Chapter 9
Minerals and Fossils
Introduction

In one of the few studies on the history of mineralogy where the role of the Arabic-Islamic cultural sphere in this field is discussed, Julius Ruska stated in 1912: "History of science has to deal with Arabic literature in three ways. History of science encounters the Muslims first as pupils of the Greeks, endeavouring, with the help of the Syrians and Persians, who knew the subject and the language, to transfer the treasures of Greek wisdom within reach into their own language and to utilise them. Studying the Greeks aroused the urge towards independent research and discovery, and as a fruit of this scientific enthusiasm we encounter an enormous corpus of treatises on matters dealing with mathematics and astronomy, natural sciences and medicine. After a few generations we find the Arabs as the teachers of the scientifically impoverished Latin West and we find their works translated, commented upon, published and recognised as authoritative works down to the 16th century and further." J. Ruska penned these lines almost one hundred years after the appearance of the first orientalist studies on this subject. These were an Italian translation of the book on mineralogy, the *Azhar al-afkār fi ḡawāhīr al-ahgār* by Āḥmad b. Yūsuf at-Tīfāṣī (d. 651/1253) and, at about the same time, a German translation of excerpts from the Persian *Ḡawāhirnāma* by Muḥammad b. Maṣūr ad-Ḍaṣṭāki (early 8th/14th cent.). In the course of time, both before and after J. Ruska, a few Arabic books on mineralogy were edited and translated into European languages. Moreover, a large number of studies and bibliographical works appeared without which the compilation of our selection of minerals would have been inconceivable. In spite of all the commendable attempts so far, the following questions seem to have been rarely asked: Which new minerals were discussed by the Arabic-Islamic scholars as compared to their Greek masters? Which new sites were discovered in Islamic times? What were their own experiences, observations, classifications and theories of their origin? Likewise there are hardly any studies on the impact of Arabic mineralogy on the advances made in the Occident. We can safely follow J. Ruska in his chronological overview of the participating cultures which played a decisive role in the history of science. And his observations are not restricted to the field of mineralogy alone: "In this connection, we have to distinguish basically between four large culture areas: the Egyptian-Babylonian, the Graeco-Roman, the Islamic, and the Christian-Occidental, which leads into the modern era. Basically, there is a significant connection between these cultures; the Far East also follows them." Unfortunately the Greeks, with all their astonishingly vast knowledge of mineralogy, provide us with hardly any clues as to which of the minerals mentioned by them and which part of information about those minerals are their own in origin and what knowledge they borrowed from other cultures. In this connection the Arabic-Islamic successors differ greatly from their teachers. Not only do they cite their Greek sources with amazing precision and mention with regard to each individual mineral what information they had adopted; frequently they give, beside the author’s name, also the title of the work, sometimes even the relevant chapter.

4 Our selection stems from the large collection of minerals of the Institut für Mineralogische Rohstoffe of the Technical University, Clausthal. For this we wish to express our thanks here. We also thank Dr. Armin Schopen for his manifold support in this connection.
Their main sources included the Arabic translation of Dioscorides’s (2nd half of the 1st cent. B.C.) Περί οίλης ιτιροτείς and Galen’s (2nd half of the 2nd cent. A.D.) Περί χάσεως καὶ δυνάμεως τῶν ἀπλῶν φαρμάκων. Apart from several authentic and not authentic Greek pharmaceutical and mineralogical treatises, a pseudo-Aristotelian book of stones also reached the Arabic-Islamic culture area. It was translated into Arabic by a certain Lūqā b. Isrāfīyūn, as he himself states. This work in which 72 stones are described holds the foremost position among the sources of Arabic mineralogy. According to J. Ruska, it is likely that “a Syrian who was familiar with the Greek and also with the Persian sources and traditions authored the book in the period of translations, before the middle of the 9th century.” According to the author of these lines, however, this work had its origin in Late Antiquity (ca. 5th-6th cent. A.D.) and was translated into Arabic in the 2nd/8th or the 3rd/9th century. This and other pseudo-texts and Hermetic treatises circulated in the Mediterranean region during Pre-Islamic and Early Islamic times. The importance of their contents was realised quite early, they were translated, treated as authentic works and cited under their pseudonyms.

We must also mention that, together with the authentic and pseudo Greek texts on mineralogy, pharmaceutics, and medicine, not only sober matter-of-fact descriptions of minerals reached the Arabic-Islamic world, but also, for instance, beliefs related to the magical effects of stones and their use as amulets. When we find such elements even in the works of Dioscorides and Galen, we must not fall into the error of thinking that the cultural importance of these works or their importance for the history of science becomes diluted because of this. Arabic-Islamic mineralogy also contains some traces of Indian6 and Middle-Persian7 sources, but these are of minimal consequence because of the dominant position of the Greek sources.

In view of the modest status of the contemporary research on Arabic mineralogy, we make here the bold attempt to communicate some of the discoveries and interpretations of Arabic mineralogy which are of interest for the history of mineralogy and geology. J. Ruska10 gave some broad outlines of the knowledge he gained from his intensive study of the material in the first half of last century. Thus he finds in Arabic cosmological and nature-philosophical treatises a “stronger emphasis on the general issues of the origin of minerals and their chemical properties,” and also of issues concerning geology—as compared to their pharmacological treatises. In this connection, what he finds particularly interesting are the observations of the fifth treatise of the Encyclopedia of the Brethren of Purity (İhwān as-Šafā‘, 4th/10th cent.) on the origin of minerals, which “contains much on geology that has not been noticed so far. Thus, e.g. the minerals are divided into three classes according to the time required for their formation. The first group is formed in dust, loam and salt steppes and needs just one year for maturing; here the rapid formation of steppe salt, gypsum and such salts in the dry climate of the Near East can be recognised. The second group is of the stones that form slowly at the bottom of the sea, such as corals and pearls. The last group consists of metals and gems which originate in the interior of stones, in mountain caves; some of these only reach maturity after centuries. The fixed stars in the sky make one full revolution in 36,000 [159] years,11 the conditions on earth change correspondingly, cultivable land becomes desert, deserts become cultivable, steppes and mountain ranges emerge from the oceans, deserts and mountain ranges sink into the sea. The mountain ranges heat up under the rays of the sun, they dry up, burst and crumble, become gravel and sand; heavy showers of rain turn them into sludge in the beds of mountain rivulets, rivers and streams; these lead them to the oceans, the lakes and the marshes;

7 v. F. Sezgin, Geschichte des arabischen Schrifttums, vol. 4, pp. 103.
11 The İhwān as-Šafā‘ obviously did not know the much improved value for the precession (v. F. Sezgin, Geschichte des arabischen Schrifttums, vol. 6, pp. 26).
the oceans act on them through the surf and the pounding of the waves, and spread them in layers at their bottom; they are deposited one above the other; they adhere to one another, form mountains and hills under water; like the sand in the steppes and deserts, they rise gradually and become firm land on which plants take over, while, to compensate for it at other places, the ocean overflows its coasts and spreads across firm country. Here it is possible to see the main features of Joh. Walther’s principle of geology, and it would be an interesting task to examine how far these geological views rest on independent observations and ideas and how far they must be traced back to those of the Greek geographers, for example.”

“The enumeration of stones and the extensive subdivision of salt-like substances” which occur in the “Book of Secrets” (Kitāb al-Asrār) by Abū Bakr ar-Rāzī (d. 313/925) were regarded by J. Ruska as “an innovation introduced by Rāzī”. Ruska also made the observation that some books are very precise in their information about the places of the occurrence of minerals. This is confirmed by other sources which were not accessible to him or were not known in his times.

“Greater attention is paid to the physical properties which can be ascertained directly or with the simplest tools. Whether the mineral is heavy or light, hard or soft, smooth or rough, brittle, whether it can be split or hammered, whether it is soluble or not, whether it is lustrous or dull, transparent or opaque, and what colours it has—all this is listed, though not systematically, but in many cases with good powers of observation, likewise the behaviour of the mineral in fire or against acids, its taste and odour.”

On the question of the advances made by the Arab authors as against their Greek sources in the decriptions of the minerals, Ruska again provides an example. On the book of stones by Aḥmad at-Tifaṣṣī (d. 651/1253) he remarks as follows: “The description of each stone is given in five chapters, the first of which deals with the cause of the formation of the stone in its mine, the second deals with the localities where it occurs, the third with its good and bad properties, the fourth with its specific powers and effects, the fifth with its commercial value.” “In describing the medicinal and chemical properties, at-Tifaṣṣī depends greatly on the work by [pseudo-]Aristotle, yet he offers much new information on the places of occurrence, on the method of differentiating between different varieties, on the defects and flaws, on the price and the use of gems.”

J. Ruska cites likewise an instructive example of the description of the places of occurrence according to at-Tifaṣṣī: “On the quarrying of emeralds in Upper Egypt highly interesting information is provided by our author. According to Bauer’s Edelsteinkunde, the old Egyptian emerald mines were rediscovered only under Mehmed ‘Ali by the Frenchman Fr. Caillioud in 1816, but the operations were stopped again after a short time, and no information was available about the operation of the mines from the period after the Roman occupation.[160] But this is not correct in so far as the mines are mentioned by al-Iṣṭaḥri in the 4th/10th century as well as by al-Idrisi about 545/1150. Al-Masʿudi already reports at length about the mining of emeralds and their varieties in the Murūg ad-dahab (ed. Barbier de Meynard, vol. 3, pp. 43 ff.). The information given by at-Tifaṣṣī can be summarised as follows: Emeralds are found on the border between Egypt and Ethiopia in a mountain range that stretches to the sea near Aswan. The senior inspector of mines, who was appointed by the sultan, informs that the first thing to be encountered in the emerald mines is black talc which, when exposed to fire, appears like golden marcasite. Through further digging the soft red sand in which emeralds occur is reached. Only small stones which are used for rings are found in the sand; the large ones and the complete emeralds are to be found in galleries and veins.”

13 Born 1797 in Kinnordy (Scotland), died 1875 in London.
16 ibid, pp. 343 (reprint pp. 257).
It was without doubt a great advance when the Arab-Islamic mineralogists discovered a procedure to evaluate minerals\(^2\) and ores according to their specific weight.\(^3\) The pycnometer invented by al-Bīrūnī (1st half of the 5th/11th cent.) made it possible for him and his successors to determine the specific weight with amazing accuracy (see below, V.9).

It may also be mentioned that al-Bīrūnī\(^2\) refuted the popular notion that all salt water everywhere on earth was transformed into fresh water at a specific hour on the 6th day of January every year and that he contradicted a method which had come down from Aristotle for the desalination of sea water. This has to do with the attempt to extract fresh water out of sea water with the help of a waxen vessel, as described in Aristotle’s meteorology: “Actually, if a waxen vessel with the neck closed tightly is submerged into the sea, after 24 hours it would contain some amount of water which had seeped into it through the waxen walls and this water would be drinkable because the earthy and salty parts had been ‘filtered out’.”\(^2\)3 Abū ‘Ali Ibn Sinā (d. 428/1037) also deals with the origin of rocks in the section on meteorology of his Kitāb aš-Šīfā'. Until the 19th century this section, available in Latin under the title Liber de mineralibus Aristotelis, was thought to be the work of the Greek philosopher Aristotle (see below, pp. 163). On the topic that interests us, M. Y. Haschmi of Aleppo has published several studies. From his work Die geologischen und mineralologischen Kenntnisse bei Ibn Sinā\(^2\) we cite the following passages on the origin of minerals:\(^2\) “Stones are formed in two ways, either through drying up as with the formation of loam, or through ossification. Loam dries up and turns gradually into stone. If it is not \([161]\) fatty, it will decompose before it becomes stone. Ibn Sinā recounts that in his youth he saw on the banks of the River Gāhūn [Amu-Darya] a type of loam which turned into stone within 23 years. Stones originate in running water in two ways, firstly through evaporation and secondly through gradual precipitation. Ibn Sinā also observed that some waters condense to stones and pebbles with different colours when they drip upon a certain spot. Some waters ossify, but only when they come into contact with certain types of stone. From this he concluded that there were some types of earth which had mineralogical properties to bring about the ossification of water. The beginning of stone formation occurs either through loam-like substances or through other substances that contain much water. In the latter case, the rock is formed either through a mineral force that causes the solidification or through the predominance of the earthy parts as in the case of salt formation … Water turns into loam and loam also turns into water. Thus the stones are either dried in the sun as in loam formation or through the hardening of water and through drying up.”\(^2\)6

After this Ibn Sinā discusses the reason for the fossilisation of plants and animals. In conjunction with this, he also mentions his own observations made in Central Asia. One of these is connected with the so-called “lightning tube”: “Sometimes stone-like or iron bodies form through lightning. In the land of the Turks (Turkistān), after thunder and lightning, copper-like bodies [in the form of lances, ağsâm...

\(^2\) Al-Bīrūnī reports in his Kitāb al-Ǧamāhir fi ma‘rifat al-gawāhir (ed. F. Krenkow, Hyderabad 1355/1936, pp. 50) on the existence of a book on the prices of precious stones, written in Damascus during the reign of Marwān b. ‘Abdalmalik (65/685-86/705) which he had come across. E. Wiedemann (Über den Wert von Edelsteinen bei den Muslimen, pp. 353, reprint in: Natural Sciences in Islam, vol. 28, pp. 237) earns the credit for having been the first to draw attention to this early source. The manuscript of the book by al-Bīrūnī, which Wiedemann used, seems to have contained a more detailed description of the old book (to be more precise, the booklet) than the printed edition which is at our disposal.


nūḥasīya ‘alā ḥai‘at as-sīhām] were formed. Ibn Sinā tried to melt a piece, but it burned with green smoke and left an ash-like substance behind. He also heard about iron that had fallen from the air. No doubt, the “copper-like body in the form of a lance” was a lightning tube or a fulgurite; these are sand grains fused together in the form of a tube which form in sand through flashes of lightning. A first description of this phenomenon was given by Karl Gustav Friedler in 1817.28 According to Eric J. Holmyard, in his discussion of the formation of mountain ranges and stones, Ibn Sinā had anticipated quite early the conclusions of Leonardo da Vinci (1452-1519) and Nicolas Steno (1631-1686).29

In the history of mineralogy, reference is made particularly to Ibn Sinā’s classification of minerals. He divides them into four classes: 1. stones (ahgląd), 2. ores (dā‘ibat, i.e. substances that can be melted), 3. substances that can be burnt (kabārīt, sulphura = varieties of sulphur), 4. salts (amlāh, substances that are soluble in water). However, I do not believe that this is in fact the “only thing” which “really survived the Middle Ages” as Karl Mieleitner30 opined in 1922. At the end of this introduction, when we now raise the question of the continuation of Arabic-Islamic mineralogy in the Occident, we must be aware of the fact that we are not dealing with one of the fundamental areas of Arabic science, such as mathematics, astronomy, medicine and geography which exceptionally many scholars dealt with and left numerous works. Therefore the process of the reception and assimilation in the Oc-

cident of this peripheral subject looks different to that of the core subjects. Thus, there is hardly any influence worth mentioning, e.g., on the encyclopaedist Alexander Neckam (1157-1227), one of the most eminent figures in the phase of reception. [162] In his book entitled De naturis rerum liber he does mention plenty of stones, but he does not give any descriptions.31 In my view, this explains why there are no more than isolated references to mineralogy in the works of Roger Bacon, the great European nature philosopher of the 13th century.32 It is the book on minerals by Albertus Magnus (1193-1280), said to be the “best mineralogical work of the Occidental Middle Ages,” which shows for the first time noticeable traces of texts translated from the Arabic. These Arabic texts include Ibn Sinā’s book of stones, the pseudo-Aristotelian book of stones and a few other materials that were made available in Latin translation from the Arabic originals by the convert, Constantinus Africanus (d. 1085 in Salerno). It is striking that in his Libri V de mineralibus he adopts Ibn Sinā’s classification of stones, which we mentioned above, placing, however, the salts and the substances that can be burnt (sulphura) between stones and metals.33 In a manner that is instructive for our question, K. Mieleitner 34 explains the nature of the special knowledge and the capacities of a personality as important for the assimilation process as Albertus Magnus is: “All in all, the mineralogical knowledge of Albertus is very meager, and in this field he excels his contemporaries only slightly. He relies mainly on the statements of his sources, but at least in his case there are the beginnings, though only in modest form, of making observations of his own. He was not familiar with the best writings of the Mohammedans, their works on the specific weight were completely unknown to him—as also to all other mineralogists of the Occidental Middle Ages—since he had at his disposal only imperfect Latin extracts of Arabic texts. Of course, Albertus also laboured under the opinions of his times, particularly the alchemical beliefs. His chemical knowledge was very meagre, although according to his own words he had read and stud-

28 v. Rudolph Zaunik, Kurze Notiz, in: Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften 41/1961/163. In F. M. Feldhaus, Die Technik. Ein Lexikon der Vorzeit, der geschichtlichen Zeit und der Naturvölker, Wiesbaden 1914 (repr. Munich 1970), column 110 one can read: “The clergyman Leonhard David Hermann found at Massel in Sile sia one such [a lightning tube] first in 1706, but he explained it as ‘a fruit of a subterranean fire’ (…). The tube is preserved in the Mineralogisches Kabinett in Dresden. Around 1796 one farmer Hentzen found such a tube in the Senne near Paderborn and correctly called it a ‘lightning tube’.”
32 ibid, pp. 477.
33 ibid, pp. 466, 468.
34 ibid, pp. 473, 474.
ied much and had undertaken journeys to find out about the nature of metals. In the explanation of the physical and chemical properties, he finds in fact very few difficulties; as a rule he has at once a completely adequate explanation for everything, in the manner of scholastic philosophy. He modified Avicenna’s excellent division of the minerals into four classes, which was not very fortunate, but at the same time very necessary because he knew so few salts and combustible bodies among the minerals that he could not put them as an equally important class next to stones and minerals. His book on precious stones differs from the numerous others of the Middle Ages only in the sense that he at least includes a few of his own observations, even if those are for the most part incorrect. The first Arabic book with mineralogical content that reached the Occident in Latin translation was apparently al-‘timād fī l-‘adwiya al-murfada by Aḥmad b. Ibrāhīm Ibn al-Gazzār (d. 369/979). It is a book of drugs in four parts, the fourth of which is devoted to minerals and mineral medicaments. It saw the light of the day in Salerno under the title Liber de gradibus as a work of the above-mentioned north-African convert Constantinus Africanus, who translated several books from the Arabic, reworked them arbitrarily, and attributed them to himself or to a Greek authority. This adaptation circulated for seven hundred years as the work of Constantinus Africanus, parallel to the Latin translation of a certain Stephanus de Cae-saraugusta (Zaragoza, written 1233) which bears the name of the actual author and the title Liber fiduciae de simplicibus medicinis.

[163] The mineralogical knowledge of the Arabic-Islamic culture area also reached the Occident through Latin and Hebrew translations of the chemical-alchemical books by Gābir b. Haiyān and Abū Bakr ar-Rāzī. In his study Übersetzung und Bearbeitungen von al-Rāzīs Buch Geheimnis der Geheimnisse, which appeared in 1935, Julius Ruska could show what kind of elaborations and adaptations were done to this book that contains an important chapter on minerals. Wide popularity in the Occident was also enjoyed by the above-mentioned pseudo-Aristotelean book of stones which was obviously translated into Latin from the Arabic in the 6th/12th century. Of course, it was considered for centuries a book by Aristotle, not only in the Occident, but also in the Islamic world. For the author of these lines it is, however, a Greek pseudo-epigraph from Late Antiquity that was first translated into Arabic and from there into Latin.

In conclusion, we may mention another work which too was translated at first from the Arabic and was circulated as the work by Aristotle. It is the Liber de mineralibus Aristoteles, which was known for centuries, besides the Tria vero ultima Avicennae capitula transtulit Aurelius de arabico in latinum, until E. J. Holmyard and D. C. Mandeville demonstrated that both the texts are a part of the section on natural sciences (ṭabi‘īyat) in Ibn Sīnā’s Kitāb aṣ-Ṣifā‘.

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Clément-Mullet, see Tifāšī


Leclerc, see Ibn al-Baitār


Qazwini, *Aǧāʾib al-mahī IConfiguration = Zakarja Ben Muhammed Ben Mahmud el-Cazwini’s Kosmographie. Literature which is cited in abbreviation in the following pages:


Schönfeld, see Tamimi

Sonthheimer, see Ibn al-Baitār


almās
Diamant

Diamond is referred to as the hardest of all stones which, unbreakable in itself, can reduce to small pieces all other stones (and metal, with the exception of black lead). Arabic sources mention only India as the deposit site.

11 pieces, white and tinted.
Diameter: ca. 1.5-5 mm. Total weight: ca. 5 ct. (5 carats = 1 g).
(Inventory No. K 3.14)
“Sunbādaq” is a Persian term; in Greek the stone is called σμύρις. It is a hard stone which has the property of being able to grind metal and stone (corundum is still used today in the production of emery paper). Because of its hardness it is considered a “deputy” (nā‘ib) of diamond (see Biruni, Ḵamāḥir, p. 102). It is also called yāqūt ahmar (ibid, p. 103).

Sudan, Sri Lanka and Isfahan in Persia are mentioned in Arabic sources as the locations of deposits.

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**biğădī**
Garnet

(1) On muscovite and quartz. 55 x 450 mm, 148 g. (Inventory No. K 3.19a)

(2) Diameter: 50 mm, 96 g. (Inventory No. K 3.19b)

balḥaš (from Persian balaḥš)
Spinel, Ruby Spinel

Described by at-Tifāšī (Azhār al-afkār, p. 19, reprint p. 42) as related to the ruby (yāqūt), this stone is identified with the term laʿl (likewise “ruby” etc.) by Ibn al-Akfānī (Nirhab ad-dāḥāʾir, pp. 755-756): “Balḥaš is called laʿl in Persian. It is a red transparent stone and it is in fact the red that is called musfir, it is also pure. In colour and lustre, it has a striking resemblance to a beautiful yāqūt. It differs from it in hardness so that it is cut when the two minerals collide with one another. That is why it must be polished with gold-coloured marcasite, which is the most excellent polishing material for this precious stone. There is one type that resembles the bahramāni and is known under the name al-yāzāki; it ranks the highest and is the most precious.” “At the time of the Buyids (321/933-448/1056), it was sold for the same price as yāqūt, until it came to be better known; then its price sank and it was decided that it should be sold by dirhams and not by mīqālūs, in order to differentiate it from the yāqūt. There are specimens tending to white and there are some which tend to the colour of violets (hanafasāğiya); these two are less valuable than the first mentioned.” “It is found in the East, three days journey from Bāḍaḥšān. This is the gate for it, so to speak, through which it comes to other countries. Some spinels occur with transparent coatings and some without. Pieces weighing more than 100 dirham have been noticed. In earlier times the price of each dirham was 20 dinar and sometimes more.”

Al-Bīrūnī (Gamāhir pp. 81-88) lists the stone under the name al-laʿl al-badaḥšī, and the same term is used also by al-Ḥāzīnī (Mizān al-ḥikmah, p. 138, reprint op. cit., p. 295).


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3 Quatremère’s statements were translated by E. Wiedemann, Zur Mineralogie im Islam, op. cit., pp. 235-236 (reprint op. cit., pp. 207-208).
**banfaš** (from Persian *banafš*)

Zircon (hyacinth)

According to at-Tifsī (Azhār al-afkār, p. 19, repr. p. 42), *banfaš* as well as *baljaš* (spinel) and *biḫādi* (garnet) belong to the types (*anwā*) and varieties (*ašbāh*) of *yāqūt* (ruby): “The wise man (ḥakim) says that these three were originally meant to become ruby, but this had been prevented by external influences like too high or too low moisture, lack of warmth or rest. That is why they turned into stones which do not resist fire.”

There are said to be four classes (*ašnāf*) of *banfaš*. The first is called *mādini*. It is of a clear light-red colour. The second is called *asādast* and is black. The third (without a name) is yellow. The fourth remains without any description (Azhār al-afkār, p. 21, reprint p. 40). J. J. Clément-Mullet¹ identified *banfaš* as zircon.²

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Amethyst

About the stone al-ğamast, also called al-ğamaz, Ibn al-Akfâni (d. 749/1348) says in his book *Nuhâb ad-dâhâ’îr fi alwâl al-gawâhir*:\(^1\) “It is a stone that resembles the violet-coloured *yâqût* (*al-yâqût al-banafsaqî*)\(^2\). The most precious variety sold for the highest price is the rose-coloured variety (*wardî*). It is found near as-Ṣafâra‘ in the Ḥiḡāz. Some specimens are found which are covered with a white coating; they resemble the snow on the surface of which there is some reddishness.” The deposit sites are Waṣîrîr in Persia and the region around the city of as-Ṣafâra‘ in the Ḥiḡāz. In medicine it was believed that the stone strengthened the brain and the stomach.


In the pseudo-Aristotelian book of stones (see above, p. 117) rock crystal is called a stone that resembles glass. This view was also generally held by Arab scholars. Upper Egypt, Indian Ocean (al-Bahr al-ahdar), Armenia and Sri Lanka are mentioned as the deposit sites.

*billaur, ballûr, mahã*

Rock Cristal

zumurrud
Emerald

Zumurrud and zabargad (v. the following) are generally considered in Arabic sources to be one and the same stone. Some mineralogists are of the view that both are found in the same mines and that zabargad is the less valuable variety.

Upper Egypt, the localities of Sindân and Kambâyât in India and a region called Buga in the Far East are mentioned as deposit sites.¹


Diameter: 12 mm, enclosed in rock: 85 x 50 mm.
Total weight: 120 g.
(Inventory No. K 3.48)
Beryl is related in mineralogy to emerald. Arabic mineralogists could not agree whether zabargad and zumurrud were the same kind of stones or different ones. On the sources, see above under emerald.

(1) Greenish−yellow
Diameter: 22 mm, 55 ct.
(Inventory No. K 3.10a)

(2) Greenish
Diameter: 18 mm, 35 ct.
(Inventory No. K 3.10b)

Jean-Jacques Clément-Mullet\(^1\) translates the Arabic name into French as *œil-de-chat* and identifies the stone as quartz chatoyant. 

At-Tifashi (*Azhahr al-ajkar*, pp. 28-29, reprint pp. 35-36) considers the stone to be an insufficiently developed ruby which is mined together with the ruby as an inferior variety. He complains that none of the books of stones known to him mentioned this stone.

This is the stone called ἴασπις λίθος by the Greeks (Dioscorides, book 5, chapter 159, v. J. Berendes p. 551). Ibn al-Baitār mentions the stone in his Ġāmi‘ (vol. 4, p. 209) and quotes from Dioscorides, Galen and al-Ǧāfiqī. At the beginning he says, following Dioscorides: “Some claim that jasper is a kind of emerald. There is one variety whose colour comes close to that of smoke and represents as it were something covered by smoke. Another variety of jasper has white lustrous veins and is called Astrius (kaukābi). Another type is called Terebinthinum (ṭarrīnīn) because it has a colour similar to that of the fruit of the terpentine tree …” (transl. Sontheimer, vol. 2, p. 602, cf. transl. Leclerc, vol. 3, p. 427). Al-Bīrūnī mentions China (Ḫutan) as the deposit site; there since Antiquity various jasper varieties that were as pale as milk were preferred to diamonds, rubies or emeralds.

v. also Bīrūnī, Ġamāḥir, pp. 198-199; Muwaffaqaddīn al-Harawī, Abniya, pp. 120, 346 (transl. Achundow, pp. 190, 284, 318; reprint pp. 62, 156, 190).
Agate

(1) Broken.
Diameter: ca. 135 mm, 0.69 kg.
(Inventory No. K 3.02 a)

(2) Sawed and polished.
Diameter: ca. 130 mm, 0.75 kg.
(Inventory No. K 3.02 b)

(3) Water Agate.
Diameter: 50 mm, 95 g.
(Inventory No. K 3.02 c)

This variety of carnelian is described in the pseudo-Aristotelian Book of Stones as follows: “Among the carnelians there are also those which are less beautiful, whose colour is that of meat water and in which there are fine white lines. Whosoever uses this variety as the stone for his seal, his anger will subside. It staunches haemorrhages and actually has its special effect on women whose menstrual period lasts too long. Its powder smoothens the teeth, removes dental caries and draws out the rotten blood from the roots of the teeth.” (Steinbuch des Ar- istoteles, pp. 103,144, reprint op. cit., pp. 111,152).

This variety seems to be identical with that which al-Birûnî mentions in the Kitâb al-Gamâhîr (p. 174), following Naṣr b. Ya’qûb al-Kindî (4th/10th cent.). It is said to have been called ‘aṭiq ḫalânî and to have been less valuable than carnelian. He mentions India as the deposit site.
This stone, which was especially popular in Arabia, occurs in various colours, but preference was given to that having a certain red shade which is called in Arabic laun māʿ al-lahm (“meat-water colour”). This designation is explained by Ibn al-Baitār (Ḡāmiʿ, vol. 3, p. 128) as “the colour of the water that oozes when salt is sprinkled on meat”. The Latin name carnelian goes back to this fact. Pliny calls the stone sardonyx. ‘Aqīq was (and still is) used for necklaces, signet rings and inlaid work at prayer niches (miḥrab) at mosques. It was also used as a powder for dental care. Arabic sources mention, among others, Yemen, the vicinity of Basra and the banks of river Jordan as the deposit sites.

Onyx

This stone, quite well known in Arabia, is often mentioned together with the carnelian because of the deposit sites. Ibn al-Faqih al-Hamadani, the geographer who was active in the first half of the 4th/10th century (Kitab al-Buldân, Leiden 1885, p. 36), after mentioning its source, goes on to say: "In the mountains of al-Yaman there are deposits of onyx (ғаз'); it has different varieties. All of them appear in the same places that carnelian occurs. The best and most valuable variety is al-baqaranî, others are al-'arwâni, al-farisi (from Fars), al-ḥabsi (from Ethiopia), al-mu'assal (looking like honey), al-mu'arraq (having veins)." Ibn al-Baiṭâr (Gâmi', vol. 1, p. 163) also knows a variety from China.

Valuable information on this stone is to be found in the Kitab al-Iṣāra ilā maḥâsîn at-tîgära by Abu l-Faḍl ad-Dimaṣqî (p. 18): "Artists fashion large impeccable pieces of jewellery from it. Often they get high prices because of the skill they had to employ, since it is a stone that is difficult to work with. One of its varieties is the bâqarânî onyx. Signet rings are made out of it with the names of the kings and nobles. It fetches high prices." "Onyx consists of successive parallel layers, each having a clear white, black and red colour. With the help of these the artist carves out letters whose colour is different from that of the background. Sometimes three colours are also found, be it in writing or in a picture. Generally they can show three colours only in a picture because the picture is of the human body and can be carved through three layers; in the case of writing they can achieve that only when the surface of the signet ring is not flat (i.e. several colours are only possible when depictions are in relief)."

\[1\] E. Wiedemann, Zur Mineralogie im Islam, op. cit., p. 245 (reprint op. cit., p. 217).

\[2\] Translated by E. Wiedemann, op. cit., p. 235 (reprint op. cit., p. 207).
Of the varieties of marcasite mentioned by Šamsaddin ad-Dimašqi, we may also show here "the copper marcasite":

As deposit sites of marcasite, ad-Dimašqi mentions Hadat in Lebanon, Gūsiya near Karak, and Yaʿfir, a village near Damascus.
This stone, called ἀιματίτης by the Greek predecessors, appears in Arabic writings in the Arabic form ṣadanaġ and also under the names ḥağar ad-dam ("blood stone") and ḥağar at-ṭūr ("mountain stone"). At-Tamimi (Muršid, pp. 65-69), to whom, as far as I know, we owe the most detailed treatment of the subject, says: "There are two varieties, one of them is masculine and the other feminine. The masculine haematite is the hard, smooth, externally very red variety that serves people (?) when it is rubbed on a red spot or a boil that is caused by a congestion in the face and in the head and in the other limbs; then it distributes the blood, removes the boil and is beneficial to the person; and that is why it is called blood stone. As for the feminine one, it is formed like a lentil, deep red and nice to the touch and (it looks) as if there are red lines in the form of a lentil on its surface. It is collected and melted (together) and glued one on the top of the other. It can be of different shades of deep red, and can be (differently) brittle when crushed. Those which are deep red and shine on the inside, when it breaks are chosen, which is clear from (other) rocks and which is easy to pulverise …" "Another variety is called blood stone from Yemen (yamānī); its colour comes close to black and it is not very hard. This is more useful to the eyes than the Nubian variety (nūbī). Another variety of Šadanaġ is called that of Malāṭiya (malāṭi); yet another variety is imported from Libya, it is close to the Nubian variety in colour when heaped on top of each other …" (after the transl. by Jutta Schönfeld, ibid., pp. 66-68).

According to Arabic sources, the deposit sites are Malatya in Anatolia, the mountain of Tabor and al-Karak in Palestine and certain regions in Yemen, in Egypt, in Sudan and North Africa.

(1) Var. haematite Diameter: 60 mm, 0.3 kg. (Inventory No. K 3.21a)

(2) Var. kidney ore 200 x 100 mm, 1.96 kg. (Inventory No. K 3.21b)
Loadstone

The loadstone is also called *hağar al-bāḥit* in Arabic. Knowledge of this mineral, which reached the Arabs from the Greek and other neighbouring cultures, was widespread in the Islamic world. The use of the loadstone in the ship’s compass, which was at first rather primitive, reached the Arabic-Islamic culture area possibly from China. However, the further development of the compass and its systematic use as a means of orientation seems to have been an achievement of the nautical science which developed in the Indian Ocean region.¹

lāzuward
Lapis Lazuli, Lazurite

According to ar-Rāzi, there is only one variety of lazurite. It is dark blue with a little red and has shining gold-coloured eyes (al-Rāzi’s Buch Geheimnis der Geheimnisse, p. 86). Ar-Rāzi, who displays a sound knowledge of the subject here, describes the stone as one of four “oily” stones which have an oily lustre or which achieve special lustre when rubbed with oil (ibid, p. 44).

As a medicinal remedy lapis lazuli is used for diseases caused by black bile such as the symptoms of melancholy. About its function as a laxative at-Tamimi (Muršid, pp. 77-78) says that he had tried it but “found no truth in it”. In powder form the stone is one of the most important and most cherished pigments (true ultramarine) even today. Among the deposit sites, al-Birūnī (Gamāḥir, p. 195) mentions a mine in the vicinity of the mountain Bigādī in Badaḫšān, in the extreme north-east of Afghanistan.

Turquoise is also called ḥağar al-ğalaba ("victory stone") and ḥağar al-ʿain ("eye stone"). In Arabic sources Nishapur and Gundishapur (South-East Iraq) are mentioned as the deposit sites.
According to the description by Arabic mineralogists, this green stone belongs to the minerals containing copper. Ar-Rāzī (al-Rāzī’s Buch Geheimnis der Geheimnisse, p. 86) describes it as a green stone with veins out of which seals and amulets are carved. He knows of new and old malachites from Egypt, from Kīrmān and from Ḥūrāsān (Khorasan in north-eastern Persia). The old malachite from Kīrmān was the best. Al-Bīrūnī (Gamāḥīr pp. 196-197) also mentions the high quality of malachite from Kīrmān and refers to the mountain range Ḥarrat Bani Sulaim in the vicinity of Mecca as another deposit site.

In medicine the stone was credited with a certain antidotal effect. It was also used against leprosy and as a medicine for the eyes (Qazwīnī, ‘Aḡā’īb al-mahlūqāt, p. 225).

Hemimorphite

The origin of the word is uncertain. It is assumed it could have derived either from the Persian or the Sanskrit. Tūtiyā is counted among the stones. Arabic mineralogists knew it in white, yellow, green, brown and grey hues. In medicine it was used as a remedy for the eyes and against ulcers. The deposit sites mentioned are the coasts of the Indian Ocean, India (Sind), Persia (Kirmān), Mesopotamia (Baṣra), Eastern Anatolia (Armenia), Byzantium, Syria (Hims), localities on the eastern coast of the Mediterranean (Beirut), in Northern Africa (Tūnis) and in Moorish Spain (al-Andalus).

Zinc Spar

Hemimorphite is usually “accompanied by another zinc-containing mineral, viz. zinc carbonate, which as a mineral is named zinc spar or calamine and plays an important role as zinc ore. It is to be found at times also in bright green, blue and probably also in violet-coloured aggregates just like hemimorphite …” (Bauer, Edelsteinkunde, p. 524).
bādzahr
Bezoar Stone,
or perhaps:
ḥağar al-ḥaiya
(<Snake Stone>)
Serpentine

(1) Green.
120 x 90 mm, 478 g.
(Inventory No. K. 3.47a)

(2) Grey.
100 x 45 mm, 242 g.
(Inventory No. K 3.47b)

(3) Black.
100 x 70 mm, 375 g.
(Inventory No. K 3.47c)

According to al-Qazwini (‘Ağā‘ib
al-mahlūqāt, p. 217), the two stones are
confused with one another. The name of
the first is derived from the Persian (zahr =
poison).¹ Both were used as antidotes. They
are also said to be useful against leprosy
and the diseases of the heart, the kidneys
and the stomach.
Persia, especially Ḥurāsān (Khorasan) and
India are mentioned as deposit sites.

Dioscoride, Livre 5, chap. 161 (v. J. Berendes,
p. 55); Steinbuch des Aristoteles, pp. 104–105, 147–
149 (reprint op. cit., pp. 112–113, 155–157); Tamimi,
200–202, 207–208; Qazwini, ‘Ağā‘ib al-mahlūqāt,
(trad. franç., Leclerc, vol. 1, p. 412; German transl.

¹ v. J. Ruska, Das Steinbuch aus der Kosmographie
des ... al-Qazwini, op. cit. p. 29 (reprint op. cit. p.
249).
In Persian and Turkish the stone is called mermer. The Arabic sources in which it is described know it in various shades and mention that it is used for building and as a tombstone. In Arabic medicine it was used as styptic in pulverised form.

A yellow brittle stone which has been used as a pigment since the Palaeolithic period and which serves in the medical field for the treatment of skin diseases.

The stone mağnisiyā, which was known in numerous colours, is often mentioned in Arabic sources together with marqašīta, the marcasite, which was likewise known in many colours. That is why they were quite frequently mistaken for one another. About mağnisiyā, Abū Bakr ar-Rāzī states as follows: “There are different varieties (colours). There is one earthy black variety in which there are shining eyes. Then there are also hard iron-like pieces of it; that is the masculine variety. Then there is a red variety with crust; that is the feminine variety; in it there are flashing eyes and it is the best of its kind.” J. Ruska says in explanation: “The word mağnisiyā refers in Rāzī’s work on the manganese oxides which even now are differentiated for practical purposes as soft and hard manganese ores. With ‘flashing eyes’ he probably means small areas of crystal which flash in the sun while they moved to and fro and perhaps he also means areas shining like metal against a dull background. The red variety which appears in the form of a crust is obviously manganese spar which is to be found often at manganese sites as a product of transformation. The differentiation of the various varieties leads us to assume that Rāzī was familiar with a natural site in Persia.”

With great probability mağnisiyā is identical with the mineral which in our times is called pyrolusite. It was used for the manufacture of glass. Deposit site is Persia.


2 Translated by J. Ruska, Al-Rāzī’s Buch Geheimnis der Geheimnisse, op. cit., p. 86.

3 ibid, p. 43; v. also p. 146 about the two methods of calcination of mağnisiya.
**hağar al-‘uqāb**

Eagle Stone, Rattle Stone

"A stone that resembles the Tamarind seed; when it is shaken a sound is heard from inside, (but) when it is broken, nothing is seen in it. It is found in the nest of the eagle that brings it from India. When somebody goes towards the nest, it [the eagle] takes it [the stone] and throws it towards him so that he may take it and turn back, as if the eagle knew that he came in search of this stone." The stone is also called hağar an-nasr ("eagle stone") and hağar iktamakt.

Four deposit sites are mentioned: Yemen, Antioch, Cyprus and Northern Africa.

Alum

2 specimens.
Diameter: 24 mm.
Total weight: 60 ct.
(Inventory No. K 3.03)

According to ar-Rāzi, alum belongs to the group of vitriols. These are used in dyeing and tanning, as additives to coloured inks and for clarifying turbid liquids. In the field of medicine, they have their use as styptics, as ingredients of eye medicines and of collyria, in skin diseases, as gargling water for toothaches and for fortifying the gums. Deposit sites are Egypt, Libya, Yemen and Eastern Turkistan.

Ar-Rāzi speaks of seven types of vitriols, among them qalqadis, qalqaثار, qalqand and sūrin. Other scholars like Ibn Sīnā and Ibn al-Baṭṭār mention the colours white, yellow, red and green; blue is missing. Ar-Rāzi also deals with procedures for the artificial production of vitriols (v. Al-Rāzi’s Buch Geheimnis der Geheimnisse, op. cit., pp. 47, 87-88; Ibn al-Baṭṭār, Gāmi’, vol. 2, pp. 148-152).

According to Arabic sources, the deposit sites are Syria, Egypt, Yemen, Cyprus, Spain as well as Qūr™un und īabarist®n in Northern Persia and Bāmīyān in present-day Afghanistan.


(1) White.
2 pieces, Ø: 30 mm, 13 g.
1 piece, Ø: 50 mm, 34 g.
(Inventory No. K.3.54a)

(2) Coloured Vitriol
96 x 63 mm, 55 g.
(Inventory No. K.3.54c)

(3) Blue.
Length: 58 mm, 28 g.
(Inventory No. K.3.54b)

(4) Green.
Ground. 13 g.
(Inventory No. K.3.54d)

(5) Golden Eyes.
Ø: 42 mm, 18 g.
(Inventory No. K.3.54e)

(6) Chalcanthite (copper vitriol).
Ø: 46 mm, 51 g.
(Inventory No. K.3.59)

According to Muḥammad b. Ḥamd at-Tamīmi (4th/10th cent.), there are two kinds of antimony. One comes from the region of Isfahan, the other from the Maḏrib. Of the latter he knows again two kinds (Kitāb al-Murṣid, pp. 31–35).

In Arabic literature galena is not clearly differentiated from antimony (*iṭmid*), which is listed above (p. 193). Frequently both terms are used as synonyms. The most detailed and best treatment of the subject can be attributed to the *Kitāb al-Murṣid* by Muḥammad b. Aḥmad at-Tamīmī (pp. 31-36). A valuable commentary on it with additional references to further sources is published by Jutta Schönfeld (ibid., pp. 132-137). Among the characteristics of galena, Lorenz Oken\(^1\) mentions its metallic sheen and its funnel-shaped cavities which at-Tamīmī obviously refers to as "*muʿāyyan* (endowed with eyes); the flatter these ‘eyes’ are, that is to say the smoother the surface, the better the quality of Galena" (ibid., p. 133).

As deposit sites, Arabic sources mention Moorish Spain (al-Andalus), North Africa (Tunesia) and Persia. In this connection, the two mountains Ṣabal Zaḡwān near Tunis (v. Yāqūṭ, *Muḥam al-buldān*, vol. 2, p. 935) and Ṣabal al-Kuhl near the Spanish town of Baza (Qazwīnī, ‘Aḡāʾib al-maḥlūqāt, p. 171) are mentioned by name (v. ibid., p. 134). Furthermore, the eye make-up, or rather the fine powder used in its production which is made from, graphite for example, is called kuhl in its generic sense.

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zaibaq

Mercury

c.a. 15 g. in a welded ampoule
(Liquid at room temperature)
(Inventory No. K 3.43)

Ḡābir b. Ḥaiyān, ar-Rāzī and most Arabic
chemist-alchemists count mercury among the “spirits”
(arwāh). The word zaibaq goes back to a Middle Persian
word which reached the Syriac and the Arabic language.1
As deposit sites, Arabic sources mention Ỉṣṭaḥr near
Persepolis, another site in Azerbaijan, south-east of Lake
Urmia and a region in the mountains of Bāmiyān in the
west of the Hindukush.2

zungūfr

Cinnabarite (Cinnabar)

Dimension: 120 x 180 mm.
Weight: 160 g.
Poisonous!
(Inventory No. K 3.57)

Apart from the cinnabar (zungūfr maḥlāq) extracted
from mines, artificially produced cinnabar (zungūfr
maṣnū’ī) was also known in the 4th/10th century.
The most famous deposit site was Spain (v. Ibn
al-Baīṭār, Ġāmi’, vol. 2, p. 170; J. Ruska, al-Rāzī’s
38-51).
In medicine, cinnabar was one of the ingredients in
ointments for injuries and was used as a powder in
the treatment of ulcers.

1 v. J. Ruska, al-Rāzī’s Buch Geheimnis der Geheimnisse, op.
cit., p. 37.
2 Ibid., pp. 38.
Arabic mineralogists and chemists sometimes treat būraq (borax) and tinkār (tinkal) as two separate substances and at other times as a single one. Abū Bakr ar-Rāzī seems to be of the opinion that tinkal is produced artificially from borax and that borax was known in five colours. The “borax of the bread” (būraq al-ḥubz) and the “borax of the goldsmiths” (būraq aṣ-ṣīnā‘a) was white. The best variety he continues, was the “borax from Zarāwand” in Persia. Al-Qazwīnī (‘Ağā’īb al-maḥlūqāt p. 212) mentions India and Kerman in Persia as the deposit sites.

The German word ‘Talk’, which designates a variety of gypsum, is derived from the Arabic term *talq*. In medical science *talq* was used against ulcers and as a styptic. As deposit sites, Arabic sources mention India, Yemen, Spain and Cyprus.

Rock Salt

(1) Idiomorphic.
Diameter: 75 mm, 185 g.
(Inventory No. K 3.51)

(2) Coarse.
120 x 80 mm, 0.5 kg.
(Inventory No. K 3.51a)


ğibsın, ǧaṣṣ
Gypsum

Gypsum in the unfired form was used as a styptic.

(1) Var. alabaster
90 x 70 mm, 341 g.
(Inventory no. K 3.18 a)

(2) Var. selenite
160 x 120 mm, 356 g.
(Inventory No. K. 3.18 b)
Arab chemist-alchemists enumerate sulphur among the “spirits” (arwāh) as against metals, which they call “bodies” (aḡsād). In contrast to the bodies, the spirits are “colouring” and “volatile”. Arab chemists and mineralogists know sulphur in various colours, among them yellow, red, white and black hues. They considered red sulphur to be the most valuable. Sulphur was an indispensable element in chemical and industrial processes. According to ar-Rāzī, the substances with which sulphur and zarnīḥ (see below) were treated included “chryso-colla, nūrā, limes, the filings of iron, of copper, of tin and of black lead, vitriol, salt, white lead, litharge, glass, potash, talcum …”¹ In a joint study Eilhard Wiedemann and Julius Ruska found twenty names for sulphur when they attempted to compile the code names commonly used by Arabic alchemists. These names were predominantly Arabic, rarely Persian or Syrian and hardly ever Greek.² In the medical field the use of sulphur was very widespread, for instance, for the treatment of scabies, jaundice, asthma and coughs, in the case of maculae or scorpion stings.

¹ J. Ruska, al-Rāzī’s Buch Geheimnis der Geheimnisse, op. cit., p. 111.
Arab mineralogists knew arsenic in several colours. They also knew its use as a poison. They mention Isfahân as the deposit site.

Steatite

Arab philologists refer to this mineral extracted from mines as “the quintessential pot” (al-qidr muṭlaqan), since it is especially suitable for the production of vessels, coal basins, lamps etc. Ḥiḡaz (Western Arabia) and Yemen were the most well-known deposit sites.1 The geographer aṣ-Ṣarīf al-Iḍrīṣī2 calls the locality al-Haurāʾ on the east coast of the Red Sea the most important deposit site from where it was exported to many countries. A mine for this mineral (maʿdīn al-būrūm) located near a village of the same name situated between at-Tāʾif and Mecca was already known in Umayyad times.3 Al-Qazwini4 also mentions Ṭūs in north-eastern Persia as a well-known deposit site. According to Ibn al-Baitār (Ǧāmiʿ, vol. 2, p. 10), the pulverized stone was used for dental care, and also—according to ar-Rāzī—as an ingredient of ‘artiﬁcial loam’, which was indispensable in the chemical laboratories of those times (see above, p. 134).5

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4 Āṭār al-bilād, p. 275.
5 Al-Rāzī’s Buch Geheimnis der Geheimnisse, pp. 61, 96, 195; E. Wiedemann, Zur Mineralogie im Islam, p. 251 (reprint op. cit., p. 223).
In the pseudo-Aristotelian book of stones (p. 120, reprint p. 128) pumice is described as follows: “This is a stone of the ocean, light, of loose substance; it swims on water. It is found in Sicily, it is mostly white and is called sea-butter. When animal hides are rubbed with it, they become rough. It cleanses the teeth and is included in powders for the eyes. With pumice it is also possible to remove colour and ink from paper. — It removes the leucoma from the eye, particularly from the eyes of animals, when (the veterinarian) mixes it with honey. But he does not apply it in pure form, because it would hurt the animal due to its causticity” (after the transl. by J. Ruska, p. 176, reprint p. 184). Arabic sources mention Armenia and Alexandria, besides Sicily, as the deposit sites. Tamimi (Muršid, pp. 91-95) says: "As for its true composition, it is one of the burnt ashes; because the fire that occurs in Sicily on the mountain which lies on the sea and which is called volcano, spits this stone out, big rocks and small ones, and that stone is of the nature of fire. When it falls into the water of the sea, it swims on the surface of the water, because in its body there is porosity and brittleness” (after the transl. by Jutta Schönfeld, op. cit., p. 92).

Pitch coal or jet is a bituminous lignite. The Arabic name *sabağ* comes from the Middle Persian *šabak* (New Persian *šabah*). In the field of medicine, jet was used against cataract of the eye and against nightmares.

As deposit sites, al-Bīrūnī (*Gamāḥir*, p. 199) mentions Tabarān in Persia and the region to the east of the Dead Sea. Other sources mention India as the place of origin.

(1) Diameter: 90 mm, 188 g.
(Inventory No. K 3.17)

(2) 64 x 116 mm.
(Inventory No. K 3.38)

Aluminium Oxide

Apart from the use of aluminium oxide for the manufacture of chemical ovens and the īn al-hukamān (translated by Julius Ruska as “artificial clay”, see above, p. 134) used in laboratories, Arabic physicians know several kinds of clay the knowledge of which they derived from Dioscorides and Galen. Ibn al-Baitār (Ǧami‘, vol. 3, pp. 106-112) mentions among others:

1. īn maḥṭām, “sealed” clay, terra sigillata (σφραγίσα), handed down from Galen.
2. īn Miṣr, Egyptian clay (thus Galen; Dioscorides calls it ἰχνοτόκας γῆ).
3. īn Sāmīš, clay from the island of Samos (σάμια γῆ), described by Dioscorides and by Galen.
4. īn Gazirat al-Maṣṭiği, clay from the island of Chios (χῖος γῆ), described by Dioscorides and by Galen.
5. īn Qimūliyā, clay from the Cyclades island KimoIos (κιμωλία γῆ), described by Dioscorides and by Galen, possibly identical with the aluminium oxide that the inhabitants of Basra called īn ḥurr (Ibn al-Baitār, Ǧami‘, vol. 3, p. 111).
6. īn karmī, “grape-vine clay” (ἄμπελλιτίς γῆ), according to Dioscorides a black aluminium oxide from Seleucia in Syria.
7. īn armanī, Armenian clay (արմենիա γῆ), described by Galen.
8. īn nisāḥūrī, clay from Nīšāpūr in north-east Persia.


Arab scholars knew from their Greek predecessors Dioscorides and Galen two kinds of meerschaum under the names halkyonion and adarkes. Even though they generally differentiate between them, they call both of them *zabad al-bahr* ("meerschaum"). In the writings of Ibn al-Baitār (*Gāmi‘*, vol. 3, p. 43) the latter seems to occur as *sūraq*. It corresponds to sepiolite, which is a component of meerschaum. According to Dioscorides (book 5, chapter 136), adarkes is suitable “for the removal of leprosy, eczema, white spots, liver spots and such … it also helps with sciatica.”

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1 v. J. Berendes, op. cit., p. 541.
**durr, lu’lu’**

Pearl

In the field of medicine, the pearl is added to medicaments in pulverised form. It is used for strengthening the membranes of the eyes and their muscles, for strengthening the heart and against melancholy. As deposit sites, Arabic sources generally speak of the Indian Ocean, specially Bahrain in the Persian Gulf, Sri Lanka, the Red Sea (Dahlak Archipelago) and Zanġibār (Zanzibar).


**mūmiyā’**

Mineral Wax, Ozocerite

75 x 55 mm, 215 g.
(Inventory No. K 3.16)

"A hard, black and shining mineral liquid which oozes out of rock caves" (Dietrich). It occurs in Yemen, in southern Persia and in India. In medical applications, mūmiyā’ is used for fractures, sprains, bruises, haematoma and for the treatment of wounds; it is also used as an antidote.

Margân and bussad

Corals

Margân and bussad are quite frequently used as synonyms. In North Africa “coral” is called qarn (“horn”). It was known in red, white, black and blue colours. Pulverised coral was used as a remedy for eye diseases, against stomach pain and pain in the spleen. As deposit sites, Arabic sources mention, inter alia, the coasts of the Mediterranean, the Red Sea and Sicily.

Amber, in Persian “straw-robber” (kāh-robā) in the sense of attracting straw, is not considered a stone by Arab-Islamic scholars, but mostly as a resin or a plant product. Arab physicians adopted amber from their Greek predecessors\(^1\) as a styptic, a heart-strengthening medicament and as a relief for pain in the eyes. Al-Bīrūnī\(^2\) says that he included amber in his book of gems only because it was known and popular among the eastern Turks. Obviously the knowledge of amber’s property of attracting straw after being rubbed, which al-Bīrūnī mentions as something that is well known, reached the Muslims from the Chinese via the eastern Turks.\(^3\) The coasts of the Caspian Sea, the Mediterranean and the eastern coasts of the northern and southern Atlantic Ocean are mentioned as deposit sites.

\(^1\) v. Ibn al-Baitār, Gāmi’, vol. 4, pp. 88–89.
\(^3\) F. M. Feldhaus says in his Die Technik. Ein Lexikon der Vorzeit, der geschichtlichen Zeit und der Naturvölker (Wiesbaden 1914, repr. Munich 1970), column 78: “Electricity of amber was already known to the Chinese around 315 AD. In Europe only Gilbert recognised this power of nature (Gilbert, De magnet, London 1600).”
Gallnuts or Galls

Excrescence of plant tissue induced by gall wasps; used in the extraction of tannic acid (Tannin)

20 pieces.
Total weight 50 g.
(Inventory No. K 3.60)

Myrobalans

Fruit of *Terminalia chebula*, rich in tanning agent.

7 pieces.
Total weight 27 g.
(Inventory No. K 3.62)

Gum arabica

Dried juice of African Acacias, high-quality water-soluble bending agent.

7 ‘tears’.
Total weight 67 g.
(Inventory No. K 3.61)
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I. Personal Names

A — 'A

'Abdallâh b. Ahmad Ibn al-Bâtiâr al-Mâlaqi Abû Muhammâd 164, 166, 171, 172, 173, 175, 177, 178, 179, 180-209 passim
'Abdarrâman b. 'Umar ad-Îmaîsî al-Îgabîr
Zainâddîn 109
Abû 'Abdallâh al-Îwârîzîmî, see Muhammâd b. Mûsâ Abû 'Ali Ibn Şînâ, see al-Îhusîn b. 'Abdallâh
Abû l-Fadîl ad-Îmaîsî, see Ga'far b. 'Ali
Abû l-Qâsim az-Îzhrâwî, see Halaf b. 'Abbâs
Abû r-Raiûnî al-Îbûnî, see Muhammâd b. Ahmed
Achundow, Abdul-Înâlîg 164, 175, 198, 206
Adelard of Bath 105
Aeitus 31
Ahmâd b. 'Ali b. 'Abdallâqûdîr al-Maqrîzî Taqîyaddîn 169
Ahmâd b. Muhammâd al-Îâqîfî Abû Ga'far 175
Ahmâd b. Muhammâd b. Işıq Ibn al-Faqîh
al-Îmâdânî Abû Bâkr 178
Ahmâd b. Yûsûf at-Tîfîsî Şihâbaddîn Abu l-'Abbâs 157-184 passim, 197, 204
Albert, Daniel M. 29 n.
Albertus Magnus 108, 162
Albucasis, see Halaf b. 'Abbâs
Albucîzîr (= Abû Bâkr ar-Îzîsî), see Muhammâd b. Zakariyâ'
Alcoati, see Sulaimân b. Hâîrîtî al-Qûtî
Alhacen or Alhazen, see al-Îhsân b. al-Îhsân Ibn al-Îhîm
Alî b. al-'Abbâs al-Îmâzûsî, Lat. Hâly Abbas 4, 9, 9 n., 33
Alî al-Îharawî Muwaffaqaddîn Abû Mansûr 164, 175, 198, 206
Alî b. al-Îhusîn b. 'Alî al-Îmâzûdî Abu l-Îhsân 160, 198
Alî b. 'Îsâ al-Îkândî 16
Alî b. Sahîl Râbbañ al-Tabârî Abu l-Îhsân 164, 209
Ammâr b. 'Alî al-Îmâzûlî 6, 16
Anawati, Georges C. 108 n.
Andersen, Sigurð Ry 27 n.
al-Însâry, Abd-Rahman al-Îtîyîbî 97 n.
Arkânûnî, Usânî Îmâzûbûsî 164
Aristotle 102, 159, 160, 176
von Arlt, Ferdinand Rîtter 17

INDEX

Armaldus Villanovanus 108
Avenzoar, see 'Abdalmalik b. Muhammâd b. Marwân
Averroes, see Muhammâd b. Abî Ahmad b. Muhammâd
Avicenna, see Abî 'Alî b. 'Abdallâh Ibn Sûnî

B

Baas, Hermann 166
Bacon, see Roger Bacon
Bahmanîr, Abî Ahmad 164
Barbet, Alix 73 n.
Barbier de Meynard, Charles Adrien Casimîr 160
Bauer, Max 159, 159 n., 164, 170 n., 185
Baytop, Turhan 120, 120 n., 121, 121 n., 122
Beinmarski, Adam 18, 25 n., 26 n.
Beer, Georg Joseph 17
Bennion, Elisabeth 69 n.
Berendes, Julius 164, 165, 167, 170, 174, 181, 182, 183, 184, 197, 207
Bischoff, Dieter 165
Black, Joseph 104
Boyle, Robert 99
Brethren of Purity, see Îlwân as-Şâfâ'
Brockelmann, Carl 5 n., 17 n., 43 n., 113 n., 152 n.
Brunschwig, Hieronymus 112 n., 119, 127 n., 129
Buddî, Hendrik 30 n.
Buntz, Herwig 96 n., 97 n., 105 n.

C

Cailliaud, Frédéric 159
Carbonelli, Giovanni 110, 123 n., 124 n., 128, 128 n., 133, 133 n., 137, 137 n., 138, 138 n., 139, 139 n.
de Carolis, Ernesto 73 n.
Channing, Johannes 4, 76, 76 n.
Cheîkho, Louis 164, 171 n.
Ciarallo, Annamaria 73 n.
Constantîn l'Afrîcain 8, 8 n., 9, 29, 33, 162

D

Dânişpâzûh, M. Taqi 116 n., 165
Darmstädtler, Ernst 105 n.
PERSONAL NAMES

Diergart, Paul 109, 113 n.
Dietrich, Albert 164, 207, 208
ad-Dimasqi, see Muḥammad b. Ibrāhīm b. Abī Ṭālib
Dioscorides 28, 158, 167, 175, 179, 186, 205, 206
Duval, Rubens 109

E
Edwards, Diane D. 29 n.
Ethé, Hermann 7 n.
Ettinghausen, Richard 28 n.

F
Feldhaus, Franz Maria 114, 161 n., 209 n.
Fischer, Wolfdietrich 165
Fonahn, Adolf 7 n.
Forbes, Robert James 112 n., 113 n., 119 n.
Friedler, Karl Gustav 161
Füssel, Stephan 29 n.

G — Ġ — Ġ
Gaʿfar b. ʿAlī ad-Dimasqi Abu l-Faḍl 178
al-Gāfqi, see Ahmad b. Muhammad
Galen 8, 19, 19 n., 20, 31, 33, 158, 175, 205, 206
Ganzenmüller, Wilhelm 110, 142–150 passim
Garbers, Karl 103 n., 109 n., 124 n., 134 n.
al-Ğaubari, see ʿAbdarrāḥmān b. ʿUmar al-Ğazari, see Ismāʿīl Ibn ar-Razzāẓ
Geber, see Gābir b. Haiyān
Gerard of Cremona 3
Gibb, Hamilton Alexander Rosskeen 164
Gilbert, William 209 n.
Gildemeister, Eduard 112 n., 114 n., 119 n., 119 n.
Giorgione 33
Girke, Dorothea 165
Graefe, Alfred 17
Grimm, Sigismund 31
Grmek, Mirko Drazen 4 n., 82 n.
Guerini, Vincenzo 61 n., 64 n., 65 n.
Guglielmo da Saliceto 4
Guido de Cauliaco (Guy de Chauliac) 4
Gurlt, Ernst Julius 4, 36, 38, 38 n., 39, 54 n., 67 n., 71 n., 73 n., 81 n., 83 n., 85 n., 86 n., 87 n., 88 n., 89 n.

H — H — H
Ḥalid b. Yazid 97, 97 n., 98 n.
Ḥalīfa b. Abī l-Maḥāsin al-Ḥalabi 5, 6, 16, 23, 27, 43, 45, 46, 47, 48, 49, 50, 51, 52, 53

Haly Abbas, see ʿAli b. al-ʿAbbās
Hamarneh, Sami Kh. 30 n., 31 n., 70 n., 92 n.
von Hammer, Josef 157 n., 169
Hartlaub, Gustav F. 96 n.
al-Ḥasan, ʿAlmah Yūsuf (Ahmed Y. al-Hassan) 109, 126, 143 n., 152 n., 153
al-Ḥasan b. al-Ḥasan Ibn al-Haṭṭām AbūʿAlī, Lat. Alhacen or Alhazen 9, 9 n., 16, 18, 19, 20, 21, 24
al-Ḥāṣim, Muḥammad Yahyā (Mohammed Yahia Haschmi) 158 n., 160, 160 n., 161 n.
al-Ḥassān, Ahmad Y., see al-Ḥasan, Ahmad
Hauser, Fritz 35 n.
al-Ḥāznī, see ʿAbdarrāḥmān al-Ḥāznī
Hell, Josef 177
Hentzen (agriculteur) 161 n.
Hermann, Leonhard David 161 n.
Hidāyat Ḥusain, M. 103, 109
Hill, Donald Routledge 35, 109, 126, 143, 143 n., 152 n., 153
Hippocrates 31, 33
Hirschberg, Julius 5 n., 16, 17, 17 n., 23, 24 n., 27, 43, 44 n., 45, 46, 47, 48, 49, 50, 51, 52, 53
Hoffmann, Friedrich 112 n., 114 n., 119 n., 119 n.
Holmyard, Eric John 161, 163, 163 n.
Houtsma, Martijn Theodor 164
Huard, Pierre 4 n., 82 n.
Hubaṣī b. al-Ḥasan al-ʾAsam ad-Dimasqi 16
Ḥunain b. Ishaq 3, 8, 9, 16, 19
al-Ḥwārizmi, see Muḥammad b. Mūsā AbūʿAbdallāh

I
Ibn al-Akfānī, see Muḥammad b. Ibrāhīm b. Šāʾid
Ibn al-Baṭārī, see ʿAbdallāh Abī Ḥāmid
Ibn al-Faqīh al-Hamaḍānī, see Abī Ḥāmid b. Muḥammad b. Ishāq
Ibn al-Ğazzār, see Ahmad b. Ibrāhīm b. Abī Ḥālid
Ibn al-Ḥaṭṭām, see al-Ḥasan b. al-Ḥasan
Ibn Manṣūr, see Muḥammad b. Mūkarram b.ʿAlī
Ibn Ḥan-Nādim, see Muḥammad b. Abī Yaʿqūb b. Ishāq
Ibn ar-Razzāẓ al-Ğazari, see Ismāʿīl Ibn ar-Razzāẓ
Ibn Ṣūlād, see Muḥammad b. Abī Ḥāmid b. Muḥammad
Ibn Sināʾ, see al-Ḥusain b. ʿAbdallāh
Ibn Umail, see Muḥammad Ibn Umail
al-Idrisī, see Muḥammad b. Muḥammad b. ʿAbdallāh Ḫwān as-Ṣafāʾ (the Brethren of Purity) 158, 159 n.
Irlīch, Eva 4, 4 n., 5
Ishaq b. ʿIrman 29
Ishaq b. Sulaimān al-Ịṣrāʾīlī Abū Yaʿqūb, Lat. Ysaac 33
Ismāʿīl, ʿAbdallāh 160 n.
Ismā‘il b. Ḥasan b. ʿAbd al-ʿUrūn
Ismā‘il Ibnu Razzāz al-Gazari Abu l-‘Izz Abū Bakr
Badi‘azzamān 35, 110
al-ɪṣṭaḥrī, see Ibrāhīm b. Muḥammad

J
Jacob, Georg 209 n.

K
Kahlbaum, Georg W. A. 109, 113 n.
Kamāladdīn al-Fārisī, see Muḥammad b. al-Ḥasan al-Kindī, see Na‘f, Muḥammad b. Muḥammad b. Ya‘qūb b. Ya‘qūb as-Ṣabbaḥ
Kraus, Paul 99, 100, 100 n., 102, 102 n., 103
Krenkow, Fritz 160 n., 164
Kühn, Carl Gottlob 205 n.
Künzl, Ernst 78

L
Lavoisier, Antoine-Laurent 99, 104
Leclerc, Lucien 4, 36, 36 n., 38, 38 n., 39, 40–89 passim, 164, 166, 167, 171, 172, 173, 175, 179–209 passim
Lewis, Geoffrey L. 3 n., 36 n.
Lindberg, David C. 21 n.
Lippert, Julius 5 n., 43 n.
von Lippmann, Edmund Oskar 112 n., 152 n., 160 n.
Lūqā b. Isrā‘īlyūn 158
Lyell, Charles 159

M
Mackenzie, A. 17
Madkūr, Ibrāhīm 160 n.
Maḥbūbī Aradakānī, Ḥusain 164
Mandeville, Desmond Cameron 163, 163 n.
Maṃṣūr b. Muḥammad b. ʿAbd b. Yūsuf 7, 8
al-Maqrīzī, see Muḥammad b. ʿAlī b. ʿAbd al-Qādir Margolin, Jean-Claude 107 n.
Marianus of Alexandria 97
Marwān b. ʿAbdal Malik, Umayyad caliph 160 n.
al-Mas‘ūdī, see ʿAlī b. al-Husayn b. ʿAlī Mattioli, Pietro Andrea 114
Matton, Sylvain 107 n.
Mehmmed ʿAlī 159
Mehmed II Fāṭih, Ottoman Sultan 4
Mehren, August Ferdinand 113 n., 165, 200 de Menasce, Jean Pierre 158 n.
Meyerhof, Max 3, 3 n., 16, 19 n., 20
Mieleitner, Karl 161, 162, 162 n.
Mittwoch, Eugen 5, 43 n.
Muḥammad b. ʿAbdal Malik al-Ḥwārizmī as-Ṣāliḥī al-Kāṭi Abu l-Ḥakim 104, 109, 143
Muḥammad b. ʿAbd al-Bīrūnī Abu r-Raḥān 160, 160 n., 164, 166, 167, 169, 171, 172, 173, 175, 176, 177, 180, 181, 182, 183, 184, 186, 190, 192, 195, 201, 204, 207, 208, 209
Muḥammad b. ʿAbd b. Muḥammad Ibn Ruṣd al-Qurtubi Abu l-Walid, Lat. Avroesios 34
Muḥammad b. ʿAbd b. ʿAṣār b. ʿAbd Allāh 165, 166, 167, 173, 177, 180, 181, 182, 183, 184, 185, 186, 193, 194, 196, 203, 204, 206, 207, 208
Muḥammad b. al-Ḥasan al-Fārisī Kamāladdīn Abu l-Ḥasan 9, 18, 19, 19 n., 22, 24
Muḥammad b. Ibrāhīm b. ʿAbd al-Ansārī as-Sūfī Šaǐr ar-Rabwa ad-Damaqīsī Samsaddīn Abū ʿAbd Allāh 109, 113, 114, 117, 165, 179, 183, 200
Muḥammad b. Ibrāhīm b. Ṣāʾīd b. al-Akṣānī al-Anṣārī as-Sahāwī Samsaddīn Abū Abd Allāh 164, 169, 171, 173, 183
Muḥammad b. Ṣaṃṣūr as-Daštāki 157
Muḥammad b. Muḥammad Aftāṭīn al-Harmasi al-ʿAbbāsī al-Bisṭāmī 152
Muḥammad b. Mūsā al-Ḥwārizmī Abū ʿAbd Allāh 109, 123, 134, 141, 141 n., 164, 189, 198
Muḥammad Ibn Umail Abū ʿAbd Allāh (lat. Senior Zadith filius Hamuelis) 104, 108
Müller-Bütow, Horst 69 n.
Munk, Ole 27 n.
Muntasīr, ʿAbdalhalīm 160 n.
Muwaffaqaddīn al-Harawi, see ʿAlī al-Harawi

N
Naṣr b. Yaʿqūb al-Kindī 176
Nazif, Mustafa 18
Neckam, Alexander 161
Niel, Charles 61 n.
Niẓāmi-i ʿArūḍī 32

O
Oken, Lorenz 164, 170 n., 194
O’Neill, Ynez Violé 9 n.
PERSONAL NAMES

P
Pagel, Julius Leopold 23
Pallas, Peter Simon 121
Pansier, Pierre 23
Paulus de Tarento 107, 108
Peckham (Pecham), John, archbishop of Canterbury 18, 26
Pereira, Michela 108 n.
Pertsch, Wilhelm 152 n.
Pliny 177
Ploss, Emil Ernst 96 n., 97 n., 105 n.
Polyak, Stephen L. 17, 18, 18 n., 20, 21 n., 22 n., 24, 26 n., 27 n.
Priestley, Joseph 99
Prüfer, Curt 3, 3 n., 19 n.
Purkynje, Johannes Evangelista 19

Q
Qâbûs b. Wûšmgr 32
al-Qazwînî, see Zakariyâ’ b. Muḥammad b. Maḥmûd Quatremerê, Étienne 169, 169 n.

R
Raimundus Lullius 108
Raineri, Antonio 157 n., 165
ar-Râzî, see Muḥammad b. Zakariyâ’
Razes, see Muḥammad b. Zakariyâ’
Roger Bacon 18, 25, 108, 162
Roos̄en-Runge, Heinz 96 n., 97 n., 105 n.
Ryff, Walter 62

S — Ş — Ş — Ş
Şabra, ’Abdalhamîd (Abdelhamid I. Sabra) 21 n., 22 n.
Sachau, Eduard 160 n.
Şadaqâ b. Ibrâhîm aṣ-Ṣâdiqî 17
Saemisch, Theodor 17
Ṣalāḥaddin (b. Yusuf al-Kâhhal) 23
Ṣamsaddin ad-Dimaqṣî, see Muḥammad b. Ibrâhîm b. Abî Tâlib
Ṣarafaddîn, see Şerefeddin
aṣ-Ṣârif al-Idrîsî, see Muḥammad b. Muḥammad b. ’Abdallâh
Sarton, George 4 n., 105 n.
Savage-Smith, Emilie 11 n.
Schahien, Abdul Salam 69 n., 73 n., 74 n., 75 n., 78 n., 79 n., 80 n.
Schedel, Hartmann 29, 29 n., 34, 34 n.
Schelenz, Hermann 112 n.
Schepelern, Henrik D. 27 n.
Schipperges, Heinrich 9 n., 31 n., 33 n., 96 n., 97 n., 105 n.
Schmucker, Werner 209
Schneider-Dresden, O. 209
Schönfeld, Jutta 165, 180, 194, 203
Schopen, Armin 157 n.
Schramm, Matthias 18, 19, 19 n.
Seibold, Ilse 159 n.
Seidel, Ernst 7 n., 8
Senior Zadith filius Hamuels, see Muḥammad Ibn Umail
Şerefeddîn Sabuncuoğlu 4, 4 n., 56, 74 n., 82, 91
Sezgin, Fuat 3 n. ff. passim
Shemtov b. Isaac of Tortosa 77
aṣ-Ṣiddîqi, Muḥammad Zubair 164
Sievernich, Michael 30 n.
Sigel, Alfred 152 n.
Soemmerring, Detmar Wilhelm 27
Solingen, Cornelius 69
Sonndecker, Glenn 30 n., 31 n.
von Sontheimer, Joseph 164, 166, 167, 171, 172, 173, 175, 179–209 passim
Speter, Max 112 n.
Spies, Otto 69 n.
Spînk, Martin S. 3 n., 36 n., 69 n.
Stapleton, Henry E. 97 n., 103, 104, 104 n., 109, 143 n., 165
Steinschneider, Moritz 112 n., 162 n.
Steno, Nicolas 161
Stephanos 97
Stephanus de Caesaraugusta 162
Stillman, John Maxson 105
Storey, Charles Ambrose 7 n.
Sudhoff, Karl 4, 7 7 n., 8, 9, 10, 17, 18, 23, 24, 25 n., 58, 58 n., 60 n., 61, 61 n., 63 n., 64 n., 65 n., 67 n., 70, 70 n., 71 n., 73, 75, 76, 76 n., 78 n., 80 n.–88 n. passim
Sulaimân b. Ḥârît al-Qûṭî, Lat. Alcoati (?) 23, 24

T — T
at-Ţahrâni, Āğa Buzurg 7 n., 157 n.
Talḥa b. ’Ubaidallâh 97 n., 98 n.
at-Tamîmi, see Muḥammad b. Aḥmâd b. Saʿîd Terzioglu, Arslan 32 n., 33 n.
Thomas, archbishop of Canterbury 34
at-Tîfâsî, see Aḥmâd b. Yûsuf von Töply, Robert 9, 9 n., 23 n.

U
Uzel, İltër 4 n.

V
Vesalius, Andreas 20
da Vinci, Leonardo 18, 27, 161
INDEX

Vitello, see Witelo
van Vloten, Gerlof 123 n., 164
Volger, Lothar 164

W
Walchner, August Friedrich 164
Walther, Johannes 159
Witello (Vitellius, Vitellio, Vitello) 18, 20, 26
Wüstenfeld, Ferdinand 165

Y
Ya‘qūb b. Ishāq b. as-Ṣabbāḥ al-Kindī Abū Yūsuf 103, 109, 124, 134
Ysaac, see Ishāq b. Sulaimān

Z
az-Zahrāwī, see Ḥalaf b. ‘Abbās
Zaunik, Rudolph 161 n.
Zayyīd, Sā‘īd 160 n.

II. Technical Terms and Place Names

A — ‘A
adarkes (meerschaum, sepiolite) 206
Afghanistan, mineral sites 182, 192
agate (gīns min al-‘aqiq, ‘aqiq ḥalang) 176
aǧsād (“bodies”, pl., chemical term) 103
aǧsām nuḥāsiyya ‘alā hā’ai‘ at as-siḥām (fulgurite, “lightning tube”) 161
‘ain al-hirr (cat’s eye) 174
alā dat aš-šu’batain (“instrument with the fork”) for levering out broken teeth 64
alā li-kaṭy ḥuqq al-wark (cauter for use in lumbar sciatica) 67
‘alā šāk al-šalam (“tongs-shaped instrument” in gynaecology) 73
alā tuṣbihu ‘atata šagīra (“instrument like a small chisel” for levering out broken teeth 63
alā tuṣbihu l-kašāliḥ (“instrument shaped like a hook”) for the extraction of foreign bodies from the pharyngeal cavity 58–59
alā tuṣbihu l-miqāṣ li-qat‘ waram al-lauzatain (scissor-like instrument for removing tonsils etc.) 57
alā tuṣbihu š-simmāra al-kaḥira (“instrument like a large fish hook”) for levering out broken teeth 64
alabaster 199
alūt al-ḥalāf yuḥṭağū ilaiḥā fi ihğārå al-ğanīn (implements needed for the extraction of the fetus) 73
alchemical laboratory equipment and instruments 107, 109–153
alchemy 95–153
alembr (Lat. alembic, Arab. al-anbīq) with beak (according to Abū Bakr ar-Rāzī) 126
alembr with a beak in other forms (according to Abū Bakr ar-Rāzī) 128
alembr with beak and receptacle (according to Abū Bakr ar-Rāzī) 116
Alembic caecum (inbīq a’mā, chemical instrument) 125, 126
Alembic duplicati, double alembic (chemical instrument according to Abū Bakr ar-Rāzī) 127
alembrics, Anatolian (collection Baytop, Istanbul) 120–122
alembrics, “blind” alembrics (inbīq a’mā) 125
alembrics on a distillation apparatus (az-Zahrāwī) 112
Alexandria 8, 9, 18, 97, 203
Algeria 4
albās, see diamond
aludel, alutel (al-utāl, apparatus for sublimation) 104, 123, 139, 143
alum (ṣabb) 103, 191
aluminium oxide, see tin
amāṭījīs (Hämātit) 180
amber (kahrubā’, kahramān) 209
amethyst (ǧamast, ġamaz) 171
Amplon. Library at Erfurt 23
ampulla lutata (round retort sheathed in clay, chemical instrument according to Abū Bakr ar-Rāzī) 134
ampullae (ampulla, ampullae, Arab. qinnīna or qārūra, chemical instruments) 131, 133, 134
ampullae, see also phials
Amu-Darya (Gaihūn) 161
amulets 158, 184
Anatolia, mineral sites 180, 185
anatomical illustrations of the eye 3, 8, 16-27
anatomical pictures 7−15
anatomy of the brain 16
anatomy of the eye 9, 16
antibiotic, pl. anabiq (distillation caps, chemical equipment) 109, 125
Andalusia (al-Andalus) 111, 185, 194
antidots 184, 186, 207
antimony (i˚mid) 193, 194
Antioch 190
apparatus for the distillation of rose-water (described by az-Zahr®w¬) 111−112
‘aq¬q (carnelian) 176, 177, 178
‘aq¬q halanq (agate?) 176
aqua vitae, see ethyl alcohol
Arabia, metallurgy and manufacture of glass 97
Arabia, mineral sites 171, 184, 202
Arabia, popularity of the carnelian 177
Armenia, mineral sites 172, 185, 203
Armenian clay (tìn arman¬) 205, 207
arte®n (iron ore, ochre) 188
artery system 7, 10, 12, 14
arti®fi®clay (fl¬n al−Ωikma, fl¬n al−Ωukam®') 134, 202, 205
arw®Ω (“spirits”, chemical term) 101, 103, 195, 200
ása (myrtle leaf, ophtalmological instrument) 47
as®dast (type of zircon) 170
asthma 200
Astrius (kaukab¬) 175
Aswan 160
Athens 135
Atlantic Ocean, amber deposit sites 209
Austrian National Library, Vienna 4
automaton, human automaton (homunculus) 101
awn−tongs (kalbat®n nu◊'l¬ya, ophtalmological instrument) 53
axe (tabar, ophtalmological instrument) 50
Azerbaijan 195

banfa·, Pers. banañš (zircon) 170
bard (cataract needle) 44
Basel 7
Basra (al-Ba∫r) 177, 185
Baza (town in al-Andalus) 194
Beirut (Bairüt) 185
Benaki Museum, Athens 135
Berchile (distillation apparatus for rose-water, described by az-Zahr®w¬) 112
beryl, chrysolith (zabar™ad) 173, 174
bezoar stone (b®dzahr) 186
Bibliothèque nationale, Paris 5
bjå®då (garnet) 168, 170
Bigadi (mountain in Afghanistan) 182
bile, black bile 182
black lead 166
bladder instillation, bladder irrigation 70, 71
bloodletting 35, 50
bloodletting, instruments for measuring the quantity of blood 35
Bologna 110
bones, system of the bones 7, 10, 11, 13
borax (båraq) 103, 196
brain (medical, anatomical) 16, 25
brain, amethyst for strengthening the brain 171
brain, diagram of the membranes of the brain (Ibn Sin®?) 25
bruises 207
Buga (region in the Far East) 173
båraq (Borax) 196
burl®n (mentioned by Ġåbir b. Ḥåiyån) 100
bussad (coral) 208
buat (pl., retorts) 111
Byzantium 7, 185

B
Badahšan (in Afghanistan) 169
bådzahr (bezoar stone) 186
Baghdad (Bagdad) 29
al-båhr al-å∫êr (Indian Ocean) 172
Bahrain (Bahrain) 207
båhramâni 169
balha∫, Pers. balahi∫ (spinel) 169, 170
balloon syringe (mi∫ıgan) for bladder irrigation 71
ball®r (rock crystal) 172
Bamyan (Båmiyån in present−day Afghanistan) 192, 195
banafa∫iya (violet coloured spinel) 169

C
Caecum alembic (chemical vessel) 125, 126
calamine 185
Canna (chemical vessel) 131
Canna retroversa (chemical vessel according to Ab® Bakr ar−Råzi) 130
Cannina (carafe, chemical vessel according to Ab® Bakr ar−Råzi) 135
Cannutum (for the “dissolution of spirits”, chemical vessel according to Ab® Bakr ar−Råzi) 137
Canterbury 26
capillary filter beaker (råvåq fi ḡåm, chemical equipment according to Ab® Bakr ar−Råzi) 139
carmelian (‘aq¬q) 176, 177, 178
Caspian Sea, amber sites 209
casting moulds (rå∫ or misbåka, chemical equipment) 109
INDEX

casting spoons (miğrafa, chemical equipment) 109
cat’s eye (‘ain al-hirr) 174
cataract of the eye 204
cataract needles (miqdaΩ, bar¬d, ophtalmological instruments) 44
catheter (qiτtāτr) for the urinary tract 69
Cauchil (vessel for the “sublimation of spirits”) 124
cauldron with lion paws (chemical equipment from Liber florum Geberti) 148
causal explanation of the causes (according to ©®bir b. Haiyân) 102
cauter 36-43, 46, 50, 51, 54, 56, 60, 67, 68, 81
cauter for use in lumbar sciatica (®la li-kaiy Ωuqq al-wark) 67
cauter called “point”, see mikw®t allat¬ tusamm® an-nuqfla
cauter with ring-shaped branding area for the treatment of the back 67
cauter, see also mikw®t
Caxa (vessel for “dissolution of spirits”) 138
Central Asia 161
cephalotribe (mi·d®¿, gynaecological instrument) 78, 79
chemical laboratory equipment 107, 109-153
chemistry 95-153
China, loadstone 181
China, mineral sites 175
Chios, clay 205
chrysocolla 200
chrysolith, see beryl
cinnabar, cinnabarite (zun™ufr) 195
circumcision of boys 72
Clausthal 157 n.
clay, artificial clay (tin al-hikma, tin al-hukamâ”) 134, 202, 205
cleaner for the tear gland fistula (mihsaf al-γarab) 43
collyria 191
colours and dyeing 104, 191
compass in nautical science (ship’s compass) 181
Constantinople, see Istanbul
copper pyrite (marqa·¬˚a nuΩ®s¬ya) 179
coral (marγjan and hussaq) 158, 208
cornea 19, 48
cornea, transferring outside the conjunctiva 23
Cornus (horn-like vessel for the dissolution of chemical substances according to Abî Bakr ar-Râzi) 140
corundum, emery (sunbâdadγ) 167
cough, treatment 60, 200
counterfeiting of precious drugs 103
Crawford Library of the Royal Observatory, Edinburgh 21
crescent-shaped cauter, see mikw®t hil®l¬ya
Cucurbita duplicata (“doubled gourd”, chemical vessel according to Abî Bakr ar-Râzi) 129
cucurbita, see also retorts
Cyprus, mineral sites 190, 192, 197
cysts 83

d — d
då’ibât (substances that can be melted) 161
Dahlak Archipelago (in the Red Sea) 207
dahna(q (malachite) 184
Dead Sea 204
dental care, dentifrices (made of minerals) 176, 177, 191, 202
dental caries 176
dental instruments (az-Zahrâwi) 61-66
dental treatment 61-66
desalination of sea water 160
diamond (almâs) 166, 167
dissolution, spherical device for dissolution (Dissolutio cum apiis, chemical vessel according to Abî Bakr ar-Râzi) 140
distillation apparatus 111-119
distillation apparatus from al-Mizza for extracting rose-water 113-115, 119
distillation apparatus according to Šamsaddin ad-Dimaṣqi 117
distillation caps (inbiq, anbiq, pl. anâbiq, chemical equipment) 103, 109, 120-122, 126
distillation of ethanol 112, 118-119
distillation of organic substances 100
distillation of rose-water 111-115, 117
“doubled gourd” (chemical vessel), see Cucurbita duplicata
durr (pearl) 158, 207

e
eagle stone, rattle stone (haγar al-‘uqâb) 190
ears, treatment of the ears 54-55
earwax 192
Eastern Anatolia 185
eczema 206
Edinburgh 21
Egypt (in the history of alchemy) 104
Egypte, mineral sites 159, 160, 172, 173, 180, 184, 191, 192
Egyptian clay (tin Misr), aluminium oxide 205
elementary qualities 100
elements, four elements in the material world 100, 101
elixir (in alchemy) 100, 147
embryo 7, 12
emerald (zumurrud) 159, 160, 173, 174, 175
emerald mines in Upper Egypt 159-160
emery paper 167
Ephesus 78
epilepsy 68
... esgen (and Cannina, two vessels with wide necks for sublimation) 135
ethyl alcohol (aqua vitae), distillation of ethyl alcohol 112, 118-119
Europe 9, 17
experiment (described by Ġâbir b. Haiyân) 101
extraction of the fetus 73-80
eye, anatomical illustration by Ḥunain b. Ishâq 19-20
eye, anatomical illustration by Ibn al-Haṭam 19-20
eye, anatomical illustration by Kamâladdin al-Fârisî 22
eye, anatomical illustrations 6, 8, 16-27
eye, diagram of the eye by Leonardo da Vinci 18, 27
eye, diagrams of the eye by Ibn al-Haṭam and Kamâladdin 18, 21, 22
eye, longitudinal section of the human eye after John Pecham 26
eye, medical treatment with instruments 42-53
eye, mineral remedies 184, 185, 191, 207, 208, 209
eye, physiology of the organ of vision 17
eyeball, diagram of the eyeball (Ibn Sînî) 24, 25
eyelids, treatment 46, 47, 51

F
fakk ḥaraz az-zahr (luxation of the dorsal vertebrae) 82
fâṣd al-ḡâḥba (opening the vein in the forehead) 50
feet and thighs, cauterization 38
fetus, see extraction
fīrûzâq (turquoise) 183
fissures on the lips 41
fixed stars 158
forces of nature, working together (according to Ġâbir b. Haiyân) 101
fornas rotunda (P. A. Mattioli) 114
fossilisation of plants and animals (Ibn Sinâ) 161
fossils 209-210
fractures 207
fulgurite, "lightning tube" (ağsâm nubahîya 'alâ hai'at as-sihâm) 161
furnellus lune et veneri ("silver and copper kiln" from Liber Florum Geberti) 149
furnus (mustauqad, alchemical kiln) 143
fusio spiritum (hâl al-arwâḥ) 137
al-Fustâf (in Cairo) 92

G - Ġ
Čâbal al-Kuḥî (mountain near the Spanish town of Baza) 194
Čâbal Zaḡwân (mountain near Tunis) 194
ġâft, see saft
Čâhûn, see Amu-Darya
galena (kuhl) 194
gallnuts 210
ġamast, ġamaz (amethyst) 171
ġâmi', Lat. summa 106
garnet (bîgâdi) 168, 170
ġâss, see gypsum
gatherer (mîqaṭ, ophtalmological instrument) 53
ġâz' (onyx) 178
āl-ġâz' al-'arwâḥ (variety of onyx) 178
āl-ġâz' al-hâqârâh (variety of onyx) 178
āl-ġâz' al-fârisî (onyx from Fars) 178
āl-ġâz' al-ḥabâšî (onyx from Ethiopia) 178
āl-ġâz' al-mu'târaq (onyx having veins) 178
āl-ġâz' al-mu'tâsâssî (onyx looking like honey) 178
gems 158
gems, artificial 152
general surgery, see surgery
genital organs, female 7
gold, art of making gold 97
gold-coloured marcasite, see marcasite
"grape-vine clay" (tin karmit), aluminium oxide 205
graphite 194
gum arabic 210
Gundishapur (Qundişâpûr) 183
Čûrğân 192
Gûṣiya (near al-Karak, in present-day Jordan) 179
gynaecological instruments 73-81
gypsum (ġîbsîn, ġâss) 158, 199

H — H — H

hacksaw, "compact hacksaw" (minsâr muḥkam) in trauma surgery 88
hacksaw, "large hacksaw" (minsâr kabîr) in trauma surgery 89
Hadat (in Lebanon) 179
haematite (ṣâdanaq, amâţîsî) 180
haematoma 207
hearth, see kiln
hağar al-ʿain ("eye stone") 183
hağar al-bâḥît (loadstone) 181
hağar al-bîrâm (steatite) 202
hağar ad-dam ("blood stone") 180
hağar al-ḡâlaba ("victory stone") 183
hağar al-ḥaiya ("snake stone"), serpentine 186
hağar iktamak 190
I — 'I

idealised portraits of famous physicians 28-34; see also portrait
'illa ("cause") according to Ġābir b. Ḥaiyān 102
illustration, see portrait
'ilm (according to Ġābir b. Ḥaiyān) 100
'ilm al-ḥawāṣṣ ("science of the specific characteristics"
mentioned by Ġābir b. Ḥaiyān) 102
'ilm al-mīzān (theory of equilibrium according to Ġābir
b. Ḥaiyān) 101
'ilm as-šan'a (alchemy) 97
imitation of metals 97
imitation of nature (recommended by Ġābir b. Ḥaiyān)
101
inbiq a'mār ("blind") alembic, chemical vessel according
to Abū Bakr ar-Rāzī) 126
inbiq dāt al-ḥātam (alembic with beak) 126
inbiq, see also anbiq
cision of bones 86
India, mineral sites 166, 173, 176, 185, 186, 196, 197,
204, 207
Indian Ocean (al-Bahr al-ahḍar) 172, 181, 185, 207
injection syringe 70
ink 104, 191
Institut für Mineralogische Rohstoffe, Technical Univer-
sity, Clausthal 157 n.
instrument “of the ancients” (laulab dāhar ḍakarathu
l-awā'il) in gynaecology 73, 76-77
“instrument with the fork” (āla dāt aṣ-ṣa'batain) for
levering out broken teeth 64
“instrument like a hook” (āla tushibihu l-kalālib) for the
_extraction of foreign bodies from the pharyngeal
cavity 58-59
“instrument like a large fish hook” (āla tushibihu s-sinnāra
al-kabira) for levering out broken teeth 64
instrument “like a small chisel” (āla tushibihu 'atala
ṣāgīra) 63
instruments for levering out broken teeth 63-64
instruments for measuring the quantity of blood after
bloodletting 35
Iraq (al-'Irāq), Mesopotamia 99, 111, 183, 185
iron ore, ochre (artakān) 188
Iṣfahān (Iṣfahān) 167, 193, 201
Islamic Museum, Cairo 92
Iṣṭaḥr (near Persepolis) 195
Istanbul or Constantinople 32
iṭnīd (antimony) 193, 194

J
jasper (yāṣḥ, yaṣm, yast) 175
jaundice 200
jēt (ṣabāq, Pers. šabah, šabak) 204
Jordan (river) 177
jugs (k āz, pl. kīzān, chemical equipment) 109

K
kabārīt (pl. of kibrīt) 161; see also sulphur
kahrūbā'ī, kahrāmān (amber) 209
kalālib (tongs for the extraction of teeth and tooth frag-
ments) 65
kalbatān nusāliya (awn-tongs, ophtalmological instru-
ment) 53
Kambāyāt (city in India) 173
al-Karak (in present-day Jordan) 179, 180
karāka (apparatus for distillation for extracting
rose-water) 113
kaukāhi (Asttrius) 175
kāz (scissors in ophthalmology) 48
Kerman (Kirmān in Persia) 184, 185, 196
Khalili Collection, London 126
Khorasan (ūrūsān in Persia) 184, 186
kibrīt, see sulphur
kidneys, diseases of the kidneys 186
kiln with alembic (two kilns from Liber florum Geberti)
146, 151
kiln with a cap and two beaks (from Liber florum
Geberti) 144
kiln for chemical operations (from Liber florum Geberti)
144
kiln "that fans itself" (tannur nāfīḥ nafsahā according to Abū Bakr ar-Rāzi) 141
kiln in the form of an elephant’s trunk (from Liber florum Geberti) 149
kiln with a glass lid attachment (aus Liber florum Geberti) 147
kiln for heating a retort suspended above it (from Liber florum Geberti) 146
kiln for the production of artificial gems (according to al-Bīṣṭāmī) 152
kiln with retort in the form of a cap (from Liber florum Geberti) 148
kiln, “silver and copper kiln” (furnellus lune et veneris from Liber florum Geberti) 149
kiln of Zosimos 153
kilns, chemical and alchemical 103, 110, 141-153
al-khmiyā’ 97
Kimolos (Cyclades island), aluminium oxide 205
Kirmān, see Kerman
kuΩl (galena) 194
Kunsthistorisches Museum, Vienna 33
k'z (chemical equipment) 109
k'z muflaiyan (“a pitcher coated with clay”, chemical equipment) 134
la'l (“ruby”) 169
al-la'l al-badaḥši (spinel) 169
lancet (mibda', ophthalmological instrument) 49
lapis lazuli, lazurite (lásaward) 182
laulab ādar ḍakarathu l-awā‘il (gynaecological instrument “of the ancients”) 73, 76-77
laulab yafaθu bihi ǧam ar-raḥim (“device in the form of a screw for opening the neck of the cervix”, gynaecological instrument) 73
laxative 182
lūζward (lapis lazuli, lazurite) 182
Lebanon, mineral sites 179
leprosy 184, 186, 158, 162, 200
mibda' (lancet “for eradication of a blister”) 49
mibda’ (scalpell for the extraction of arteries at the temples) 83
mibda’ (scalpel for removing tonsils) 57
mibda' li-qat’a ẓ-ẓafra wa-nutūw laḥm al-āmāq (scalpel “for cutting off the pterygium and for removing adhesions in the inner corner of the eye”) 47
mibda’ raqiq (fine scalpel for the treatment of the ear) 55
mica, muscovite 197
miθrad (raspatory, bent at the end) 86
miθrad (raspatory with indentation) 87
miθrad ("peeler", "scraper", chirurgical instrument for the incision of bones) 86
miθrad (scraper “for scratching scabies and for removing conjunctival concretions”) 49
miθrad ‘arid (broad raspatory, chirurgical instrument) 87
miθrafā (casting spoons, chemical equipment) 109
mibda' (covered scalpel, Arab. “secret chamber”) 85
mihqan (ballon syringe for bladder irrigation) 71
mihqan (stamp syringe for instillation of the bladder) 70
milṣaf al-ĝarab (cleaner for the tear gland fistula) 43
mikwāt allattī tusammā an-nuṣṭa (cauter “called point”) 54, 60
mikwāt dāt as-saffūdāin (cauter “with two spits”) 81
mikwāt dāt talāt safāfīd (cauter “with three spits”) 81
mikwāt al-ṣarāb (cauter for the tear gland fistula) 43
mikwāt hilāliyya (crescent-shaped cauter) 46
mikwāt fi kaiy ǧāfn al-ʿain ... (cauter for cauterising the roots of the hair on the eyelid) 51
mikwāt fi kaiy al-kabīd al-bārida (instrument “for cauterisation in the case of cold liver”) 37
mikwāt fi kaiy marad ar-riʿa wa-s-suʿāl (cauter for use in the case of diseases of the lungs and coughing) 60
mikwāt li-kaiy mawādīʿ aš-ṣaʿr az-ẓāʿ id (cauter for cauterising the locations of superfluous eyelashes) 51
[mikwāt] fi kaiy an-nāṣūr alladī fi maʿaq al-ʿain (cauter for the treatment of fistulas in the tear gland) 42
mikwāt fi kaiy nātān al-anf (cauter to be used in the case of nasal putrefaction) 56
mikwāt fi kaiy al-qadamain wa-s-sāqain (cauter for the treatment of the feet and the thighs) 38
mikwāt fi kaiy ar-raʿaʾ (cauter for the treatment of the head) 39
mikwāt fi kaiy aṣ-ṣaʿr (cauter for the treatment of episepsis) 68
mikwāt al-laqwa (cauter to be used in the case of paralysis of the face) 40
mikwāt mīṣmārīyya (cauter in the form of a fingernail) 36
mikwāt ṣaḥira sikkīniyya li-kaiy ʿiṣqāq aš-ṣaʿra (small cauter in the shape of a scalpel for the treatment of fissures on the lips) 41
mikwāt al-yāfīḥ (cauter for the vertex of the head) 50
mikwāt zaitūniyya (“olive-cauter”) 39, 68
milk (rock salt) 198
milch brandy 121
miliqaʾ (gatherer, ophtalmological instrument) 53
mineral medicaments 162
mineral wax, ozocerite (“mùmūyiyya”) 207
mineralogy, Arabic books on mineralogy (books on stones) 157, 158, 159, 162, 163, 174, 203
minerals, classification 161
minerals, origin and chemical properties (in the Arabic literature) 158
minerals, places of occurrence 159
minerals in the work of Abū Bakr ar-Rāzī 163
minerals in the work of Albertus Magnus 162
minerals in the work of ʿAlī b. Ḥāfiẓ 163
minerals in the work of Ibn Sīnā (Avicenna) 161, 162
minerals in the work of the Iṣwān 158
minerals in the work of Ibn Sīnā (Avicenna) 161, 162
minerals in the work of ‘Abd Allāh b. ‘Rāzī 163
minerals in the work of Albertus Magnus 162
minerals in the work of ʿAlī b. Ḥāfiẓ 163
minerals in the work of Ibn Sīnā (Avicenna) 161, 162
minerals in the work of the Iṣwān 158
miqāš (cats in the circumcision of boys) 72
miqāš (scissors in ophthalmology) 46, 48
miqāš, see also ʿala tuṣbihu l-miqāš
miqdah (cataract needle) 44
miqraq (scissors in ophthalmology) 48
miqātaʾ (plate shears, chemical equipment) 109
misbaka (casting moulds, chemical equipment) 109
misḏāḥ (cephalotribe, gynaecological instrument) 78, 79
misraʾ (scarificator for removing cysts and tumours) 83
mizān, see ilm al-mizān
Mozul 16
mountain ranges, formation of mountain ranges (according to Ibn Sīnā) 161
mümişiyāt, see mineral wax
muscles, system of the muscles 7, 10, 11, 13
muscovite, mica (mùmūyiyya) 168, 197
Museum für Angewandte Kunst, Frankfurt am Main 132
Museum für Islamische Kunst, Berlin 133
Museum for Turkish and Islamic Art, Istanbul 32
mustauqad (furnus, alchemical kiln) 143
myrobalans 210
myrtle leaf (āṣa, ophtalmological instrument) 47

N

nāfiḥ nafsah (kiln “that fans itself”) 141
nafis (“that fans itself”, Latin version) 141
nasal putrefaction 56
natural sciences on the basis of strict exactitude (Gaḏīr b. Ḥāfiẓ) 102
nature, see forces of nature
natures, four natures (according to Gaḏīr b. Ḥāfiẓ) 101
Near East 158
nerves, system of the nerves 7, 10, 12, 14
nervous disorders 67-68
nightmares 204
Nīṣapur (Nīsābūr, Nīsāpūr) 183, 205
Northern Africa (Māḏīrīb), mineral sites 180, 185, 190, 192, 194
nūra 200

O

ointments 103, 195
“olive-cauter” (mikwāt zaitūniyya) 39, 68
onyx (“gaz”) 178
ophthalmological instruments 5-6, 42-53
optic nerve crossing 6, 16, 27
ores 103, 160, 161
origin of minerals, see minerals
origin of rocks, see rocks
orpinment (zarnīḥ atfār) 201
orthopaedic bench for the treatment of luxations of the dorsal vertebrae 82
orthopaedics 81-82
ossification of water 161
Oxford 7

P
padsaw (minšär, chirurgical instrument) 88
Palestine, mineral sites 177, 180
paralysis of the face 40
pathology of the brain 16
pearl (duurr, chirurgical instrument) 88
Palestine, mineral sites 177, 180
papillae, contraction of the pupil upon the incidence of light 17
pupil, theory on the image of the pupil by Kamâladdin al-Fârisî 19
pynometer 160
pyrolusit (magnisiyâ) 189

Q
qâbila, pl. qawâbîl, see receptacle
qadâhân mûtâyânân ("beakers coated with clay") 134
Qairawân 29
qâisûr, qâisûr (pumice) 203
Qali 200
qâlqadis (vitriol) 192
qâldînd (vitriol) 192
qâlqajâr (vitriol) 192
qar'a, pl. qârâ', Lat. cucurbita (retort, "gourd", chemical equipment) 109, 126, 129
qar'a mû'tânânâ ("doubled gourd", chemical equipment according to Abû Bakr ar-Râzi) 129
qarn ("horn", here: coral) 208
qârâra, pl. qawârîr (bottle, chemical equipment) 109, 133
Qaryat al-Fau (place in Saudi Arabia) 97
qâjûtîr (catheter for the urinary tract) 69
qawârîr lî-hâl al-arwâh (chemical apparatus for the "dissolution of spirits") 138
qîdâr min nûhâs ("kettle of copper") 112
qinnâna (cannina, cannutum, chemical equipment) 109, 133, 135, 137
qiyyâs (according to Gâbir b. Haiyân) 100
quartz 168

R
ranula 192
raspatories for the removal of tartar 61-62
raspatories (miqrad) in surgery 86-87
râf (casting mould, chemical equipment) 109
rattlle stone, eagle stone (hashâr al-'uqâb) 190
raven's beak (saft, ophtalmological instrument) 52
râwîq fi gâm (filter in a "goblet", chemical equipment according to Abû Bakr ar-Râzi) 139
realgar (zarî'în aham) 201
receptacle (qâbila, pl. qawâbîl, chemical vessel) 109, 114, 116
receptaculum 119
Red Sea 207, 208
reflection on the upper surface of the lens (Kamâladdin al-Fârisî) 19
resin, see amber
INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

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INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

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INDEX
sulphur \((kibrît, \text{pl.} \textit{kabûrît})\) 101, 103, 161, 162, 200
sulphur pyrite 179
sunbâdaq (corundum) 167
sûraq (sepiolite, meerschaum) 206
surgery, general surgery 3, 4, 5, 9, 83-85
surgery, trauma surgery 86-91
surgical instruments 83-91
sûrîn (a type of vitriol) 192
Syria 16, 23
Syria, mineral sites 179, 185, 192

T — T

tabar (“axe”, knife for bloodletting in the case of eye diseases) 50
Tabarân (in Persia) 204
Tabaristân (in Persia) 192
Tabor (mountain in Palestine) 180
tadbr (chemical procedure) 101
at-Tâ’if 202
talcum, “Talk” (German word, Arab. \textit{talq}) 197, 200
\textit{talq} (muscovite, mica) 197
tanning 191
\textit{tunnûr} (kiln) 141
tear 61
\textit{taš'i’d} (sublimation) 123
\textit{taulîd} (artificial procreation) 101
tear gland fistula 42, 43
Terebinthinum (\textit{tarminân}) 175
Terra sigillata (“sealed” clay) 205
theorie of science (’ilm, qiyyás, burhân according to Ğâbir b. Haṣâyn) 100, 101
\textit{ṭin} (aluminium oxide) 205
\textit{ṭin armani} (Armenian clay) 205
\textit{ṭin Gazîrat al-Maṣṭâki} (clay from the island of Chios) 205
\textit{ṭin al-hikma, ṭin al-hukamâ‘} (artificial clay) 134, 205
\textit{ṭin hurr} (clay from Kimolos?) 205
\textit{ṭin karmî} (“grape-vine clay”, black aluminium oxide from Seleucia) 205
\textit{ṭin mahtûm} (“sealed” clay, Terra sigillata) 205
\textit{ṭin Misr} (Egyptian clay) 205
\textit{ṭin niṣâbûrî} (clay from Niṣâpur) 205
\textit{ṭin Qimûliyû} (clay from the island of Kimolos) 205
\textit{ṭin Sâmûš} (clay from the island of Samos) 205
tinkal (tinkâr) 196
Toledo 5
tombstones made from marble 187
tongs (mâsîk, chemical equipment) 109
tongs (\textit{kâlâêt, ġift}) for the dental treatment 65-66
tonsillectomy 57
transmutation 97, 103
trauma surgery, see surgery
treatment of the ears, nose and respiratory passages 54-60, 192
treatment of the urinary tract 69-71
treatments on the head and the face with a cauter 39, 40, 50
Tripoli (in present-day Lebanon)
Tuba (vessel for “fixing the spirits” according to Abû Bakr ar-Râzî) 136
tumours 83
Tunisia (Tûnis), mineral sites 185, 194
Turkistan (Turkistân) 161, 191
turquoise (\textit{fîrûzaç}) 183
Tûs (in north-eastern Persia) 202
tâtiyâ (hemimorphite) 185
tweezers (mâsîk, chemical equipment) 109
tweezers (\textit{ġift}) for the extraction of the roots of teeth etc. 66
tweezers (\textit{ġift}) for removing foreign bodies from the auditory canal 55

U

ulcers 185, 192, 195, 197
University Library in Bologna 139
Upper Egypt 172, 173
\textit{al-ṭûl} (Lat. alutel, aludel, apparatus for the sublimation of dry substances) 104, 123, 139, 143

V

Vas decoctionis elixir (kiln for boiling the elixir, from \textit{Liber florum Geberti}) 147
Vas decoctionis mercuris (kiln for heating mercury, from \textit{Liber florum Geberti}) 142
vasae congelationis (chemical apparatuses for solidification) 130
vasae fusionis spiritum (chemical apparatuses for the “dissolution of spirits”) 138
veins, system of the veins 7, 10, 12, 14
vessel for the “dissolution of spirits” 137
vessels made up of two identical glass components 124
vino, system of the veins 7, 10, 12, 14
vessel for the “dissolution of spirits” 137
vessels made up of two identical glass components 124

W

warda (“rose leaf”, ophtalmological instrument) 45, 49
Waşgîrd (in Persia) 171
white lead 200
wounds, treatment of wounds 207

Y

Ya’fûr (village near Damascus) 179
al-Yaman, see Yemen
\textit{yâqût} (ruby) 169, 170, 174
\textit{yâqût ahmar} (corundum) 167
al-yāqūt al-banafaṣaḡī 171
yašb, yaṭm, yast (jasper) 175
yāzāki (spinel) 169
Yemen (al-Yaman), mineral sites (also fossils) 177, 178, 180, 190, 191, 192, 197, 202, 207

Z
zabad al-bahr (sepiolite, meerschaum) 206
zabarqād (beryl, chrysolite) 173, 174
zāgāt (vitrains) 103, 191, 192, 200
zahr (poison) 186
zaibaq (mercury) 101, 103, 195
Zanzibar (Zanjibār) 207

III. Titles of Books

A — ‘A
al-Abniya ‘an haqqa‘iq al-adwiya (Muwaffaqaddn al-Haraw) 164, 175, 198, 206
K. al-Aḍidiya (Ishāq b. Ya‘qūb al-Isrā’īlī) 33
‘Ain aš-ṣan’a wa-aun aš-san’a (Abu l-Ḥakīm Muḥammad b. Abūl-Malik al-Ḥwārizmī al-Kāṭī) 109, 143
Albucasis de Chirurgia (Johannes Channing) 4
K. al-‘Aṣr maqālāt fi l-‘ain (Ḥunain b. Ishāq) 20
al-‘Aṭār al-baṣqīya ‘an al-qurīn al-hāliya (al-Birūnī) 160
Āṭār al-bišād (al-Qazwīnī) 165, 202, 195
Azhār al-afkār fi ḡawāhir al-ahgār (Āḥmad b. Yūṣuf at-Tifāṣī) 157, 159, 165–184 passim, 197, 204

B
al-Basā‘ir fi ʿilm al-manāẓir (Kamāladdin al-Fārisī) 22
Book on stones (pseudo-Aristotle), see Liber de mīnēribus Aristotelis
Das buch der waren kunst zu distillieren (Hieronymus Brunswig) 127, 129
K. al-Buldān (al-Hamādānī) 178

C — Č
Čahār maqāla (Nizāmī-i ‘Arūḍī) 32
Canon Medicinae (Avicenna) 31, 33; see also al-Qānūn fi t-tibb
Cerrāhiyetü ‘l-Ḥanīyye (Şerefeddin Sabuncuoğlu) 4, 56, 74, 82
Chirurgia Albucasis (transl. Gerard of Cremona) 4, 5
Codice Atlantico 27
Cyrurgia (Guglielmo da Saliceto) 4

D — D
Daḥīra-i Ḥwārazmsāḥi (Ismā‘īl b. Hasan b. Āḥmad al-Ḡurgānī) 7, 9, 10
De Aluminibus et Salibus (11th/12th c., Spain) 107
De inventione veritatis (Geber) 105
De investigatione perfectionis (Geber) 105, 106, 107
De magnete (Gilbert) 209
De naturis rerum liber (Alexander Neckam) 162
De operationibus alchemiae (14th/15th c.) 142

E
Firdaus al-hikma fi t-tibb (‘Ali b. Rabban at-Ṭabarī) 164, 198, 209

G — Ğ
K. al-Ǧamāḥīr fi ma‘rifat al-ḡawāhir (al-Birūnī) 164–209 passim
K. al-Ǧāmi‘ bain al-‘ilm wa-l-‘amal an-nāfī‘ fi šinā‘at al-hiyal (Ibn ar-Razzāz al-Ǧazarī) 35, 110
K. al-Ǧāmi‘ lī-mufradāt al-adwiya wa-l-‘aǧdiya (Ibn al-Baṣṭār) 164–209 passim
al-Ǧāmi‘ lī-ṣifāt aṣlāt an-nahāb wa-durūb anwā‘ al-mufradāt (al-Idrīsī) 164, 187, 192, 197
Ǧawāhir al-funūn wa-s-sanā‘ī‘ fi ṣarīb al-‘ulūm wa-l-bad‘a‘ (Muḥammad b. Muḥammad Afīātūn al-Harmasī al-‘Abbāsī al-Bisṭāmī) 152
Ǧawāhirnāma (Muḥammad b. Manṣūr ad-Daṣṭākī) 157
Groß Chirurgen / oder Vollkommene Wundarznei (Walter Ryff) 62

H — H — H
K. al-Ḫawāṣṣ (Ǧābir b. Ḥaiyān) 102
K. al-Ḥawi fi t-ṭib (Abū Bakr ar-Rāzī) 29, 30, 165, 198

I — ‘I
‘Ilal al-ma‘ādīn (Abū Bakr ar-Rāzī) 185, 201
K. al-Īsāra ilā maḥāsin at-tīṣāra (Abū Ǧaḍl ad-Dimāṣqī) 178
K. al-l’timād fi l-adwiya al-mufrada (Ibn al-Ǧazzār) 162, 164, 166, 193, 207

K
K. al-Kāfī fī l-kuhl (Ḫalīfa b. Abī l-Maḥāsin al-Ḫalabī) 5, 6, 27, 43, 45, 46, 47, 48, 49, 50, 51, 52, 53
Kāmil al-ṣinā‘a‘ at-ṭibbīya (‘Ali b. al-ʿAbbās al-Mağūsī) 9
K. Kīmiyā‘ al-ʿīr wa-t-tas‘īdāt (al-Kindī) 103, 109, 124, 134

L
K. al-La‘ba (Ǧābir b. Ḥaiyān) 106
Liber Canonis (Avicenna) 24, 25; see also al-Qānūn fī t-ṭib (Liber Continens) (Raḥazes) 29, 30; see also K. al-Ḥawi
Liber de arte Distillandi de Compositis (Hieronymus Brunṣhwig) 119
Liber de gradibus (Ibn al-Ǧazzār, plagiarized by Constantinus Africanus) 162
Liber de mineralibus Aристотелиs, "book on stones by Aристотелиs" 160, 163, 165-201 passim, 204, 207, 208
Liber de septuaginta (Geber) 107; see also K. as-Sab‘īn
Liber de simplicibus medicinis (Ibn al-Ǧazzār, Übers. Stephanus de Caesaraugusta/Saragossa) 162, 193
Liber florum Geberī (Geber) 110, 142, 144, 145, 146, 147, 148, 149, 150, 151
Liber ludorum (K. al-La‘ba by Ǧābir b. Ḥaiyān) 107
Liber radicum Rāsis de alkimia (K. al-Uṣūl by Ǧābir b. Ḥaiyān) 108
Liber servitoris de praeparatione medicinarum simplici- cium (Latin translation of the 28th chapter from K. at-Tasrif by az-Zahrāwī) 111-112
Liber Theoricae nec non Practicae (Albucassis) 31
Libri V de mineralibus (Albertus Magnus) 162
Lisin al-ʿarab (Ibn Manẓūr) 202

M
Mafātīth al-ʿulūm (Abū ‘Abdallāh al-Ḥawārizmī) 109, 123, 141, 164, 189, 198
K. al-Manāẓir (Ibn al-Haṭtam) 21, 24
Mappae clavicula (10th cent. ?) 104
Materia Medica, Περὶ ἕλεὶς ἰατρικῆς (Dioscoride) 28, 158, 167, 175, 197, 205, 207
Methodus medendi certa, clara et brevis (Albucassis) 4
Mīzān al-hikma (al-Ḥazīnī) 169
K. al-Mudḥal at-ta‘limi (Abū Bakr ar-Rāzī) 103, 165, 179, 185, 197
Mu‘gam al-buldān (Yāqūt) 113, 165, 194
Maḥtūr fī kaṣf al-asrār (al-Gaubarī) 109
K. al-Maṣā‘id (at-Tamīmī) 165–208 passim
Murāḏ ad-dahab (al-Ma‘ṣūdī) 160
Muṣḥaf ʿas-sawwar (Zosime) 98

N
Nuḥbat ad-dahā‘ir fī awḥāl al-ǧawāhir (Ibn al-Akfānī) 164, 169, 171, 173, 183
Nuḥbat ad-dahr fī aʿgā‘ib al-barr wa-l-bahr (Samsaddīn ad-Dimāṣqī) 113, 117, 165, 179
Nuḥbat al-muṣṭaṣiq fī ḥṭirāq al-ʾāfāq (al-Idrīsī) 202

O
Omnia opera ysaac (Yaṣaqa = Ḫaṣaq b. Yaʿqūb al-Īsrāʿīlī) 33
Opera omnia (Galēn) 205
Opera que extant omnia (Pietro Andrea Mattioli) 114

P
Περὶ ὕλης ἱατρικῆς, see Materia Medica
Περὶ ἁρματας καὶ δύναμεος τῶν ὑπών ψαρμάτων (Galēn) 158
Perspectiva (Wiṭelo) 18, 26
Perspectiua Rogerii Bacconis (Roger Bacon) 25

Q
al-Qānūn fī t-ṭib (Ibn Sinā) 23, 31, 33

R
K. ar-Radd ‘ala l-Ḵindī fī raddihī ‘ala s-šinā‘a (Abū Bakr ar-Rāzī) 103
Rosarium (Arnold of Villeneuve) 108
INDEX

S — Ś — Ş

K. as-Sab’īn (Gābir b. Hayyān) 106, 107, 108
R. fi ș-Šan’a aš-sarīf wa-ḥawāssīḥā (Ḥālid b. Yazīd) 97
n.
Secretum Bubacaris (Rhazes) 107, 110
Secretum Secretorum (Rhazes) 110; see also Sirr al-asrār
Semita recta (Albert le Grand) 108
K. aš-Ṣifā’ (Ibn Sinā) 160, 161, 163
Sirr al-asrār (Abū Bakr ar-Rāzī) 106, 107, 110, 124,
131–141 passim, 165, 172, 180, 182, 183, 184, 185,
189, 191, 192, 195, 196, 199, 200, 202, 203; see also K.
al-Asrār
Summa (Geber?) 106, 107
Summa collectionis occulte secretorum
nature (Geber) 143
Summa perfectionis magisterii (Geber) 105, 106, 107, 108

T — Ţ

Tabi’yāt (natural sciences in K. aš-Ṣifā’ d’Ibn Sinā) 163
at-Taisir fi l-mudāwāt wa-t-tadhīr (Ibn Zuhr) 34
Tanqīḥ al-Manāẓir (Kamāluddin al-Fārisī) 19, 22

Tarkīb al-’ain wa-’ilaluhā wa-’ilāḡahā ’alā ra’y Ibuqrāt
wa-Ḡālinās wa-hiya ‘aṣr maqālāt (Ḥunain b. Ishāq)
3, 19
at-Tasrif li-man ‘aḡīza ’an at-ta’līf (al-Zahrāwī) 3, 5, 16,
30, 31, 36, 37, 38, 39, 40, 41, 42, 44, 46, 47, 51, 54–92
passim, 111
at-Tasrif li-man ‘aḡīza ’an at-ta’līf (az-Zahrāwī in
Hebrew transl. by Shemtov b. Issak de Tortose) 77
Taṣrīḥ-i Manṣūrī (Mansūr b. Muḥammad b. Aḥmad b.
Yūsuf) 7, 9, 11, 12, 13, 14
Testamentum Geberi (Geber) 105
Theorica et practica (Paulus de Tarento) 107
Tres epistole (Roger Bacon) 108
Tria vero ultima Avicennea capitula transtulit Aurelius
de arabico in latinum 163
Tuḥfat ad-dahr fi ’aḡā’ib al-barr wa-l-bahr (Ṣamsaddin
ad-Dimaqī) 183, 200
Turba Philosophorum 104

U — ʿU

K. al-ʿUmda (Sadaqa b. Ibrāhīm aš-Šāḏīlī) 17
K. al-ʿUsāl (Gābir b. Hayyān) 108