would fade away into the surrounding sea of darkness. The same colorful and legendary references even mentioned how one of the legendary biblical tribes of the children of Israel which was supposed to have converted to Islam and believed in the mission of the prophet of Islam, reportedly resided on the farthest eastern edge of China. All those impressions simply paint a picture that was quasi-legendary, which most certainly reflects the poorly known reality of old Chinese contacts with the civilizations of the ancient Middle East. Only a faint memory of those contacts seems to have remained well into the early days of Islamic civilization.

As Islamic civilization began to define its own contours and project its map onto the globe with its rapid spread in the seventh and eighth centuries and China came into direct contact with the Islamic Empire, legends began quickly to give way to historical realities. As it happened, this new Islamic civilization was fast spreading along the western frontiers of China itself, and had very swiftly encompassed all the lands from the western border of China, in modern-day Central Asia, all the way to the Iberian peninsula, the underbelly of Europe. In that new setting, more realistic visions of the respective cultures of China and the Islamic world began to emerge, despite the fact that the sources in both cultures still spoke of the immense distances between the two.

The historical narratives which began to characterize those visions included, for example, the famous account that spoke of an encounter between the Great Chinese Khan, as he was called in the Arabic sources, with the ambassador of the last Persian King Yezdigird III (d. 651). There is almost universal

agreement among historians that this account could very well portray a real historical event. In his account of the twenty-second year of Hijra (= 644 CE), the great Muslim historian Tabari (?838-923 CE), a native of Tabaristan in the Caspian Sea region of Persia, relates the following (here quoted in paraphrase in order to avoid the dry historical narrative):

When the Muslim armies began to press eastward against the borders of the Sasanian Empire, the last Sasanian monarch, Yezdigird III, fled eastward in order to avoid capture. In his despair, this Yezdigird apparently sent an ambassador to China in order to seek the help of its king in fending off the Muslim invasion. In that encounter the Chinese king and the Persian ambassador were supposed to have had the following conversation:

> He [the Chinese king] first said, 'Although it is the duty of kings to come to each other's aid, I still want you to describe those people to me, for you say that they were few and they managed to expel you from your country, despite the fact that you were a multitude, and that could only mean that they were onto something good, while you were onto evil.'
>
> [The ambassador] then responded, 'Ask me and I shall tell you.'
>
> The king asked, 'Do they fulfill their promises?'
>
> He responded, 'Yes, they do.'
>
> 'What do they ask of you before they fight you?,' [the king asked].
>
> The ambassador responded, 'They ask one of three things: They either ask us to adopt their religion, and if we accept they would treat us like them. Or they ask us to pay tribute and seek their protection. Or they fight us.'
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> [The king] then asked, 'How do they obey their chiefs?' to which the ambassador said, 'They are most obedient to their spiritual guides.'
>
> 'What do they forbid and what do they allow?' [the king asked].
>
> The ambassador told him.
>
> The king then asked, 'Do they ever permit that which was forbidden to them, or forbid that which was permitted?'
>
> The ambassador said, 'No.'
>
> The king then said, 'These people will never be defeated until they permit that which was forbidden and forbid that which was permitted.'
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> Then he asked the ambassador, 'Tell me of their dress.' And the ambassador told him. 'And their mounts?' To which he responded, 'Arabian horses,' and he described them to him. To which the king said, 'What marvelous defenses these [horses] are!!' Then [the ambassador] described for him the camels, and how they kneel and rise with their loads. To which the king said, 'This is a description of mounts with long necks.'
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> The king then sent with the ambassador a letter to Yezdigird that said, 'I did not refrain from sending you an army whose front could be in Merv and its rear in China because I was ignorant of my obligations to you, but because these people, who were described to me by your ambassador, could destroy mountains if they so wished. They could even remove me from power. So my advice is that you deal peacefully with them and accept to live with them and do not stir them up if they don't stir you up.'

This anecdote about a possibly real event portrays the Chinese king in a very positive light, the same kind of light one would usually reserve for an ally. One does not suspect any ill intention towards the Chinese, this despite the fact that those same Chinese were described in the same sources as being polytheists. Furthermore, one cannot fail to detect the mutual respect with which the early Muslims treated the Chinese. Other stories confirm this by referring to the Chinese king as the epitome of justice and fairness, and never recount a bad word about him. All the while he is portrayed as being very far away, and thus was in no position to constitute an immediate threat.

Yet, despite the impression of distance, the presence of each culture in the imagination of the other became more immediate during Islamic times. We are told, for example, that the second Abbasid caliph al-Mansur (754-775 CE), laid down the foundations of his new city Baghdad in what is today Iraq and at that specific geographic site simply because he thought he would gain a tremendous advantage on account of its proximity to the Tigris River. Since the river empties into the Persian Gulf,

he emphasized that this gave him ready access to trade with China. The other reason was to collect taxes from the western Muslim lands through the equally nearby Euphrates River. For those reasons, and for many others as well, that very same city, Baghdad, was destined to become later on the bustling center of the Islamic Empire for some seven centuries.

Al-Mansur's dream of locating his capital at the start of the Chinese trade route seems to have borne fruit. Two centuries after the foundation of his city, a biographer and intellectual historian of Baghdad, al-Nadim, recounts a captivating story in his famous book *al-Fihrist*, a veritable encyclopedia of what an educated gentleman of the time should know drawn from an almost exhaustive record of names of authors and books. He spoke of a Chinese student who appeared in the city of Baghdad towards the beginning of the tenth century. There he requested that the famous Muslim physician Abu Bakr al-Razi (Latin: Rhazes) [Fig. 3] dictate to him the works of the Greek physician Galen as fast as he could, so that the student could take a copy of those works with him back to China.

Fig. 3. European depiction of the Arab doctor al-Razi, in Gerardus Cremonensis "Recueil des traités de médecine," 1250-1260. Source: Wikipedia Commons, after, Samuel Sadaune, Inventions et découvertes au Moyen-Âge.

The story may be completely apocryphal. Yet it confirms a frame of mind of a Baghdadi intellectual who was apparently full of admiration for the ability of the Chinese student to write down every word in his short-hand system. Now, whether the student carried Greek medicine back with him to China remains in the realm of legend, to say the least. My suspicion, and Joseph Needham's as well, is that he did not. Chinese medicine remains to this day quite independent of the philosophico-medical tradition of the Greeks.

On the cultural level, and irrespective of the story's scientific validity, it certainly confirms the sense of the immediate presence of Chinese culture in the imagination of the early Muslim intellectuals. It also confirms the other reports that are preserved in the various Arabic sources about the amazing skills of the Chinese, in almost every field they undertook. In the words of the fourteenth-century geographer and belletrist Qazwini, we are told that the Chinese have magnificent skills in the crafts (*lahum yadun basitatun fi al-sina'at*). The ninth-century Jahiz had already reported that God had endowed the Chinese with the very special skill for the crafts, and goes on to say that it was probably the only gift they were given.

This widespread fame for excellence in artifacts could have also been strengthened by the marvelous techniques that the Muslims brought back from China along with their trade objects [Fig. 4]. Deservedly so, Muslims

Fig. 4. T'ang Dynasty earthenware plate found in the 9th-century CE remains of Samarra, upriver from Baghdad. Museum für Islamische Kunst, Berlin, Inv. no. Sam. 839.

regarded these trade objects with the utmost admiration. The trade required skills in navigation, a flourishing field in which there clearly was a debt to the Chinese. Navigational instruments came to include the magnetic compass, which was first invented in China, quickly modified in Islamic lands, and later passed on to Europe.

The acquisition of paper followed a similar route, in that this Chinese invention was appropriated by the Muslims towards the middle of the eighth century and passed on to Europe as well. The manufacture of fine silk and art objects in Islamic lands similarly imitated and adapted Chinese examples, as did the development of block printing in complete imitation of the Chinese practice. Gunpowder did not become a military tool until slightly later, but it too passed on from China to Europe through Islamic lands. Wherever one looked in early and medieval Islamic times, one could not help but notice the fascination with things Chinese that circulated widely in the society. It was such impressions of the superior Chinese craftsmanship which must have given rise to a widely disseminated Arabic adage — reported even by the seventeenth-century Andalusian author al-Maqarri, in his *Nafh al-tib* — which said: "God has granted his beneficence to three human organs: the brains of the Greeks, the hands of the Chinese, and the tongues of the Arabs."

Naturally some Chinese inventions and craft works had greater influence than others. For example, it was quickly realized that paper was of momentous importance. As a result, it spread very quickly in Islamic lands. Arguably it was responsible for the genuine revolution of knowledge that took place in the Islamic world during the late eighth and early ninth centuries. Incidentally, the same person who reported the story of the Chinese student coming to Baghdad to study medicine with Razi was also called *al-warraq* (= the paper maker/ or paper consumer; by his time this could also mean a bookseller). The fourteenth century bureaucrat and encyclopedist, al-Qalqashandi, enumerated six different Arabic names for paper, and then classified their qualities starting with the Baghdadi paper as the best, and the European paper as the worst. More importantly, he did not forget to mention that paper was invented in China, before he went on to speak of his

Fig. 5. Illuminated Qur'an, Shiraz (Iran), ca. 1560-1575 (not on Baghdadi paper). The pages are open to the end of Sura 113 and beginning of Sura 114. Museum für Islamische Kunst, Berlin, Inv. no. I.42/68.

intimate knowledge of the paper culture. He classified all kinds of paper that he knew — he had to know a lot of them as a bureaucrat — and he specifically stressed that the Baghdadi-type paper became the preferred medium for the writing of the Qur'an, because, unlike vellum, it could not be easily erased and changed [Fig. 5]. That very same feature may also explain the reason why the caliph Harun al-Rashid (786-809 CE), of the *Thousand and One Nights* fame, would give an order at the beginning of the ninth century to have all the government records be transferred onto paper [Fig. 6].

Fig. 6. Gold dinar of Caliph Harun al-Rashid, AH 174/CE 790-91. Collection of the Münzkabinett, Bode-Museum, Berlin.

Other sources, and there are great numbers of them, speak of Chinese objects in such superlative language that one gets the impression Muslim authors were enamored with the fantastic technological skills and inventions imported from China to the lands of Islam. Those stories point to the conclusion that the material objects stood as brilliant witnesses to the technical accomplishments of the Chinese artisans. The

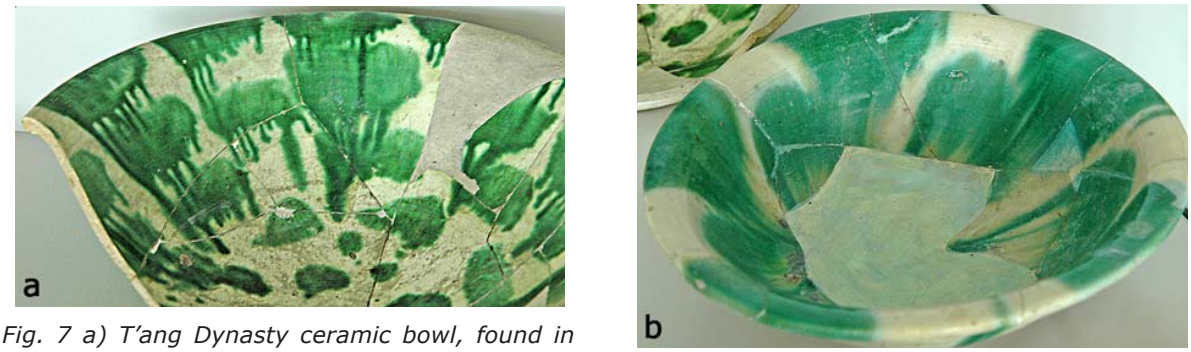

Fig. 7 a) T'ang Dynasty ceramic bowl, found in the 9th-century CE remains of Samarra, upriver from Baghdad, and b) its Islamic imitation. Museum für Islamische Kunst, Berlin, Inv. nos. Sam. 784a, 748. Photos © Daniel C. Waugh, 2004

admiration for those artisans began to inspire the Islamic artists themselves to produce their own wares in the Chinese style, as any respectable collection of Islamic art can easily testify [Fig. 7].

When it came to the theoretical sciences, the story was slightly different. In contrast to the quick dissemination of Chinese technological inventions in the Muslim world and the eventual passage of those inventions on to Europe through its Muslim contacts, the theoretical sciences seemed to have faced a virtual "wall," one not far removed from the physical China wall. Even if we were to believe the story of the Chinese student managing to copy down, in one month as the story went, the whole of the Galenic medical works that were circulating in tenth-century Baghdad, we are still pretty certain that Galenic medicine did not make much of an impact on the independent Chinese medicinal system.

The "wall" might block exchange in both directions, as we can see from the example of the very sophisticated astronomical system of the ancient and medieval Chinese, which used our very modern equatorial coordinate system instead of the ecliptic system of the Greeks and the Muslims who followed them. Chinese astronomy could not pass westward through that wall, until perhaps the most recent times, well after the Jesuits had landed in China in the sixteenth and seventeenth centuries. Despite the Chinese sophistication in astronomy, a deliberate attempt to transfer to China some of the latest state-of-the-art astronomical instruments of thirteenth century Muslim lands [Fig. 8] was an apparent failure. A medieval source describes how around the year 1267 a Persian astronomer Jamal al-Din (Cha-ma-lu-ting, in the Chinese sources) carried to China from the famous Ilkhanid observatory in Maragheh in northwest Iran a dozen or so astronomical instruments, together with their detailed description in Chinese. Yet, as Needham has carefully documented, the Arabic names of the astronomical instruments were transliterated into Chinese rather than translated. So one must concur with Needham's observation that despite the great efforts to initiate this transfer of astronomical knowledge from the lands of Islam into China, "the direct effect [of those instruments] upon Chinese astronomical practice seems to have been nil."

The reason for the celebrated success of the transmission of Chinese technological innovations westwards and the apparent total

Fig. 8. Although not one of the instruments purportedly sent to China, astrolabes, like this elegantly decorated one in brass with silver inlay, made in AH 638/CE 1241 by Abd al-Karim al-Misri, exemplify the superb craftsmanship of Muslim astronomical instruments. Collection of the British Museum, Inv. no. ME OA 1855.7-9.1.

failure of transmitting fundamental scientific ideas eastward to China itself deserves some re-emphasizing. The explanation may lie in the manner in which Chinese science itself had developed, and even more importantly in the very antiquity of that science. China came in contact with Islamic civilization during the seventh and the eighth centuries, at the very time when Islamic civilization was open to all sorts of other scientific traditions. Chinese scientists, whether in mathematics, astronomy, medicine, or chemistry (then called alchemy), were already set in their ways and had already formed a coherent explanation of the universe around them. Unlike Islamic civilization, which at the time had no world-view of its own with which to oppose incoming ideas, Chinese civilization was already of a great antiquity and had achieved the required harmony between its social and scientific needs. At that stage foreign ideas would naturally have little, if any, effect.

Fig. 9. Stonepaste ceramic bowl with dragon design. Iran, 14th c. Copy of design on Chinese Blue-and-White porcelain. Museum für Islamische Kunst, Berlin, Inv. no. 5380.

But this did not mean that a technique here or a solution of a specific problem there could not be passed from one culture to the other. All it means is that individual technological ideas that do not incorporate a change in one's world-view could actually be adopted without greatly affecting the normal practice of science or the fundamental scientific beliefs and concepts that lay at the very foundation of science itself. The Chinese could adopt, as they did, the screw, or the clock, or the crankshaft, as has been so abundantly demonstrated by Needham, without having to change their minds about the nature of the heavenly bodies, or the five elements of which the world was made, all in total variance with Aristotelian views.

None of the travelers who went to China from the Muslim lands during the Middle Ages ever seems to have brought back impressions of scientific ideas or actual scientific texts that could cause a fundamental change of scientific attitude in either culture. But they always brought back scores upon scores of medicinal substances and drugs (rhubarb and ginger immediately come to mind), as well as metallic and porcelain objects, which became abundantly popular and imitated in Islamic civilization [Fig. 9]. They also brought descriptions of items of clothing as well as the cloths themselves. The techniques used to craft the objects could be emulated in the Islamic world and improved upon, as was done with the production of paper, in which linen and rags replaced mulberry bark.

Naturally, those visitors and merchants brought back as well many, many stories of the exotic lands which they had visited. The twelfth-century geographer and traveler al-Idrisi lists some twenty-five trade items brought by sea from China to Aden in southern Arabia, starting with iron and ending with lead, and including such things as spices, camphor, coconuts, and items of fine clothing and velvet. When he spoke of Chinese rhubarb, which was apparently regularly imported by Muslim merchants, he spoke of it as the best, both for its physical as well as its medicinal qualities. The Muslim merchants who imported the plant obviously learned about its medicinal value from the Chinese themselves during their sojourn in China. Thus it was only in such cases that one could say that some hard-core scientific knowledge was passed on as well.

The most famous Muslim traveler, Ibn Battuta, brought word in the fourteenth century of the Chinese innovation of paper money, which was used nowhere else. He also brought back stories of the huge Chinese chickens that were much larger in size than the geese with which he was familiar. What seems to have impressed him most, however, was the fantastic ability of the Chinese to paint the likeness of a person, and to do so with such incredible details that such paintings were used to locate and arrest foreign visitors if they committed crimes. This

was something probably similar to our modern mug shots, but apparently with much better fidelity. Their kings, just like the Indian kings, says al-Idrisi, were highly interested in painting and took care to teach this art to their children. They even went as far as choosing the best painter among their children to succeed them.

In other scientific areas such as alchemy, Chinese theory and practice did not owe much to the Islamic, nor did the mostly Hellenistic-based Islamic alchemy apparently owe much to the Chinese. Islamic alchemy was on the whole attempting to transmute the base metals in order to produce gold, as one could reasonably expect to do if one based his work on an Aristotelian theoretical basis. Chinese alchemy was seeking a drug, called the elixir, that would lead to longevity or even ensure immortality. The two systems were essentially incompatible

One has to wonder about the direction of transmission of ideas when such concepts as elixir began to appear in both cultures almost at the same time, slightly after the early Muslim ships first landed in China in the early part of the eighth century. Thinking in terms of comprehensive world views and major coherent systems of thought, one would assume that cultures with such deeply diverging orientations regarding the purpose of alchemy would have little to borrow from one another. Techniques and individual concepts and processes might be quite another matter. It is plausible that the early Muslims who heard of that Chinese enterprise would themselves attempt to prepare the elixir, as long as it did not require a major shift in their system of thought. Lacking a well formulated system of scientific and philosophical thought, early Islamic culture could freely borrow such ideas and techniques. In contrast, the deeply ingrained Chinese world view prevented analogous borrowing from the Islamic world.

Although in later centuries there are borrowings touching some theoretical medicinal concepts, their exact circumstances are far from being well understood. In other fields such as astronomy, we may witness similar approaches to the techniques of observations and observational instruments, but may look in vain for analogous influences in more theoretical fields such as planetary theories.

One could easily trace scientific developments in both cultural spheres and at times see similarities that invite speculation as to who was borrowing from whom. But given the current state of our knowledge about either culture, it is impossible to determine the direction of such influences if there were any. However, one thing seems certain: technological inventions which were definitely produced in China during the first thirteen centuries of the Common Era, such as the discovery of earth magnetism and the use of the compass for navigation, invention of paper, printing, gunpowder, the wheelbarrow and the like, all seemed to have swept through the rest of the world thanks to the mediation of the vast Muslim empire on the western border of China. Precious little of hard-core scientific knowledge followed.

Note: This essay is based on a lecture co-sponsored by the Silkroad Foundation and Iona College, New Rochelle, New York, where the talk was presented May 3, 2008.

About the author

George Saliba, Professor of Arabic and Islamic Science, Columbia University, works on the history of Arabic/Islamic science in general and particularly the history of planetary theories from antiquity to the Renaissance. He has a special interest in the transmission of science, and particularly the transmission of Islamic science to western Europe during the Renaissance, the subject of his most recent book *Islamic Science and the Making of the European Renaissance* (MIT Press, 2007). One of his earlier publications about the transmission of science, which was published on the Internet under the title *Mediterranean Crossings*, was later translated into Chinese and published in the Chinese journal *Horizons*, vol.1 (2000): 46-63. For more information visit his website at <http://www.columbia.edu/~gas1/saliba.html>.

Recommended readings

Apart from the author's own publications, which may be consulted for additional bibliography, note Arun Bala, *The Dialogue of Civilizations in the Birth of Modern Science* (New York: Palgrave Macmillan, 2006). In Joseph Needham's

magisterial, *Science and Civilization in China*, 7 vols. in 27 (Cambridge, Eng.: Cambridge University Press, 1954-), alchemy is covered in vol. 5, pts. 2-5; medicine in vol. 6, pt. 6. On the importance of paper in the Islamic world see Jonathan M. Bloom, "Silk Road or Paper Road?" *The Silk Road* 3/2 (2005): 21-26, which summarizes his elegant book *Paper Before Print: The History and Impact of Paper in the Islamic World* (New Haven: Yale Univ. Pr., 2001). A good many (but by no means all) of the important Arabic sources are available in English translation. Note in particular the translation of *The History of al-Tabari / Ta'rikh al-rusul wa'l muluk*, 40 vols. (Albany: State University of New York Pr., 1985-); *The Fihrist of al-Nadim: a Tenth-Century Survey of Muslim Culture*, Bayard Dodge, ed. and tr. (New York: Columbia Univ. Pr., 1970); *The Travels of Ibn Battuta*, A.D. 1325-1354, tr. H.A.R. Gibb [Works issued by the Hakluyt Society, 2nd ser., nos. 110, 117, 141, 178, 190], 5 vols. (Cambridge, Eng.: Cambridge Univ. Pr., 1958-2000).

On the Road:

Caravan Routes of Iran

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Photographs by **Ruth Harold**

For travelers and merchants of the middle ages, Iran was unavoidable. The great caravan roads that linked China and India to Rome or Constantinople passed through Persian lands, and the sea-lanes terminated at ports in the Persian Gulf. Iranian rulers took full advantage of their geographical opportunities: they taxed foreign trade, and made every effort to keep East and West from making direct contact. Merchants chafed at the exorbitant tolls, but there was little they could do about it; efforts to by-pass Iranian spaces, either by land north of the Caucasus Mountains, or via the Red Sea, had only limited success. Iran's relative prosperity from medieval times through the 17th century was due, in no small measure, to revenue from trade.

Iran is a large country, with a continuous history of some 2500 years as a nation and a state. The major caravan routes, which trace back far into antiquity, remained in use into the 20th century, and geography dictates that modern roads must generally run parallel to those of the past. In consequence, Iran's abundant legacy of art and architecture is quite accessible, or would be but for recurrent political frictions. The present article is the fruit of a long road journey in 2000, when tensions abated for a time, which took us diagonally across Iran from northwest to southeast, roughly following the route of Marco Polo's journey in 1273 CE. The world of the caravans is vanishing fast, but those who look can still find places where the roar of automobile traffic has not yet drowned out "the whispers of the desert-wind, the tinkling of the camels' bell."

The world of the Arab geographers

We are remarkably well informed concerning the historical geography of Iran, thanks chiefly to a small band of Muslim scholars, writing mostly in Arabic, who recorded in detail the state of the region in the 10th and 11th centuries CE. At that time, Iran was at least nominally part of the Abbasid Empire (though in practice much of the country was ruled by local dynasties or by the Seljuk Turks), and Baghdad was the center of the universe. This was the city glorified in "The Thousand and One Nights" (known in English as "The Arabian Nights"), a glittering metropolis of palaces, mosques and schools, hospitals and bazaars, that covered some five square miles and held more than a million souls.