AVICENNAE

DE

CONGELATIONE ET CONGLUTINATIONE LAPIDUM

BEING SECTIONS OF THE

KITÂB AL-SHIFÂ'

The Latin and Arabic texts

edited

with an English Translation of the latter and with critical notes

by

E. J. HOLMYARD, M. A., M. Sc., F. I. C., M. R. A. S.,
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PREFACE.

In an article entitled *Das sogenannte IV. Buch der Meteorologie des Aristoteles* Ingeborg Hammer-Jensen has expressed very clearly the subject of the present book. After dealing with certain writings ascribed to Aristotle, Hammer-Jensen says : — « Im Mittelalter war aber ein anderes mineralogisches Schriftchen unter dem Namen des Aristoteles im Umlaufe : *liber de mineralibus Aristoteles*. In den Handschriften der lateinischen Uebersetzungen des Gerard von Cremona findet sich eine Subskription, zufolge der das IV. Buch schon vor Gerard von Cremona von Hermann uebersetzt war, *tria vero ultima Avicennae capitula transtulit Aurelius de arabico in latinum*. Die genannten drei Kapitel sind als *liber de congelatione (conglutinatione)* bald unter dem Namen des Avicenna, bald unter dem des Geber gedruckt, aber auch mehrmals als *liber de mineralibus Aristotelis*, so z. B. in Bologna 1501. Ferner hat die lateinische Handschrift 16142 in der Bibliothèque Nationale von Paris, eine Uebersetzung der vier Bücher der Meteorologie, einen mineralogischen oder vielmehr geologischen Anhang, welcher zum Teil mit dem obengenannten Schriftchen identisch ist. F. de Mély ist auf diesen Anhang aufmerksam geworden, hat gesehen, dass das Stück sämtliche von Vincent de Beauvais angeführte Citate « des IV. Buchs der Meteorologie » enthält und hat den Text in der Rev. des Etudes Grecques 1894, p. 185 ff. veröffentlicht. F. de Mély meint hier ein ursprüngliches Stück des III. Buchs der Meteorologie, dessen lückenhaften Schluss er erwähnt, entdeckt zu haben ; er nimmt viele Interpolationem seitens der Araber an, lässt sich aber in dem was er selbst *cette rapide étude* nennt, auf keine nähere Behandlung der Frage ein. »

In the following pages we have shown that *liber de mineralibus*

Aristotelis is a translation — more or less satisfactory and not always complete — of passages occurring in Avicenna's great work *The Book of the Remedy*. We hope, therefore, to have finally settled a problem which has engaged the attention of many scholars, and to have thrown light upon a somewhat obscure region of Aristotelian criticism. The *Mineralia*, moreover, is intrinsically interesting to the historian of science, not merely for its contents but because it is one of the few mediaeval translations of Muslim scientific works of which we possess the original Arabic text.

Our attention was first drawn to the *Mineralia* by Al-Jildakî's statement that Avicenna had expressed his views on alchemy in his *Book of the Remedy (Kitâb al-Shifâ')*, but having read Prof. Wiedemann's remark that Prof. Horten of Bonn had found nothing about alchemy in the *Shifâ'*, we were inclined to think that Al-Jildakî — although usually very reliable — had been mistaken. An examination of the *Mineralia*, however, showed us that some of the *dicta* quoted by Al-Jildakî were undoubtedly given there in Latin dress, so we were led to investigate the *Shifâ'* itself, in the India Office MS. We then found that the whole of the *Mineralia* had been translated from certain chapters of the *Shifâ'*, including the celebrated passage beginning *Sciant artifices alchemiae*.

When our work was already well advanced, Professor H. E. Stapleton, of Presidency College, Calcutta, wrote to tell us that he had himself, many years previously, made the same discovery. On comparing the Latin text with the Arabic text of a lithographed edition published at Teheran, he says, " the identity of the two was found to be so obvious that although all the portions of the Shifa corresponding to the Mineralia were translated for checking purposes, nothing further was thought necessary than a brief reference to the original authority » (*vide* Stapleton and Azo, Memoirs A. S. B., III, 1910, p. 59, note 2). It is clear, therefore, that credit for priority

must be given unreservedly to Prof. Stapleton ; though we think that the reference mentioned above — which merely states that, in the *Shifâ'*, Avicenna argued that as we do not known the specific differences between the metals, transmutation is impossible — cannot easily be understood to imply any connection between the *Shifâ'* and the *Mineralia*.

When Professor Stapleton heard of our proposal to publish the present book, he most generously placed at our disposal his own translation of some of the passages in the *Shifâ'*, his notes on the Latin text, many other notes, and a copy of the Latin version as given in the Bologna edition of 1501 collated with that of the Lyons edition of 1528. It is unnecessary for us to say that we deeply appreciate this help, which has been invaluable. Our translation of the Arabic text has, however, been made independently ; it was afterwards compared with Prof. Stapleton's version, from which we have taken certain phrases while in other places we have found ourselves unable to agree with it. Prof. Stapleton's version was available only from the beginning of *Caput II* of the Latin rendering, as he was unable to find his translation of the passages corresponding to *Caput I*.

We have pleasure in expressing our thanks also to Mrs. Singer, who told us of the Trinity College MSS. of the *Mineralia*, and to the following gentlemen : — The Librarian of the India Office, for a lengthy loan of a splendid MS. of the *Shifâ'* ; the Librarian of Trinity College, the Trustees of the British Museum, and the Librarian of the Bodleian Library, for allowing us to have rotographs made of MSS. in the libraries under their control ; Mr. W. L. Cooper, Librarian of the University of Bristol, for the trouble he took to procure for us books which we wished to consult and which were not readily available ; Dr. C. van Arendonk, Librarian of the University of Leyden, for having made for us a rotograph of a MS. of a work by Al-Ṭughrâ'i *(Ḥaqâ'iq al-Istishhâd)* ; Muḥammad Qâsim Bey, of the

Physical Department, Cairo, for obtaining copies of MSS. ; Maḥmûd Efendi Ḥamdy, of the Royal Library, Cairo, for copying for us the work by Al-Ṭughrâ'î mentioned above ; Mr. Robert Steele, for references to Avicenna in Roger Bacon ; Sir Robert Hadfield, Bt., F. R. S., and Professor R. A. Nicholson, for answering queries about meteoric iron and its possible use for swords among the Arabs ; and finally Monsieur Paul Geuthner, for undertaking the publication of the book.

E. J. Holmyard.
D. C. Mandeville.

Clifton College, Bristol.
July, 1927.

N. B. For the Arabic text only one of us is responsible (E. J. H.).

CONTENTS

LOUVAIN (Belgique) -- IMPRIMERIE J.-B. ISTAS.

INTRODUCTION.

At the end of the third book of the *Meteorologica*, Aristotle distinctly promises a book Περὶ μετάλλων or Περὶ λίθων [1], but no Greek text of such a book is extant. Scholars have, however, found it difficult to make up their minds as to whether Aristotle fulfilled his promise or not, since mediaeval Latin versions [2] of the *Meteorologica* often append to the Fourth Book an additional chapter, in three paragraphs [3], entitled *De Mineralibus*. Here the promised subject is dealt with in such a masterly fashion that many critics have not hesitated to ascribe it to Aristotle. That this chapter is not a direct rendering of a Greek original is evident from the fact that it contains Arabic proper names [4]; for the same reason it follows that the Arabic version itself cannot have been a literal translation of a Greek text. The problem is then to decide whether the *Mineralia* contains a genuine Aristotelian nucleus, and if so to free it from the accretions which enclose it.

F. de Mély [5], from a study of the Latin text, concluded that the *Mineralia* contained fragments of an authentic Aristotelian chapter Περὶ λίθων, and, subjecting the text to a critical analysis, believed that he had been able to distinguish between these passages and subsequent additions [6]. Omitting the latter, he says, « quels sont

1. III. 6. 378 *b*. 5. — κοινῇ μὲν οὖν εἴρηται περὶ αὐτῶν ἁπάντων, ἰδίᾳ δὲ σκεπτέον προχειριζομένοις περὶ ἕκαστον γένος.

2. *E. g.*, Bibliothèque nationale, MS. latin 16142 — and many others.

3. Viz., *de congelatione et conglutinatione lapidum; de causa montium; de quatuor speciebus corporum mineralium.*

4. *E. g.*, Lurgeam, Coracem.

5. Le Lapidaire d'Aristote, *Revue des Etudes grecques*, VII, 1894, 181-191.

6. The passages which he rejected are as follow, the references being to pages in the present book :

(i). Sed argentum vivum est de parte secunda, quamvis sit elementum ductilium, et aliquibus ductilibus simile. (Page 50.)

les aperçus de génie qui nous restent? Ne parlons pas de cette théorie d'un corps unique, origine de tous les minéraux, car elle est de tous les pays; nous ne saurions trop insister sur ce point. Pour la première fois nous trouvons ici une tentative d'explication scientifique de la formation des aérolithes, bien différente de celle que Sénèque présentera plus tard; l'auteur indique l'origine plutonienne et neptunienne des montagnes; de cette dernière formation, il tire l'explication absolument scientifique des corps d'animaux marins fossilifiés trouvés sur les montagnes, — pendant tout le moyen âge les os de mammouths n'étaient autres que des os de géants, de Teutobocchus, on discutait encore du temps de Voltaire; — enfin il signale le changement continuel de l'aspect terrestre, la formation de nouveaux rivages ..... les alluvions, tout cela traité avec ce talent d'observation qui justifie l'influence qu'a exercée sur notre époque, à plus de deux mille ans de distance, l'heureuse impulsion donnée à l'esprit humain par le philosophe de Stagire. »

Hammer-Jensen, dealing with the same problem, remarks (1): « Freilich ist herein mehr Unaristotelisches, als F. de Mély meinte, ... aber sicherlich findet man hier auch Reste, und einen sehr bemerkenswerten Rest des echten IV. Buches der Meteorologie .... Wenn wir annehmen, dass das IV. Buch der Meteorologie theoretische Erörterungen über das Entstehen der verschiedenen Steine (darunter Meteorsteine und Fossilien) und Metalle, und etwas von den verschiedenen Fundorten, dazu ein Stück wie das vom Entstehen der Berge enthalten hat, bekommen wir ein Bild dieses Buches, das ganz den drei anderen Büchern entspricht. »

(ii). In ripis quoque Gyon, visa est terra, quae dicitur in lapides converti in spatio triginta trium annorum. (Page 45.)

(iii). Sunt enim certa loca super quae aquae effusae convertuntur in lapides qui diversorum colorum sunt. (Page 45.)

(iv). coagulans virtute occulta ..... sunt etiam multa alia quibus coagulant quae liquefaciunt certissime. (Page 46.)

(v). Est que locus in Arabia ..... tamen causae eorum manifestae sunt. (Page 47.)

(vi). Et in Persia quoque cadunt in coruscationibus ..... apud Tepestren. (Page 47.)

1. *Das sogenannte IV. Buch der Meteorologie des Aristoteles.* Hermes, L, 1915, pp. 113-136.

If we now turn to the history of the Latin versions of the *Meteorology* we shall find that the true origin of the *Mineralia* was more than once stated in the manuscripts themselves. According to F. H. Fobes (1), « there were current at the end of the Middle Ages two complete Latin versions of Aristotle's *Meteorology* — the « Vetus Versio », of which books i to iii were from the Arabic and book iv was from the Greek, and the « Nova », wholly from the Greek ..... Of the Vetus Versio, a work of the twelfth century, the first three books were probably based upon the ninth-century Arabic version (from from the Syriac) connected with the names of Aboul Kheir el Hassan ben Saouar and Iahya ben Bathriq, and were unanimously assigned to Gerard of Cremona († 1187); the fourth book, from the Latin, was assigned by a frequently recurring explicit to « Henricus », whom Jourdain showed to have been at least as early as Albertus Magnus and Vincent of Beauvais, and whom Rose, on the basis of the explicit of the Nuremberg MS centur. V. 59, which Jourdain did not know, has identified with Henricus Aristippus († 1162), minister of William I of Sicily. I quote this explicit in full from Rose : *Completus est liber metheororum cuius tres primos libros transtulit magister Gerardus Lumbardus summus philosophus de arabico in latinum. Quartem autem transtulit Henricus Aristippus de greco in latinum. Tria ultima capitula transtulit Aluredus Anglicus sarelensis de arabico in latinum.* »

It is thus clear (*a*) that the last three chapters were an addition and (*b*) that they were translated by a different hand. Moreover, Fobes (2) quotes a note from the Oxford MS Digby 153 (f. 28) which throws further light on the problem : —

Ultimum capitulum in antiqua translacione quod sic incipit ' terra pura lapis non fit ' non est capitulum aristotelis sed additum ab aluredo, ut dicit bacun in sua naturali philosophia capitula secundo

1. *Mediaeval Versions of Aristotle's Meteorology.* Classical Philology, vol. X, July, 1915, pp. 297-314.
2. *Ibid.*

secundum albertum 3 mineralium c. 9, et contraria per totum librum suum patet quod illum capitulum est avicenne.

This very definite statement that the *Mineralia* is not the work of Aristotle but of Avicenna was questioned very early, for in his *Margarita Preciosa Novella,* written in 1330, Bonus says (1) *Item Aristoteles in fine 4. Metaphysicorum* (sic), *secundum translationem veterum, Alchemiam esse veram, expressè negat, sed eam esse sophisticam et phantasticam affirmat : quamvis quidam dicant, illa verba fuisse Avicennae, qui ipsa addidit, quod non credimus.* Nearly six centuries later, de Mély (2) writes : " Le traducteur a pris soin, malgré lui certainement, de nous laisser une trace palpable de l'origine grecque du traité. Il est un mot, en effet, qu'aucun des éditeurs ou traducteurs n'a reproduit identiquement, et cela parce qu'ils ne le comprenaient pas : Vincent de Beauvais l'écrit *optesis*, Geber, *ephtesis*, Manget, *eptesis*. Ce n'est ni un mot latin, ni un mot arabe, mais certainement l'ἕψησις (3), l'action de faire cuire, mot dont Aristote s'est continuellement servi dans les *Météores* ; mot assez complexe d'ailleurs, puisque l'*optesis* est bien l'action de faire cuire, mais en grillant, tandis que l'*epsesis* est également la cuisson, mais en bouillant ; donc cuisson sèche et cuisson humide correspondant aux exhalaisons sèches et exhalaisons vaporeuses. Enfin, pour montrer l'origine aristotélique et non avicénienne de ce traité, je demanderai encore aux Arabes un nouvel argument. Le manuscrit arabe supplément 1845, de la Bibliothèque nationale : *Le présent des frères de la pureté et de la sincérité*, au milieu de nombreuses citations d'Aristote, contient un chapitre des *Minéraux* et nous y lisons : ' Les minéraux sont divisés en trois classes en raison de leur plus ou moins de promptitude à se reconstituer à l'état parfait ou définitif. Ils sont aussi considérés au point de vue de leur consistance et de leur aptitude à la fusion. Ils

1. Manget, *Bibliotheca Chemica Curiosa,* 1702, ii, p. 14.
2. *Loc. cit.*
3. As a matter of fact, we find that this word does not occur in the original (Arabic) text, but must have been used by Alfred the Englishman to translate the Arabic انضاج, which bears approximately the same meaning.

proviennent de liquides souterrains inégalement soumis à l'action du chaud et du froid. Les montagnes soulevées au sein des eaux par des vapeurs intestines, se fragmentent et les eaux repoussées se nivellent et dessinent les contours des contrées '. N'est-ce pas, en quelques lignes, un résumé du traité de Mineris ... ? »

There, then, we have the two opposing views, one maintaining that the *Mineralia* is, or rather contains, a genuine work of Aristotle's, and the other asserting that it is not Aristotelian but Avicennian in origin. Against the second of these two opinions the fact that in the Middle Ages many alchemical books ascribed to Avicenna were current must have told heavily ; it would have appeared incredible that the man who denied the possibility of transmutation in the *Mineralia* should have written other books in which he not merely accepts the truth of alchemy but describes the philosophers' stone with circumstantial detail. On the other hand, we shall find that the very views which are expressed in the *Mineralia* are unanimously attributed to Avicenna by Muslim authors, who presumably were in a better position to speak with authority on the matter.

Ibn Khaldûn, the greatest philosophic historian of Islâm, may be quoted first. In his *Prolegomena* (1) he says : « Sachez maintenant que la pratique de cet art [alchimie] date des temps les plus reculés, et que les anciens en ont traité ainsi que les modernes. Nous allons exposer leurs doctrines, et nous donnerons ensuite notre opinion touchant la réalité du grand œuvre .... Donc nous dirons que les doctrines émises par les philosophes à ce sujet dérivent de l'une ou de l'autre des deux théories qu'ils se sont faites au sujet de la nature des sept métaux les plus communs, savoir : l'or, l'argent, le plomb, l'étain, le cuivre, le fer et le zinc. Y a-t-il entre ces métaux des différences spécifiques, de sorte que chacun d'eux forme une espèce à part? ou bien diffèrent-ils par leurs qualités particulières de manière à n'être que des variétés d'une même espèce ? .... Selon Ibn Sînâ (Avicenne) et les philosophes de l'Orient ses disciples, les métaux se

1. French translation by de Slane, iii, 254-6.

distinguent par des différences spécifiques, et chacun d'eux forme une espèce séparée et indépendante des autres, espèce qui se laisse constater par des caractères réels. Cette espèce, comme toutes les autres, a sa différence et son genre particuliers. Abou Nasr el-Farabi (1), ayant admis comme principe que les métaux appartiennent tous à une même espèce, inféra de là la possibilité de convertir un métal dans un autre, puisqu'il est possible d'en changer les accidents et de le traiter par des opérations (chimiques). A son point de vue, l'alchimie serait un art réel et facile à exercer. Ibn Sinâ, ayant adopté pour système que les métaux diffèrent en espèce, déclara que l'existence de l'alchimie comme un art réel et véritable était impossible. ' Car, disait-il, il n'y a pas moyen de soumettre les différences spécifiques aux opérations (de la chimie) ; les différences ont été créées par Dieu, créateur et ordonnateur de toutes choses ; leur véritable nature nous est inconnue et nous ne pouvons pas en former même une idée. Comment alors peut-on chercher à changer ces différences par des manipulations ? ' »

If this passage is compared with the following extract from the Latin version of the *Mineralia* (2) it will be seen that the correspondence is very close : — *Caeterum quod differentia specifica tollatur ingenio, non credo possibile, et non est quod complexio una in aliam convertatur : quia ista sensibilia non sunt differentia, qua permutatur species, sed sunt accidentia, et proprietates. Differentiae autem eorum non sunt cognitae, quia et cum differentia sit ignota, quomodo potest sciri utrum tollatur necne, vel quomodo tolli possit ?*

The evidence does not end here, however. Ḥâjjî Khalîfa states (3) that Ibn Sinâ denied the truth of alchemy in the Prolegomena to his *Book of the Remedy (Kitâb al-Shifâ')*, while Al-Jildakî († circa 1360

1. Celebrated Muslim disciple of Aristotle ; died 950 A. D.

2. Cf. page 54.

3. *Lexicon Bibliographicum*, ed. Fluegel, V, 270. — Homines in ea (alchemy) judicanda in duas abeunt partes. Multi eorum statuunt, eam minime ad effectum adduci posse. Ita statuit Sheikh Reyis *Ibn Sinâ*, qui eam vanam et inanem esse in prolegomenis libri *Shefâ* demonstrat.

A. D.) has the following passage in his book entitled *The Guarded Pearl (Al-Durr al-Maknûn)* (1) : — « 'Alî ibn Sinâ denied the existence of alchemy in the *Shifâ'*, and so did Al-Bîrûnî in his *Lapidary (Kitâb al-Aḥjâr)* ; Abû Bakr Muḥammad ibn Zakarîya al-Râzî, however, in his *Book of the Twelve (Kitâb al-Aṯnâ 'Ashrîyât)*, and Ibn Arfa' Ra's, in his poem entitled *The Particles of Gold (Diwân Shudhûr al-Dhahab)*, maintained its reality ». Again, in his commentary *(Nihâyat al-Ṭalab, The End of the Search)* upon the *Cultivation of Gold (Kitâb al-'Ilm al-Muktasab fî Zirâ'at al-Dhahab)* of Abu'l-Qâsim al-'Irâqî, Al-Jildaki says : « Avicenna considered that each of the six metals was a distinct species of one genus, just as the genus plant includes different species, and the genus animal likewise. And in the same way that it is impossible to convert a horse into a dog or a bird into a horse, or a man into a bird, so it is impossible to convert silver into gold or copper into silver or lead into iron .... He believed, however, that it was possible to dye copper white, and thus to give it the appearance and colour of silver, but it would still be copper, only dyed ; and to dye silver red and thus to give it the appearance and colour of gold, but it would still be silver, only dyed, and not gold. The white dye, he believed, was extracted from arsenic, mercury and silver, and the red from sulphur, gold and sal-ammoniac, and also from certain plants and animals. »

Finally, reference may be made to Berthelot, *La Chimie au Moyen Âge* (2), where the origin of the *Mineralia* is correctly surmised : — « On lit dans ces traductions latines, sous le nom d'Avicenne .... un opuscule [*Avicennae de Congelatione et Conglutinatione Lapidum*] relatif à la formation des pierres et des montagnes, lequel renferme des vues remarquables sur la double production de celles-ci par soulèvement et par action de l'eau, ainsi que sur l'origine des fossiles.

1. The quotations from Al-Jildaki are taken from MSS. in the possession of one of us. These MSS. are modern copies of others preserved in the Royal Library at Cairo.

2. Tome iii, p. 225 (Paris, 1893).

Il y est question d'un aérolithe ou pierre tombée du ciel *(apud Lurgeam)*, dont un roi voulut se faire fabriquer des épées. Or ce récit figure également dans un ouvrage arabe qui porte le nom d'Avicenne et qui est intitulé : *La Guérison*. L'auteur y parle d'un aérolithe tombé dans le Djordjan, dont le sultan Mahmoud Ghizni voulut se faire fabriquer une épée, lui attribuant sans doute des propriétés merveilleuses. C'est l'exemple rare d'un texte arabe actuellement existant et qui figure dans les collections alchimiques latines du moyen âge. La concordance mérite donc d'être notée. »

This brief review of the problem prepares us for the truth of the matter, which is that the *Mineralia* is partly a direct translation and partly a *résumé* of sections of a genuine work of Avicenna, *viz.*, the *Kitâb al-Shifâ'*, the " Book of the Remedy ", which he composed in response to his friend Al-Juzjâni's request that he should write a general commentary on Aristotle's works. He was too busy to write a formal commentary, but compromised by writing a plain exposition free from any attempt at refutation of adverse views. He had already written the first book of his great *Canon* of Medicine, and thereafter worked at the *Shifâ'* and *Canon* simultaneously. At this period he was living at Hamadhân under the protection of the Buwayhid prince Shams al-Daula (died 1021 A. D.), whose vizier he was. After the death of Shams al-Daula, Avicenna secretly left Hamadhân and was honourably received at Ispahân by the Kakwayhid 'Alâ al-Daula Abû Ja'far Muhammad ibn Dushmanzâr, who annexed Hamadhân in 1023 by the deposition of Samâ al-Daula, son of Shams al-Daula. It was during the time of his stay with 'Alâ al-Daula that the *Shifâ'* was finished, and according to Ibn Abi Uṣaybi'a the chapters which particularly interest us, viz. those on Physics, were composed after the death of Shams al-Daula (1021) but before Avicenna went to Ispahân (probably 1023). We are therefore able to date them very precisely (1).

1. Cf. Baron Carra de Vaux, *Avicenne* (Paris, 1900), p. 145 etc.

The Arabic version.

The Latin rendering is divided into three Chapters, *viz. de congelatione et conglutinatione lapidum* (a title by which the whole work is often known) ; *de causa montium* ; and *de quatuor speciebus corporum mineralium*. The first two of these are translations, full or abridged, of Section 1 of Discourse II of Subject *(fann)* V of the Physics of the Shifâ'. The third, *de quatuor speciebus corporum mineralium*, is a translation of Section 4 of the same Discourse. *Fann* V as a whole consists of two Discourses *(maqâla)* upon meteorological phenomena understood in the Aristotelian sense of the term, Sections 1 and 4 dealing with topics which Aristotle would no doubt have treated in the Fourth Book of his *Meteorologica* if he had ever completed it.

The Latin Translation.

We have seen that it is possible to date the Shifâ' very accurately, and fortunately we are in a position to date the translation almost as closely. From the explicit of the Nuremberg MS. to which reference has already been made (1), we know that the first three books of the *Meteorologica* were translated by Gerard of Cremona from the Arabic ; the fourth book, from the Greek, was translated by Henricus Aristippus. To the fourth book were added the three chapters which form the subject of the present discussion, and we are definitely told (2) that these were translated from the Arabic by Alfred the Englishman or Alfred of Sareshel (3). Now Alfred translated also the pseudo-Aristotelian treatise *De vegetabilibus*, and dedicated his translation

1. Page 3.
2. *Loc. cit.*
3. For Alfred the Englishman, *cf.* D. N. B., vol. I, p. 285 ; Haskins, *Studies in Mediaeval Science*, pp. 128 ff., etc.

to Roger of Hereford (1). According to Lynn Thorndike (2), the definite dates in Roger of Hereford's life seem to fall in the decade 1170-1180, though his association with Alfred may well have been later.

In the commentary to the *De vegetabilibus*, Alfred cites a *Liber de congelatis* which he had translated from the Arabic as an appendix of three « chapters » to the *Meteorologica*. There can be no hesitation in identifying the *De congelatis* with the *Mineralia Avicennae*, and we may therefore conclude that the translation of this work was made toward the end of the twelfth century, and prior to that of the *De vegetabilibus*. In a subsequent work, entitled *De motu cordis*, Alfred shows a much wider acquaintance with Aristotle than in the *De vegetabilibus*, so that the latter is presumably the earlier of the two works. The *De motu cordis* was dedicated to Alexander Neckham, who died in 1217, so assuming that the *De vegetabilibus* was earlier than the *De motu cordis*, we have a *terminus ad quem* for the date of the *Liber de congelatis*. In round numbers, 1200 A. D. may be taken as the most probable time, with the proviso that it may have been two or three decades earlier or, less probably, a few years later (3).

It is surprising how quickly the origin of the *Mineralia* was forgotten. Thus, while Albertus Magnus knew that the translation was made from Avicenna, Roger Bacon seems to have been very hazy on the point ; in his *Breve Breviarum* he quotes the passage *Terra pura etc.* as Aristoteles', in the *Tractatus Trium Verborum* he ascribes it to Gerard of Cremona, and only in 1266 or thereabouts does he find that it was an addition of Alfred's, still apparently in ignorance of its Avicennian origin — (*Communia Naturalium*, lib. 1) : « Et taceant stulti qui abutuntur autoritate illa in fine prime translationis Metheororum, quam contra veritatem allegant, dicentes scriptum esse *sciant*

1. According to Haskins, *op. cit.*, p. 128, footnote 47, a copy in the library of the University of Barcelona reads ; — Incipit liber de plantis quem Alveredus de arabico transtulit in latinum mittens ipsum magistro Rogero de Herfodia.

2. *History of Magic*, 1923, ii, p. 182.

3. The information in this paragraph has been taken from Haskins, *op. cit.*, pp. 128, 129. *De vegetabilibus* was probably written by Nicholas of Damascus.

artifices etc. ac si uset verbum Aristotelis, cum nichil ejus sit a principio illius capituli *Terra pura lapis non fit* etc. set additum ab Alveredo. » (1)

Nature of the Book.

From a scientific point of view, Ibn Sînâ's opinions upon the formation of stone, rocks and mountains are remarkably interesting, in that they show an astonishingly accurate insight into geological phenomena. They are so clearly and concisely expressed that we have felt it unnecessary to give a synopsis, preferring that Ibn Sînâ should be allowed to speak for himself. Similar remarks apply to his theories upon the nature of minerals, and particularly to his ruthless criticism of the alchemists and their attempts to transmute the base metals into gold. On the latter subject he was taken to task by the celebrated vizier Al-Ṭughrâ'î, who wrote his *Ḥaqâ'iq al-Istiṯhâd* with the definite aim of refuting the heretical opinions of the *Shifâ'*. The arguments of the *Ḥaqâ'iq al-Istiṯhâd* are of the usual type, so that no good service would be performed in reproducing them here. Ibn Sînâ appears to have made up his mind only late in life ; it is possible that at an earlier period he actually wrote books in favour of alchemy. However this may be, he had, in the *Shifâ'*, given the alchemists a blow the repercussions of which were felt throughout many succeeding centuries — the passage beginning *Sciant artifices alchimiae* is quoted innumerable times in mediaeval alchemical literature.

Ibn Sînâ's « Book of Definitions ».

In the section of the *Shifâ'* with which we are concerned in the present book, Ibn Sînâ uses many philosophical-scientific terms, such as جوهر and عنصر, which are very frequently employed in alchemy. For this reason, coupled with the fact that the exact meanings of the

1. For these references to Bacon's works, we are indebted to Mr. Robert Steele.

terms are not always readily available, we would draw attention to Ibn Sînâ's *Kitâb al-Ḥudûd*, or *Book of Definitions*, in which the need is admirably met. This work exists in Arabic in the India Office Library, MS. Loth 771, and the greater portion of it was translated into Latin by Andreas Alpagus, who died about 1520. The translation was first published in 1540, at Venice, in a volume which contains other works of Avicenna rendered into Latin by the same hand.

SOURCES.

A. Arabic Text.

A list of the chief MSS. of the *Shifâ'* is given by Brockelmann in his *Geschichte der arabischen Litteratur*, I, 454. The complete work has never been printed in a European edition, though selections from *Fann* 9 of the first *Jumla* are given by Margoliouth in his *Analecta Orientalia ad Poeticam Aristoteleam*, published in London in 1887. The second and fourth books of the *Shifâ'*, treating of physics and metaphysics respectively, were published in a lithographed edition at Teheran in 1885, with marginal notes to the first part of the second book by Âqâ Jamâl al-Dîn Khwânsârî, and to the whole of the fourth by Mullâ Ṣadrâ and others. Latin versions of various sections of the work were comparatively frequently printed in the sixteenth century; thus in the Venice edition of 1508 are included *Fann* 1, *Maqâlas* 1 and 2, and *Faṣls* 1 and 2 of *Maqâla* 3 of Book 2 of the *Physica*, translated by Dominicus Gundisalvus.

The MSS. we have used in the preparation of the present text are three: — A. *India Office, MS. 1796 (Loth 476)*. This is an excellent MS. in a good state of preservation. It forms the second volume of a copy of the *Shifâ'* in three volumes, made by Muḥammad Ṣâdiq ibn Ḥâjjî 'Abd al-Ḥakîm by order of Sayyid Muḥammad Ḥusainî in the years 1148-1154 A. H. This second volume is written on 313 leaves, size $11\frac{1}{4}$ in. by $6\frac{3}{4}$, thirty lines to a page; it is dated Kashmir, Sha'bân 1150, and seems to have been transcribed from the same MS. — of

the year 868 A. H. — as the preceding volume, Loth 475. The text is good and has been made the basis of our own.

B. *British Museum Or. 2873.* This is described as follows at pp. 484, 485 of Rieu's Supplement to the Catalogue of Arabic MSS., 1894 — « Foll. 248 ; 12 $\frac{1}{4}$ in. by 7 $\frac{1}{4}$; 25 lines, 4 in. long ; written in small and close Nesṭalik ; dated Shahjahân-âbâd (Delhi), Dul-ka'dah, A. H. 1072 (A. D. 1662) ..... Fann V. فى الآثار العلوية, in two Maḳâlahs, beginning at foll. 115*a* and 120*a* ..... The copyist, 'Abdallah, says in the colophon that he was not very proficient in Arabic, and he begs to be excused for errors of transcription. In the margins of foll. 18*a*, 40*a*, 58*b*, etc., there are colophons, apparently transcribed from the original MS., which was dated Samarḳand, A. H. 802. »

This MS. was somewhat difficult to read — at least in rotograph — and was inconclusive in many places owing to absence of diacritical points. The text itself is good.

C. *Bodleian Library, Oxford. Poc. 116.* Fol. 81*a*-fol. 110*b*. This is very clearly written, and in great part vocalized. The text, however, is very corrupt in many places, but proved useful in elucidating certain difficulties in the other MSS.

In the footnotes to the Arabic text, we have used « A » for the India Office, « B » for the British Museum, and « C » for the Bodleian manuscripts respectively. The figures in square brackets in the text, thus [Page 145*a*], refer to pages in the India Office MS.

B. Latin Text.

We have made no attempt to establish a Latin text of the Mineralia, since it became perfectly clear in the course of our investigation that Alfred the Englishman had not seldom misunderstood the original version, or that he worked from a defective text — perhaps both. In these circumstances it is obviously impossible to come to any final conclusions upon details, and with the Arabic text now available there seemed to be no reason to spend time and labour upon a necessarily unproductive task. We have, however, given the Latin text as

it appears in a XVth. Cent. MS. in the library of Trinity College, Cambridge (MS. 1400 or O. 8-25, *ff.* 8 *verso*-11 *verso*), and have collated it with (*a*) the text of another XVth. Cent. MS. in the same library (MS. 1122 or O. 2-18, *ff.* 192 *verso*-194 *verso*) and (*b*) a copy of the text printed in the Bologna edition [1], 1501, compared with that of the Lyons edition [2] of 1528, kindly lent us by Professor H. E. Stapleton.

It will be seen that the MSS. agree closely, for the most part, with the printed text, but differ widely in detail from the version printed in *Artis auriferae* [3] and in Manget [4]. The latter version, indeed, appears to derive from a different family of MSS., though when the divergence occurred we are unable to say. The text of our MSS. and of the Bologna and Lyons editions is much truer to the Arabic than that of *Artis auriferae* and Manget.

In the footnotes to the Latin text we have referred to the MSS. and Bologna and Lyons editions as follows : —

(1). TA.-MS. Trin. Coll. 1400 or O. 8-25.

(2). TB.-MS. Trin. Coll. 1122 or O. 2-18.

(3). B.-Bologna Edition.

(4). L.-Lyons Edition.

1. Aristotelis, philosophorum maximi, secretum secretorum ad Alexandrum ; de Regum regimine ; de Sanitatis conservatione ; de Physionomia. Ejusdem de Mineralibus. Alexandri Aphrodisei, clarissimi peripatetici, de Intellectu. Averrois magni commentatoris, de Anime healitudine. Alexandri Achillini Bononiensis, de Universalibus, Alexandri Macedonis, in septentrione monarche, de Mirabilibus Indiae, ad Aristotelem. *(At end :)* Et impressus Bononiae, impensis Benedicti Hectoris, anno Domini 1501 ... 20 octobris, illustrissimo Joanne secundo Bentivolo rei publicae Bononiensis lmbenas foeliciter moderante [Bologna, 1501, folio, 36 ff.].

2. Secreta secretorum Aristotelis ... Maximi philosophi Aristotelis de signis aquarum, ventorum et tempestatum. Maximi philosophi Aristotelis de Mineralibus. Alexandri Aphrodisei de Intellectu. Averrois de Beatitudine anime. Alexandri Macedonis ad Aristotelem de Mirabilibus Indie. [Lugduni, in aedibus A. Blanchard, 1528. 16mo., black letter, 83 ff.]

3. *Artis auriferae quam Chemiam vocant antiquissimi auctores*, Basle, MDCX, vol. i, p. 240.

4. *Bibliotheca Chemica Curiosa*, Cologne, 1702, vol. i, p. 636.

English Translation of the Arabic Text

THE BOOK OF THE REMEDY (1).

In the name of God, the Merciful, the Compassionate !

The Fifth Subject of the Physics, consisting of two discourses upon meteorological phenomena (2). This subject comprises the secondary

1. شِفَآء remedy, the becoming free from disease, or the giving of health. In mediaeval Latin the word was wrongly translated *Sufficientia*. The vocalization has apparently given trouble to lexicographers, the Calcutta edn. of the Qāmūs reading شَفاء (Lane, *s. v.*). Steinschneider *(Europ. Uebers.*, I. 32) accepts this reading *(Schafa)*. Carra de Vaux, *Avicenne*, 145 *footnote*, says : « Le mot en question dans le sens de remède, guérison, est vocalisé *chafâ* dans le grand dictionnaire arabe-latin de Freytag, et *chifâ* dans les dictionnaires de l'université de Beyrouth, édition française de 1893 et édition anglaise de 1899. Les éditeurs romains du *Nadjât*, de 1593, ont donné à ce livre un fort beau titre vocalisé dans lequel entre le mot qui nous occupe et où ils ont précisément omis cette voyelle scabreuse ».

2. الآثار العلوية. The *Mafâtîḥ al-'Ulûm*, *ed.* van Vloten, 1895, p. 133, says : — واما العلم الطبيعىّ فمن اقسامه علم الطبّ وعلم الآثار العلويّة اعنى الامطار والرياح والرعود والبروق ونحوها وعلم المعادن والنبات والحيوان وطبيعة شىء شىء مما تحت فلك القمر وصناعة الكيمياء تدخل تحت اقسامه لانّها باحثة عن المَعْدَنيّات *

The scope of Physics is described by Ibn Khaldûn (*Prolegomena*, De Slane's translation, III, 161) : « La Physique est une science qui a pour objet le corps en tant qu'il éprouve du mouvement et du repos. Elle examine les corps célestes, les corps élémentaires et leurs produits, tels que l'homme, l'animal (irrationel) le végétal, le minéral, ce qui se produit dans le sol en fait de sources et de tremblements de terre, ce qui a lieu dans le ciel en fait de nuages, de vapeurs, de tonnerre, d'éclairs et d'ouragans, etc. Elle s'emploie aussi pour faire reconnaître l'agent qui donne le mouvement aux corps, agent identique avec l'âme dans ses diverses espèces, savoir : l'âme humaine, l'âme animale et l'âme végétale.

« Les livres composés sur cette matière par Aristote se trouvent entre les mains du public, ayant été traduits (en arabe) sous le règne d'El-Mamoun et à la même époque que les autres traités sur les sciences philosophiques (des Grecs). (Les musulmans) composèrent ensuite des livres sur le même plan, à l'aide d'éclaircissements et d'explications (qu'ils avaient recueillis), et celui d'entre eux qui traita

causes (1) of the inanimate creation such as minerals, meteorological phenomena and the like.

The First Discourse, upon those things which occur upon the earth.

SECTION 1. *Upon Mountains.*

We shall begin by establishing the condition of the formation of mountains and the opinions that must be known upon this subject. The first [topic] is the condition of the formation of stone (2), the second is the condition of the formation of stones great in bulk or in number, and the third is the condition of the formation of cliffs and heights.

We say that, for the most part (3), pure earth does not petrify, because the predominance of dryness over [i. e. in] the earth endows it not with coherence but rather with crumbliness. In general, stone is formed in two ways only (*a*) through the hardening (4) of clay, and (*b*) by the congelation [of waters] (5). Many stones in fact, are formed

ce sujet de la manière la plus complète fut Ibn Sînâ (Avicenne). Nous avons dit qu'il avait réuni, dans son *Kitab es-Chefa*, les sept sciences philosophiques. »

Ibn Sînâ's آثار علويّة correspond to « ce qui a lieu dans le ciel en fait de images, de vapeurs, de tonnerre, d'éclairs et d'ouragans, etc. »

1. عِلَل plural of عِلّة signifies *secondary causes* as opposed to اسباب *primary causes*. *Cf.* Ibn Khaldûn, *ed. cit.*, II, 428 : « Pour faire qu'une chose ait lieu, il faut en connaître les causes premières et secondaires, ainsi que les conditions nécessaires à sa production ; en un mot, il faut connaître les principes d'où elle dérive ; car les choses se présentent toujours dans un ordre et une liaison réguliers ».

فاذا قصد ايجاد شيء من الاشياء فلاجل الترتيب بين الحوادث لا بدّ من التفطّن بسببه او علته او شرطه وهي على الجملة مبادئه اذ لا يوجد الّا ثانيا عنها ولا يمكن ايقاع المتقدّم متاخّرا ولا المتاخّر متقدّما *

2. حجارة *hijāra*, collective plural. It seems as though the next حجارة ought to be احجار *aḥjār*, the ordinary plural, but all three MSS. we have used read حجارة. Stapleton, however, working from the Teheran edition and a MS. of the Asiatic Society of Bengal, gives the suggested reading.

3. The Latin version begins here.

4. تفخير This word, rendered in the Latin version by *conglutinatio*, is unknown to the dictionaries. It appears to mean the conversion of clay into the hard form which it assumes when baked.

5. Latin *congelatio*. The reference is to the deposition of solids from water, interpreted by Ibn Sînâ (and others) as a solidification of the water itself.

from a substance (1) in which earthiness predominates, and many of them are derived from a substance in which aquosity predominates. Often a clay dries and is changed at first into something intermediate between stone and clay, *viz.* a soft stone, and afterwards is changed into stone [proper]. The clay which most readily lends itself to this is that which is agglutinative, for if it is not agglutinative it usually crumbles before it petrifies. In my childhood I saw, on the bank of the Oxus (2), deposits of the clay which people use for washing their heads (3); subsequently I observed that it had become converted into a soft stone, and that was in the space of approximately 23 years (4).

Stone has also been formed from flowing water in two ways (*a*) by the congelation of the water as it falls drop by drop or as a whole during its flow (5), and (*b*) by the deposition from it, in its course,

1. جوهر *jauhar*, essence, essential substance, substance as opposed to accident.

2. *Jaiḥûn*. Yaqut (Barbier de Meynard. *Dictionnaire géographique, historique et littéraire de la Perse et des contrées adjacentes, extrait du* Mo'djem el-Bouldan *de Yaqout*, Paris, 1861, pp. 183 *ff.*) gives a long description of the Oxus. — « Ce nom (Jaiḥûn) est étranger, et c'est sans raison que quelques auteurs le font dériver du mot جاح, qui signifie *déraciner*, *arracher*, parce que ce fleuve dévore ses deux rives. Cette opinion ne mérite pas d'être discutée. Selon Hamzah, le nom primitif de Djeïhoun est *Heroun* (هرون), vallée du Khoraçân, au milieu de laquelle est la ville de Djeïhân (جيحان), dont les Persans, dans leur prononciation emphatique, ont fait *Djeïhoun*. — D'après Ibn el-Faqih, il sort d'un endroit nommé *Rîwsarân* (ريوساران), montagne qui touche aux pays du Sind, de l'Inde et de Kaboul; cette montagne donne naissance à une source près d'un lieu nommé *'Indemis* (عندميس). — Le Djeïhoun, dit el-Isthakhri, est d'abord une rivière nommée *Djourbâb* (جُرباب), qui sort du pays de *Wekkhâb* (وخّاب) sur les frontières du *Bedakhschân*. Il se joint à d'autres rivières dans le pays de *Khottel* (ختّل) et de *Wakhsh* (وخش), et de la réunion de tous ces affluents provient le grand fleuve Djeïhoun », *etc.*

3. *(Stapleton.)* « This clay, which is known in Baghdad as *Ṭîn Khâwah*, presumably contains sodium carbonate, but we have been unable to obtain a sample in Calcutta. In India the naturally occurring *Sajji Matti* (crude sodium carbonate) is used for the same purpose ». It is green in colour and of a creamy consistency.

4. The Latin version says 33 years, but this is clearly an error.

5. برُمّته *lit.* with its rope, *i. e.* altogether, as a whole (Lane, *s. v.*). The Latin translator omitted the latter part of this sentence, probably because he did not understand it.

of something which adheres to the surface of its bed and [then] petrifies. Running waters have been observed, part of which, dripping upon a certain spot, solidifies into stone or pebbles of various colours, and dripping water has been seen which, though not congealing normally, yet immediately petrifies when it falls upon stony ground near its channel. We know therefore that in that ground there must be a congealing petrifying virtue which converts the liquid to the solid. Thus the bases of the formation of stone are [either] a soft clayey substance or a substance in which aquosity predominates. Congelation of the latter variety must be caused by a mineralizing, solidifying virtue, or earthiness must have become predominant in it in the same way in which salt is coagulated, *i. e.* earthiness becomes predominant in it by reason of its [peculiar] virtue and not of its amount. If indeed the earthy quality is not like that in salt, but is of a different kind, nevertheless the two must be similar in that they are transformed by heat, and in that the advent of heat coagulates them. Or it may be that the virtue is yet another, unknown to us. Alternatively, the converse may be true — that its earthiness has prevailed merely by a cold dry virtue.

In short, it is in the nature of water, as you know (1), to become transformed into earth through a predominating earthy virtue ; you know, too, that it is in the nature of earth to become transformed into water through a predominating aqueous virtue. In this connection, there is a substance used by those folk who have lost their way amid their artful contrivances (2) which, when they are so minded, they

1. Or, *as I have shown*, which is perhaps more probable, though MS. C definitely vocalises in the second person masculine singular.

2. A thrust at the alchemists. Stapleton says : — « The full rendering of the Arabic of these last two sentences is as follows : ' There is a thing that certain people, who have gone astray, prepare in their experiments, called *Virgin's Milk*, which is composed of two waters. This coagulates into a dry substance, which clearly proves the truth of what we have stated above (*i. e.* that water can be turned into stone). They have likewise many other things that they prepare during the processes of liquefaction and coagulation that also prove these laws '. The version of the Latin translator betrays the fact that he himself is numbered

call *Virgin's Milk* (1); it is compounded of two waters which coagulate into a hard solid. This is a indication of the truth of [what I have

amongst those who ' have gone astray '. Ibn Sînâ in using the word ضلّوا evidently refers to the ' too-ingenious ' experimenter ».

1. *Lac virginis* is a name applied to many substances in alchemical literature. The following passage occurs in a book called *Diodori Enchyontis de Polychymia libri quatuor* (Basle, 1567, p. 47); — *Aqua lac virginum dicta.* Rec. Lithargyri argenti in mortario subtiliter pulverizati, quantum volueris, maceretur per biduum vel triduum, in aceto fortissimo vini albi, ut quatuor digitis supra pulverem emineat, et singulis diebus quater agitetur. Tertio deinde vel quarto die effundatur paulatim acetum, ne agitetur aut confundatur cum aceto pulvis in fundo residens, in vasculum, quod seorsim optime obturatum, in loco frigido conservetur. Haec aqua subito splendorem et nitorem rebus inducit. Deinde paretur lixivium acre, ex cineribus optimis albis, nec dum extinctis, de ligno seu carbonibus quernis. Potest vero cum aqua pluvia seu fluviatili vel decoctione ad tertiae partis consumptionem lixivium fieri, vel destillatione per filtrum. Quibus sic paratis si ad usum revocare libeat, effundatur in volam manus aquae praescriptae ex lithargyro nimirum destillatae, guttula una, cui aliquid lixivii primi admisceatur, et de oleo crepino pars una, sic in lac subito, paulo vero post in caseum convertuntur. Ut primum autem acetum a lithargyri pulvere, ut supra dictum est, fuerit separatum, aqua frigida perfundatur, et bacculo sal qui fundo adhaeret agitetur, sicque postea exiccetur et servetur. Est enim ad allium bonae operationis. Calcis quoque huius usus quandoque est, ubi testae ovorum ad manus non sunt, necque enim calx semper inveniri potest, nisi de nova fiat. Similiter pro lithargyro sumi potest, alumen iamenum et rochae, sal gemmens, vel sal alkali, etc. Haec enim omnia contrita et pulverizata, in aqua clara, quae tribus aut quatuor digitis emineat, ad tertiae partis consumptionem decoquuntur. Huic decoctae aquae, si prior de lithargyro, commisceatur, subito fit conversio in lac, et paulo post in caseum coagulatio, atque hoc ipso quoque ad decorem et venustatem mulieres utuntur.

According to William Johnson, *Lexicon Chymicum*, printed in Manget's *Bibl. Chem. Curiosa*, vol. I, page 247, *Lac virginis* est aqua Mercurialis. Etiam *Lac virginis*, est Mercurius Philosophorum, succus Solariae et Lunariae.

Berthelot (*Moyen Age*, ii, page 29) says : Le *lait virginal* est une dénomination symbolique, souvent usitée chez les alchimistes. Ce serait en particulier le nom que les chimistes donnent au mercure, suivant le lexique de Bar Bahloul. On doit d'ailleurs entendre par là un chlorure de mercure, plutôt que le mercure métallique.

It seems clear that Ibn Sînâ's reference is merely to two liquids which when mixed give a white precipitate, such as the solutions of lead acetate and potassium carbonate mentioned in the extract from the *Polychymia* above. That a white

said above] (1). They have also many things which they use in liquefaction and coagulation which bear witness to the soundness of these judgments.

Stones are formed, then, either by the hardening of agglutinative clay in the sun, or by the coagulation of aquosity by a desiccative earthy quality, or by reason of a desiccation through heat. If what is said concerning the petrifaction of animals and plants is true, the cause of this [phenomenon] is a powerful mineralizing and petrifying virtue which arises in certain stony spots, or emanates suddenly from the earth during earthquakes and subsidences (2), and petrifies whatever comes into contact with it. As a matter of fact, the petrifaction of the bodies of animals and plants is not more extraordinary than the transformation of waters.

It is not impossible for compounds to be converted into a single element if the virtue of the latter gets the mastery over them, for each of the elements they contain may be converted into that element. For this reason anything which falls into salt-pans is converted into salt, while objects which fall into the fire are converted into fire. As for the swiftness or slowness of the conversion, that is a matter which necessarily varies according to the variation in the strength of the virtues ; if they are very violent they perform the conversion in a short time. In Arabia there is a tract of volcanic earth (3) which turns

solid is thrown down from a mixture of these solutions was known to Jâbir ibn Ḥayyân, who mentions the fact in his *Kitâb al-Khawâṣṣ al-Kabîr* (British Museum MS.).

1. *Lit.* of this.

2. خَسَفَ means *it sank down into the earth. Cf.* Qur'ân, xxviii, 82, لَخُسِفَ بِنا *= we had been swallowed up by the earth.*

3. حرّة. Lane describes a *ḥarra* as a stony tract, of which the stones are black and worn and crumbling, as though burned with fire. Stapleton has the following note : « *Harrah* is an outcrop of volcanic rock often found in Arabia. Burton (*Pilgrimage to Al-Madinah and Meccah*, Memorial Ed. Vol. I, p. 421) says : ' Harrah, from Harr (heat) is the generic name of lava, porous basalt, scoriae, greenstone, schiste, and other [stones] supposed to be of igneous origin. It is also

to its own colour everyone who lives there and every object which falls upon it. I myself have seen a loaf of bread in the shape of a *raghîf* (1) — baked, thin in the middle, and showing the marks of a bite — which had petrified but still retained its original colour, and on one of its sides was the impression of the lines in the oven. I found it thrown away on a mountain near Jâjarm (2), a town of Khurâsân, and I carried it about with me for a time. These things appear strange only on account of their infrequent occurrence ; their natural causes, however, are manifest and well-known.

Certain varieties of stone are formed during the extinction of fire, and frequently ferreous and stony bodies originate during thunder-storms, by reason of the accidental qualities of coldness and dryness which fieriness acquires when it is extinguished. In the country of the Turks (3) there fell, amid thunder and lightning, coppery bodies in the shape of arrowheads with a projection turned back towards the top. A similar one fell in Jîl and Dailam (4), and when it fell it penetrated into the earth. The substance of all these was coppery and dry. I myself undertook, in Khwarazm (5), the difficult task of fusing a head of that kind, but it would not melt ; a greenish fume

used to denote a ridge or hill of such formation.' Several famous ones exist close to Madinah. »

Doughty, *Arabia Deserta*, 1923, I, 419, says : — « In the train of Harras we see a spectacle of the old vulcanic violence that tormented this border of the Arabian peninsula. I have followed these Harras almost to Mecca ; that is through nearly seven degrees of latitude ». Doughty has numerous other references to *harras*, for which see the index to his book.

1. Lane : — A *raghîf* is « a round cake of bread, such as is thick, or not thin, generally about a span, or less, in width, and from half an inch to an inch in thickness ». Dozy, *Supplément, sub voce* : — « Dans le Minho, notamment à Oporto et à Braga, on donne le nom de regueifa à des pains blancs en forme d'anneau. »

2. Latin *Lurgeam !* Jâjarm lies approximately 56° E. by 37° N. (in modern Persia).

3. Latin version : *in Persia.*

4. Two Persian provinces on the south-west shores of the Caspian Sea.

5. Modern Khiva.

continued to come off from it until at length an ashy substance remained (1).

I regard as true, on unexceptionable evidence, an event which happened in Jûzjânân (2) in our own time : a ferreous body, which perhaps weighed 150 *mana* (3), fell from the sky, penetrated the ground, and then rebounded once or twice like a ball which has been thrown against a wall ; afterwards it penetrated into the ground again. People heard a tremendous, terrifying, noise and when they investigated the matter they took possession of the object and carried it to the Governor of Jûzjânân. He wrote about it to the Sultan of Khurâsân, contemporary with us, the Amîr Yamîn al-Daula wa 'Amîn al-Milla Abu'l-Qâsim Maḥmûd ibn Sabaktagîn al-Muzaffar al-Mughallib (4), who ordered him to send him the object or a part of it. Its

1. Mention of the greenish fume confirms Ibn Sinâ's identification of the substance as « coppery », though perhaps it may have been nickel as is the case with many meteorites.

2. Jûzjânân is in Herat (Khurâsân). It is famous as the spot from which Naṣir-i-Khusraw, author of the *Safar-nama*, set out upon his travels on December 19, 1045 A. D. Ibn Sinâ's friend and companion Abû 'Ubaidallah 'Abdu'l-Wâḥid ibn Muḥammad came from Jûzjânân.

3. A *mana* is about two pounds. Among the Chaldaeans and Egyptians the *mana* was the sixtieth part of the talent, which itself weighed 93.65 lbs. It is an extremely ancient weight, for the Ashmolean Museum has a specimen dating from the reign of Entemena, great-grandson of Ur-Nina ; it is pear-shaped, with a deep groove on each side running from the point to the base, and carries the following inscription : — *One mana of wages in wool. Dudu the High-Priest.* It weighs 680.485 grams (about 1 $\frac{1}{2}$ lbs.).

One would not have thought that a weight of rather less than 3 cwt. was very difficult to transport (p. 25). The Latin version has 100 marks, *i. e.*, approximately 100 lbs.

4. S. Lane-Poole, *Mohammadan Dynasties*, 1925, pp. 286 and 287 : — « Yamîn al-Daula Maḥmûd ibn Sabaktagîn came to the throne in A. D. 998 (A. H. 388) ». « Maḥmûd of Ghazna, the son of Sabaktagîn, is one of the greatest figures in Moḥammadan history. After overcoming his younger brother Ismâ'îl, who had forced a contest, he repudiated the supremacy of the feeble representative of the Sâmânids, and received an investiture for the governments of Khurâsân and Ghazna direct from the Caliph of Baghdâd, ' the dispenser of powers which he himself no longer enjoyed ' ..... Besides his Indian wars, Maḥmûd beat off the

removal, however, proved too difficult on account of its weight, so they attempted to break off a piece of it, but the tools could work it only with difficulty, every drill and chisel used upon it breaking. At length, however, they cut off a fragment of it and sent it to the Sultan, who ordered a sword to be struck from it, but this proved too difficult. It is said that the substance was entirely composed of small rounded granular particles adhering to one another (1). All this was seen by my friend the lawyer Abû 'Ubaidallah 'Abdu'l-Wâḥid ibn Muḥammad al-Jûzjânî (2). I am told that many of the beautiful swords of the Yaman are made from this kind of iron only (3) and that the poets of the Arabs have described the fact in their poems (4).

attack of the Îlak Khân, reduced Ghôr (1010) and the country of the Upper Marghâb (1012), and even annexed Transoxania with its two great cities of Samarḳand and Bukhârâ in 1016 ».

1. *Cf. Encycl. Britannica*, XVIII, p. 264 (Eleventh Edition) : — About eleven out of every twelve of the known meteoric stones belong to a division to which Rose gave the name *chondritic* (χόνδρος, a grain) ; they present a very fine-grained but crystalline matrix or paste, consisting of olivine and enstatite or bronzite, with more or less nickel-iron, troilite, chromite, augite and triclinic feldspar ; through this paste are disseminated round chondrules of various sizes and generally with the same composition as the matrix ; in some cases the chondrules consist wholly or in part of glass. Some meteorites consist almost solely of chondrules ; others contain only few ; in some cases the chondrules are easily separable from the surrounding material.

2. Ibn Sînâ's faithful companion for many years.

3. Sir Robert A. Hadfield, F. R. S., the eminent authority on iron and steel, whom we consulted upon this point, writes : — As regards the sword made from meteoric iron, as the latter is usually a compound of Iron and Nickel, with Cobalt and some other elements, yet at the same time hardly any Carbon, it is quite to be understood that this material, although forgeable, would only give a product which on quenching would be tough but quite soft, and not carry a cutting edge.

4. Having been unable to confirm this statement, we asked the help of Professor R. A. Nicholson, who writes : — « I cannot find any authority for the statement of Ibn Sînâ that the Arab poets refer to meteoric iron as the material from which the best swords were made. Possibly Ibn Sînâ may have misunderstood such passages as that in which Muslim b. al-Walîd describes a flashing sword as « a deadly meteor » (شِهابُ المَوْتِ). The whole subject of the sword in Arabic poetry has been treated very fully by Schwarzglose in his *Waffen der alten Araber*, but there is nothing in his citations to support Ibn Sînâ ».

This, then, is one kind of way in which stone is formed. A trustworthy man from among the Shaikhs of the kingdom of Iṣfahân, Abû Manṣûr Hormuz Diyâr ibn Mashakzâr, one in close relation with the illustrious Amîr Abû Ja'far Muḥammad ibn Dushmanzâr (may God have mercy upon him!) (1), told me that there fell from the sky, in the mountains of Ṭabaristâu, an object the fall of which resembled the fall of the above-mentioned mass of iron, except that in this case it was a huge stone. This completes the discourse upon the formation of stones (2).

As for the formation of large stones, this may occur all at once (3), by intense heat acting suddenly upon a large mass of clay, or little by little with the passage of time.

The formation of heights is brought about by (*a*) an essential cause (4)

1. S. Lane-Poole, *Mohammadan Dynasties*, 1925, p. 145: — « Moḥammad b. Dushmanzâr, known as Ibn-Kâkwayh, was first cousin to Majd-al-dawla the Buwayhid, of Hamadhân, whose dominions he annexed by the deposition of Samâ-al-dawla in 1023 A. D. He had previously taken Iṣpahân in 1007 A. D. The family continued to rule in Iṣpahân, Hamadhân, Yazd, Nahâwand, etc., until their conquest by the *Seljûḳ* Tughril Beg in 1051 A. D. »

2. *Caput I* does not end with this sentence, as it should, but with the following one. With regard to Ibn Sînâ's description of meteorites the appended passages from the *Encyclopaedia Britannica*, Vol. XVIII, are of interest: — (p. 262) « The fall of stones from the sky, though not credited by scientific men till the end of the 18th century, had been again and again placed on record.... The oldest existing meteorite of which the fall is known to have been observed is that which fell at Ensisheim in Elsass on the 10th of November 1492. It was seen to strike the ground and was immediately dug out; it had penetrated to a depth of 5 ft. and was found to weigh 260 pounds.... Meteoritic falls are independent of thunderstorms and all other terrestrial circumstances.... The largest single mass seen to fall is one of those which came down at Kniyahinya, Hungary, in 1866, and weighed 547 lb; but far larger masses, inferred from their characters to be meteorites, have been met with.... In the case of the Hessle fall, several stones fell on the ice, which was only a few inches thick, and rebounded without breaking the ice or being broken themselves.... »

In the same vol., p. 261, it is stated that an abundant meteoric display took place on October 15, 1002 A. D., a date which accords well with the observations of Ibn Sînâ.

3. دفعة. 4. سبب بالذات.

and (*b*) an accidental cause (1). The essential cause [is concerned] when, as in many violent earthquakes, the wind which produces the earthquake raises a part of the ground and a height is suddenly formed (2). In the case of the accidental cause, certain parts of the ground become hollowed out while others do not, by the erosive action of winds and floods which carry away one part of the earth but not another. That part which suffers the action of the current becomes hollowed out, while that upon which the current does not flow is left as a height. The current continues to penetrate the first-formed hollow until at length it forms a deep valley, while the area from which it has turned aside is left as an eminence. This may be taken as what is definitely known about mountains and the hollows and passes between them (3).

Very often both water and wind would be ineffectual except for the fact that the earth is not uniform, some parts of it being soft and

1. سبب بالعرض.

2. *Cf.* the opinion of Aristotle, in *Meteorologica*, that earthquakes are due to the formation of winds within the earth.

With the views expressed here and later in this section, it is interesting to compare those which Ovid ascribes to Pythagoras (*Metamorphoses*, XV, trans. by F. J. Miller, 1916, pp. 383 *etc.*) : — « I myself have seen what was once solid land changed into sea ; and again I have seen land made from the sea. Sea-shells have been seen lying far from the ocean, and an ancient anchor has been found on a mountain-top. What once was a level plain, down-flowing waters have made into a valley ; and hills by the force of floods have been washed into the sea. What was once marsh is now a parched stretch of dry sand, and what was once dry and thirsty now is a marshy pool..... Near Troezen, ruled by Pittheus, there is a hill, high and treeless, which once was a perfectly level plain, but now a hill ; for, horrible to relate, the wild forces of the winds, shut up in dark regions underground, seeking an outlet for their flowing and striving vainly to obtain a freer space, since there was no chink in all their prison through which their breath could go, puffed out and stretched the ground, just as when one inflates a bladder with his breath, or the skin of a horned goat. That swelling in the ground remained, has still the appearance of a high hill, and has hardened as the years went by ».

3. That is, so far Ibn Sînâ has merely been stating what was generally accepted ; his own views upon the details and methods of the processes follow.

others stony. The soft, earthy parts become hollowed out and the stony parts are left behind as elevations. With the passage of time, the channel is excavated and widened more and more, while the raised portion is left, becoming relatively higher and higher as more earth is hollowed out from [beside] it. These, then, are the principal causes of the three changes [mentioned at the beginning of the *faṣl*, *viz.* the formation of stone, the formation of stones great in bulk or in number, and the formation of cliffs and heights] (1).

Mountains have been formed by one [or other] of the causes of the formation of stone, most probably from agglutinative clay which slowly dried and petrified during ages of which we have no record. It seems likely that this habitable world was in former days uninhabitable and, indeed, submerged beneath the ocean (2). Then, becoming exposed little by little, it petrified in the course of ages the limits of which history has not preserved ; or it may have petrified beneath the waters by reason of the intense heat confined under the sea. The more probable [of these two possibilities] is that petrifaction occurred after the earth had been exposed, and that the condition of the clay, which would then be agglutinative, assisted the petrifaction (3).

It is for this reason [*i. e.* that the earth was once covered by the sea] that in many stones, when they are broken, are found parts of aquatic animals, such as shells, etc. (4)

It is not impossible that the mineralizing virtue (5) was generated there [*i. e.* in the petrifying clay] and aided the process, while the

1. *Cf.* page 18.

2. A suggestion which goes back at least as far as Xenophanes of Colophon (614 B. C.) and was accepted by Herodotus, Strabo, Aristotle and others.

3. *Cf.* page 19.

4. Ibn Sinà was not alone in this anticipation of the conclusions of Nicolas Steno, for Xenophanes and the other philosophers mentioned in footnote 2 based their views upon the occurrence of shells in regions far from the sea. After the death of Ibn Sinà, however, orthodox belief repudiated the natural deduction from the observed facts, although Leonardo da Vinci was courageous enough to reaffirm it.

5. *Cf.* page 22.

waters also may have petrified. Most probably, mountains were formed by all these causes.

The abundance of stone in them is due to the abundance, in the sea, of clay which was afterwards exposed. Their elevation is due to the excavating action of floods and winds on the matter which lies between them, for if you examine the majority of mountains you will see that the hollows between them have been caused by floods. This action, however, took place and was completed only in the course of many ages, so that the trace of each individual flood has not been left ; only that of the most recent of them can be seen.

At the present time, most mountains are in the stage of decay and disintegration, for they grew and were formed only during their gradual exposure by the waters. Now, however, they are in the grip of disintegration, except those of them which God wills should increase through the petrifaction of waters upon them, or through floods which bring them a large quantity of clay that petrifies on them. I have, I believe, heard that this has been observed on certain mountains. As for [the similar phenomenon] which I witnessed upon the banks of the Oxus, that place cannot properly be called a mountain (1).

Of the land which was exposed by the retreat of the waters, those parts which were of harder clay or more strongly petrified or of greater bulk than the rest remained as elevations and heights when the other parts had been carried away.

As for the veins of clay that are found in mountains, it is possible that these were formed not from the main substance which has undergone petrifaction, but from *débris* of the mountains that turned into dust and filled the valleys and ravines. It then became moistened by streams which flowed upon it, and was covered by the layers of stone forming the mountains, or interlaid with the good clay of the latter (2). It is possible also that the ancient clay of the sea was not

1. *Cf.* page 19.

2. Stapleton renders this passage as follows : — *This deposit was then moistened by flowing streams and either covered with refuse from the mountains,*

uniform in substance, and that in succession (1) some of it petrified thoroughly, while some did not petrify at all, and some was converted only into a soft stone through a certain quality predominant in it or by reason of some one of innumerable other causes.

It is also possible that the sea may have happened to flow little by little over land consisting of both plain and mountain and then have ebbed away from it; and so it came to pass that the plain was turned into clay without the same befalling the mountain. Once converted into clay, it was in a fit state to undergo petrifaction when it became exposed, and its petrifaction would be complete and strong. When exposure of the matter which was petrifying took place, it must frequently have happened that the old petrified portions [*i. e.* the mountains] were in a state fit for disintegration, and so would suffer the converse of what was happening to the earth. That is, they became moist and soft and turned into dust again, which itself is in a fit state for petrifaction. For example, when you soak a brick, some earth and some clay in water, and then expose each of them to the fire, the soaking will increase the tendency of the brick to be disintegrated again by the fire, and will also increase the tendency of the earth and the clay to petrify strongly.

or mixed with good clay from the same source. It would seem that his text was defective; no doubt it read انرضاض for ارهاص and خلطه for خلّلته. رهص is an uncommon word, and European dictionaries we have consulted do not give much help, the only one to mention it at all being that of Salmoné. There is, however, a lengthy article upon the word and its derivatives on pp. 310 and 311 of vol. 8 of the *Lisânu'l-'Arab*, 1st. edn., Boulak, 1301 A. H., from which the following extracts are taken. The rendering of ارهاص given in the translation probably expresses its sense in the present connection. We have, in fact, taken ارهاص as equivalent to the plural of رَصَف.

١. الرواهص الصخور المتراصفة الثابتة — ٢. الرَّهْص الطين الذى يجعل بعضه على بعض فيُبْنَى به — ٣. الارهاص الاثبات — ٣. الرهص ..... تَأْسِيس البنيان *

The meaning of خلّلته is clear from the context, but similar uses are not uncommon. *Cf.* Lane, *s. v.*

1. من ترتيبه .

It is possible that each time the land was exposed by the ebbing of the sea a layer was left, since we see that some mountains appear to have been piled up layer by layer, and it is therefore likely that the clay from which they were formed was itself at one time arranged in layers. One layer was formed first, then, at a different period, a further layer was formed and piled [upon the first, and so on]. Over each layer there spread a substance of different material, which formed a partition between it and the next layer ; but when petrifaction took place something occurred to the partition which caused it to break up and disintegrate from between the layers (1).

As to the bottom of the sea, its clay is either sedimentary or primaeval, the latter not being sedimentary. It is probable that the sedimentary clay was formed by the disintegration of the strata of mountains (2).

1. The text of the first sentence of this passage is unsatisfactory in all three MSS. we have used. We have therefore adopted Stapleton's rendering, as he seems to have had a text more correct than ours in this passage. He has, however, not translated the passage from *piled up layer by layer* to *between the layers*, remarking that the Arabic original of the latter portion of *Faṣl* I is full of mistakes, and that if the mediaeval translator had a similar text before him, it is easy to understand the difficulty he evidently experienced in rendering the Arabic into Latin.

Except for the sentence above-mentioned, the passage in question does not present any peculiar difficulty if our text is correct, though it is true that what Ibn Sinâ means to convey about the partitions between the layers is not as clear as could be desired. It is evident that he wished to explain (*a*) why the various layers of clay did not mix while they were still in a viscous state, which he does by postulating the formation of partitions ; and (*b*) why the partitions are not to be discovered in actual practice.

2. *Cf. Encyclopaedia Britannica*, XI, p. 656 : — « The sedimentary or stratified rocks form by much the larger part of the dry land of the globe, and they are prolonged to an unknown distance from the shores under the bed of the sea. They include those masses of mineral matter which, unlike the igneous rocks, can be traced back to a definite origin on the surface of the earth. Three distinct types may be recognized among them : (*a*) By far the largest proportion of them consists of different kinds of sediment derived from the disintegration of pre-existing rocks. In this « fragmental » group are placed all the varieties of shingle, gravel, sand, clay and mud, whether these materials remain in a loose incoherent

Such is the formation of mountains (1).

condition, or have been compacted into solid stone. (*b*) Another group consists of materials that have been deposited by chemical precipitation from solution in water. The white sinter laid down by calcareous springs is a familiar example on a small scale. Beds of rock-salt, gypsum and dolomite have, in some regions, been accumulated to a thickness of many thousand feet, by successive precipitations of the salt contained in the water of inland seas. (*c*) An abundant and highly important series of sedimentary formations has been formed from the remains of plants and animals .... As the sedimentary rocks have for the most part been laid down under water, and more especially on the sea floor, they are often spoken of as « aqueous », in contradistinction to the igneous rocks ..... It is from the sedimentary rocks that the main portion of geological history is derived. They have been deposited one over another in successive strata from a remote period in the development of the globe down to the present time. From this arrangement they have been termed « stratified », in contrast to the unstratified or igneous series. They have preserved memorials of the geographical revolutions which the surface of the earth has undergone; and above all, in the abundant fossils which they have enclosed, they furnish a momentous record of the various tribes of plants and animals which have successively flourished on land and sea. »

1. *Caput II* of the Latin version ends here.

SECTION ON THE FORMATION OF MINERALS.

The time has now arrived for us to give an account of the properties (1) of mineral substances. We say, therefore, that mineral bodies may be roughly divided into four groups, *viz.* stones, fusible substances, sulphurs and salts (2). This is for the following reason : some

1. احوال.

2. *Cf.* the classification given by Al-Râzî in his *Kitâb al-Asrâr* (see Fleischer, *Catalogus Librorum Manuscriptorum qui in Bibliotheca Senatoria Civitatis Lipsiensis asservantur, edidit Naumann*, 1838, *Codices Orientalium Linguarum*, p. 509, K. 215, no. CCLXVI). —

Elementa terrestria sex generum sunt :

املاح ; بوارق ; زاجات ; احجار ; اجساد ; ارواح.

1. *Spiritus quatuor :*

الكبريت ; الزرنيخ ; النشادر ; الزيبق.

2. *Corpora septem :*

الحديد الصينىّ ; القلعى ; الرصاص ; الحديد ; النحاس ; الفضة ; الذهب.

3. *Lapides tredecim :*

الكحل ; الشّب ; السادنج ; الفيروزج ; الدهنج ; اللازورد ; التوتيا ; الدوص ; المغنيسيا ; المرقشيثا ; الزجاج ; الجبسين ; الطلق.

4. *Vitriola quinque :*

القلقنة ; السّوريين ; القلقطار ; القلقديس ; الزاج الاسود.

5. *Nitra sex :*

بورق العرب ; البورق الزاوندىّ ; التنكار ; بورق الصاغة ; النطرون ; بورق الخبز.

6. *Sales undecim :*

الملح البيضىّ ; الملح الهندىّ ; الملح النفطى ; الملح الاندرانىّ ; الملح المرّ ; الملح الطيّب ; الطبرزد ; ملح النورة ; ملح الرماد ; ملح البول ; ملح القلىّ.

Horum elementorum sex arte quaeruntur : التنكار ; القلقطار ; القلقد يس ; ملح البول ; ملح الرماد ; ملح القلىّ ;

cetera natura praebet.

Cf. also the classification of substances given in the *Mafâtîh al-'Ulûm* (*ed.* van Vloten, 1895, pp. 258-263), which is apparently based upon that of Al-Râzî. Other schemes of classification are given in the *Letters of the Brethren of Purity* (*ed.* Dieterici, Leipzig, 1886), etc.

of the mineral bodies are weak in substance (1) and feeble in composition (2) and union (3), while others are strong in substance. Of the latter, some are malleable and some are not malleable. Of [the former, *i. e.*] those which are feeble in substance, some have the nature of salt and are easily dissolved by moisture, such as alum, vitriol, sal-ammoniac and *qalqand* (4), while others are oily in nature and are not easily dissolved by moisture alone, such as sulphur and arsenic [sulphides] (5).

Mercury is included in the second group, inasmuch as it is the essential constituent element of malleable bodies or at least is similar to it (6).

All malleable bodies are fusible, though sometimes only indirectly (7), whereas most non-malleable substances cannot be fused in the orthodox way (8) or even softened except with difficulty.

The material (9) of malleable bodies is an aqueous substance united so firmly with an earthy substance that the two cannot be separated from one another. This aqueous substance has been congealed by cold after heat has acted upon it and matured it (10). Included in the group [of malleable bodies], however, are some which are still quick (11)

1. جوهر.
2. تركيب.
3. مزاج.
4. qalqand, قلقند, χάλκανθος, green vitriol, $FeSO_4 . 7H_2O$. *Vide infra*, p. 36 etc.
5. زرنيخ, *zarnīkh*, realgar, orpiment, As_2S_2 and As_2S_3.
6. This is not merely an expression of Ibn Sīnā's natural caution but a reference to general alchemical opinion, *viz. Our mercury is not the mercury of the vulgar.* The word rendered by *essential constituent element* is عنصر.
7. ولو بالحيلة, *lit.* though it be by artifice.
8. بالاذابة الرسمية.
9. مادة.
10. انضاجه, *lit.* roasting, cooking. *Cf.* page 4.
11. In the sense of *alive*, or as in *quicksilver*. This passage proved very troublesome to the Latin translator, or at least to the copyists, the general rendering being: *Et erit exemplum a vino quod nondum gelavit propter suam unctuositatem: et ideo non est ductile.* The Trinity MS. 1122, however, seems to read

and have not congealed on account of their oily nature ; for this reason, too, they are malleable (1).

As regards the stony kinds of naturally-occurring mineral substances, the material of which they are made is also aqueous, but they have not been congealed by cold alone. Their congelation has, on the contrary, been brought about by dryness which has converted the aquosity into terrestreity. They do not contain a quick, oily humidity

a vivo for *a vino*, so that it is possible that Alfred the Englishman was not far out.

1. That *est ductile*, and not *non est ductile*, is correct is shown not merely by the agreement of all the Arabic MSS. but by the whole argument (see below). On the theory that metals are composed of an aqueous substance and an earthy substance, *cf.* Aristotle, following Heraclitus (W. D. Ross, *Aristotle*, London, 1923, p. 109) : — « There are two ' exhalations ' produced by the sun's rays acting on the surface of the earth. When the sun's rays fall on dry land, they draw up from it an exhalation which is hot and dry, and which Aristotle likens for the most part to smoke but also to fire and to wind. When they fall upon water, they draw up an exhalation which like water is moist and cold, and is called the vaporous in opposition to the smoky exhalation. The dry exhalation consists of minute particles of earth on the way to being fire, and exhibiting already, though in a weaker degree, the properties of fire — heat and dryness. The moist exhalation consists of minute particles of water on the way to becoming air, but exhibiting in the main the qualities of water — coldness and moisture .... Aristotle turns next to the effects produced by the exhalations when ' imprisoned ' in the earth, i. e. the minerals. These are divided into the metals, which are formed by the moist exhalation, and the ' fossiles ', formed of the dry ; most of the latter are said to be either ' coloured powders ' or stones formed out of such. »

According to Jâbir ibn Ḥayyân (see *Chemistry to Dalton*, by E. J. Holmyard, Oxford, 1925, p. 18), there are two constituents of metals, an earthy smoke and a watery steam. Condensation of these exhalations in the bowels of the earth gives rise to sulphur and mercury ; combination of sulphur and mercury results in the formation of metals.

Abu'l-Qâsim al-'Irâqî (see his *Kitâb al-'Ilm al-Muktasab*, edited and translated by E. J. Holmyard, Paris, 1923, p. 13) says : — « The moistness and dryness of which minerals are composed are nothing but watery steam and earthy smoke ; if compounded together in right proportion, they give rise to the six metals, while if the dryness, that is, the smoke, is in too great proportion, then are formed brittle stones such as the marcasites, magnesias, tutias, and the stones related to the mineral substances from *kuḥl* and *zarnîkh*, etc. If the moistness, that is, the steam, is in too great proportion, mercury, and nothing else, will result. »

and so are non-malleable ; and because their solidification has been caused mainly by dryness, the majority of them are infusible unless they are subjected to some physical process which facilitates fusion (1).

Alum and sal-ammoniac belong to the family of salts (2), though sal-ammoniac possesses a fieriness in excess of its earthiness, and may therefore be completely sublimed. It consists of water combined with a hot smoke, very tenuous and excessively fiery, and has been coagulated by dryness.

In the case of the sulphurs, their aquosity has suffered a vigorous leavening with earthiness and aeriness under the leavening action of heat, so far as to become oily in nature ; subsequently it has been solidified by cold.

The vitriols (3) are composed of a salty principle, a sulphureous principle and stone, and contain the virtue of some of the fusible bodies [metals]. Those of them which resemble *qalqand* and *qalqaṭâr* (4)

1. For this elegant rendering of فلذلك لا يذوب اكثرها الا ان يحتال عليه الخ we are indebted to Prof. Stapleton.

2. It will be remembered that Al-Râzî classifies alum as a stone and sal-ammoniac as a spirit. Sal-ammoniac is practically universally classed as a spirit by the Arabs, Ibn Sinâ being the only exception so far as we are aware.

3-4. E. Wiedemann has the following informative passage upon vitriols (*Sitzungsberichte der Physikalisch-medizinischen Sozietät in Erlangen*, vol. 43, p. 97, 1911) : — « Bei den Vitriolen erwähnt *Dimaschqî* einen gelben kyprischen u. s. w. Die Liste der Vitriole ist bei den *Mafâtîḥ* sehr unvollständig. Nach Seidel wäre *Qalqaṭâr* kupferhaltiger Eisenvitriol ; *Zâg* im allgemeinen Eisensulfat. Eine Reihe von Angaben über den Vitriol hat de Goeje gesammelt gelegentlich der Erwähnung des Vorkommens des Vitriols der Tinte (*Ḥibr*) in der Nähe von Kairo (*Muqaddasî* S. 209). Sie ist der gelbe Varietät (*Qazwînî* Bd. 1, S. 226), sie heisst auch al *ḏahabî* die goldige, diese kommt in *Karmân* (*Qaz.* Bd. 2, S. 164) vor ; *Ibn al Baiṭâr* und *Ibn Gazla* nennen sie *Qalqant* oder *Qalqand* oder auch nur *zâg* (*Mas.* Bd. 2, S. 407) ; T. A. sagt, sie gehört zu den Bestandteilen der Tinte. Von ihr ist eine andere Art zu unterscheiden, die auch gelb ist, der Vitriol der Färber (*Ṣabâġain*) oder der Schuhflicker (*Asâkifa*). Die grüne heisst nach *Qaz.* auch *Qalqaṭâr* und *Qalqand*, während *Ibn Baiṭâr* und *Ibn Gazla* die gelbe *Qalqaṭâr*, die grüne *Qalqant* nennen. Die weisse Art heisst *Qalqadîs* und *Schûgijâr* (*Ibn Gazla*) und *Schabb* (*Qaz.*). Die rote aus Zypern kommende *al sûrî*, das griechische σῶρυ, ist das wertvollste. Die schwarze wird nur bei *Qazw.* erwähnt. »

are formed from crude vitriols by partial solution, the salty constituent alone dissolving, together with whatever sulphureity there may

In his book *Kitâb al-Burhân fî Asrâr 'Ilm al-Mîzân*, Al-Jildakî has a section on vitriols, of which the following is a summary: — « There are seven kinds of vitriol, *viz.* the yellow, the green, the red, *qalqaṭâr*, *qalqand*, *qalqadîs* and *shaḥîra*; they are all naturally-occurring minerals, and from any one of them all the others may be prepared. *Qalqadîs* is white vitriol, *qalqand* yellow, shading off into green and black, *qalqaṭâr* is yellow vitriol in which are shining golden eyes. *Al-sûrî* is red vitriol; *al-shaḥîra* is yellow shading off into green and pure blue. Al-Râzî says that there are seven sorts of vitriol [but *cf.* footnote 2, p. 33] but mentions only six, and one of these is alum, which is not a vitriol; yet in another place he groups the alums and the vitriols separately in spite of what he said previously. In still another place he says that *qalqadîs* is a white vitriol, which is correct, and that *qalqand* is green vitriol, but this is only partially true for it implies that every green vitriol is *qalqand*, and this is not so. He says too that *qalqaṭâr* is yellow vitriol and that *al-sûrî* is red vitriol, but does not say how they may be distinguished. Finally he says that the vitriol mines are in Cyprus and that vitriols are formed from [crude] vitriols and alums, which the waters dissolve and carry down with them into the hollows of the earth, after which the heat of the sun coagulates them together. This, however, is only partially true, for the alums are different from the vitriols in nature, reactions and properties. According to Ibn Sînâ, the vitriols are partially soluble bodies, which have been dissolved and then solidified [*cf.* text]; *qalqaṭâr* is yellow vitriol, *qalqadîs* is white, *qalqant* is green and *al-sûrî* red. Dioscorides and Galen do not mention *qalqant* among the species of vitriol, but mention *qalqadîs* alone, saying that its name in Greek is *chalkanthos*. It is clear to anyone who examines their writings that *qalqant* with them is *qalqadîs* itself, and that what they call *vitriol* is green vitriol, which Ibn Sînâ calls *qalqant*. Ibn Juljul [*cf.* Brockelmann, I, 237 — Abû Dâ'ûd Sulaimân ibn Ḥassan ibn Juljul was physician in ordinary to the Spanish-Arab Caliph Hishâm II al-Mu'ayyad billah, 976-1009 A. D. There is a Latin version of one of his works on simples in the Bodleian: *Supplementum simplicium, quae in Dioscoride desiderantur*] says that whoever maintains that *qalqant* is *qalqadîs* has erred, and that his error proves his ignorance of these two substances. Galen and Dioscorides say that it has been maintained that *shaḥîra* is green vitriol, and Ibn Sînâ says the same. Others say that *shaḥîra*, which is the vitriol of 'Irâq, is cobblers' vitriol. Abû Ja'far Muḥammad ibn Aḥmad ibn Sayyid al-Khâfiqain, one of the reliable authorities on simples, quoting from Galen in the 9th. chapter of his book on *Medicinal Simples*, describes the vitriol mines in Cyprus [here follows a long description]. Dioscorides says that the commonest sort of *qalqant* is that which has the colour of lazward [lapis lazuli], and is hard, heavy, clean and pure. I [*i. e.* Al-Jildakî] say that why vitriols are boiled [and crystallized] is to purify them from their earthy particles which become mixed

be. Coagulation follows, after a virtue has been acquired from a metallic ore. Those that acquire the virtue of iron become red or yellow, *e. g. qalqaṭâr*, while those which acquire the virtue of copper become green. It is for this reason that they are so easily prepared by means of this art (1).

Mercury seems to be water with which a very tenuous and sulphureous earth has become so intimately mixed that no surface can be separated from it without something of that dryness covering it. Consequently it does not cling to the hand or confine itself closely to the shape of the vessel which contains it, but remains in no particular shape unless it is subdued (2). Its whiteness is derived from the purity of that aquosity, from the whiteness of the subtle earthiness which it contains, and from the admixture of aeriness with it (3).

A property of mercury is that it is solidified by the vapours of sulphureous substances (4); it is therefore quickly solidified by lead (5)

with them in the mines and weaken their properties. There is general agreement that the choicest sort of *qalqaṭâr* is that which is coppery in colour and is easily powdered; it has no stone in it. The best kind of vilriol is that which comes from Cyprus. »

1. We have taken the ما of ما امكن ان يعمل to be ما التعجّبية though the Trinity MS. 1400 reads *unde impossibile est artificialiter ista duo fieri.* A similar use of ما التعجّبية occurs later.

2. Probably the meaning is: unless it is amalgamated or sublimed or fixed, *i. e.* converted into a compound.

3. *Cf.* Geber, *Sum of Perfection*, Third Part, Chap. VI (London, 1678): — « Argentvive, which is also called Mercury by the Ancients, is a viscous water in the bowels of the earth, by most temperate Heat united, in a total Union through its least parts, with the substance of white subtile earth, until the humid be contempered by the dry, and the dry by the humid, equally. Therefore it runs easily upon a plain superficies, by reason of its Watery Humidity; but it adheres not, although it hath a viscous Humidily, by reason of the Dryness of that which contemperates it, and permits it not to adhere. It is also, as some say, the Matter of Metals with Sulphur. »

4. *I. e.* converted into sulphides.

5. It is rather difficult to understand why lead should be given as an example of a sulphureous substance which coagulates mercury. Ibn Sînâ may be confusing elementary lead with *galena*, PbS, or perhaps رصاص, lead, is an error for زرنيخ, *zarnîkh*, arsenic sulphide.

or by sulphur vapour. It seems, moreover, that mercury, or something resembling it, is the essential constituent element (1) of all the fusible bodies, for all of them are converted into mercury on fusion (2). Most of them, however, fuse only at a very high temperature (3), so that their mercury appears red. In the case of lead, an onlooker does not doubt that this is mercury, since it melts at a lower temperature, but if during the fusion it is heated to the high temperature [mentioned above], its colour becomes the same as that of the other fusible bodies, *i. e.* fiery-red.

It is for this reason, *viz.* that it is of their substance, that mercury so easily clings to all these bodies (4). But these bodies differ in their composition from it by reason of variation in the mercury itself — or whatever it is that plays the same part — and also through variation in what is mixed with it and causes its solidification (5).

If the mercury be pure, and if it be commingled with and solidified by the virtue of a white sulphur which neither induces combustion (6) nor is impure, but on the contrary is more excellent than that prepared by the adepts (7), then the product is silver. If the sulphur besides being pure is even better than that just described, and whiter, and if in addition it possesses a tinctorial, fiery, subtle and non-combustive virtue — in short, if it is superior to that which the adepts can prepare — it will solidify the mercury into gold.

Then again, if the mercury is of good substance, but the sulphur which solidifies it is impure, possessing on the contrary a property of combustibility, the product will be copper. If the mercury is corrupt, unclean, lacking in cohesion and earthy, and the sulphur is also

1. عنصر.
2. This naïve interpretation of the nature of a fused metal is common in alchemy.
3. حمى means literally a vehement heat.
4. *I. e.* amalgamates with the metals.
5. *I. e.* sulphur or something resembling it.
6. غير محرق.
7. *I. e.* the alchemists.

impure, the product will be iron. As for tin, it is probable that its mercury is good, but that its sulphur is corrupt; and that the commingling [of the two] is not firm, but has taken place, so to speak, layer by layer, for which reason the metal shrieks (1). Lead, it seems likely, is formed from an impure, heavy, clayey mercury and an impure, fetid and feeble sulphur, for which reason its solidification has not been thorough (2).

There is little doubt that, by alchemy, the adepts can contrive solidifications in which the qualities of the solidifications of mercury by the sulphurs are perceptible to the senses, though the alchemical qualities are not identical in principle or in perfection with the natural ones, but merely bear a resemblance and relationship to them (3). Hence the belief arises that their natural formation takes

1. A reference to the well-known *cry of tin*. *Cf.* Geber, *ed. cit.*, p. 163: — « That there is a twofold substance of argentvive in tin, whereof one is not fixed, and the other fixed, is proved, because it makes a crashing noise before its calcination, but after it hath been thrice calcined, that crashing is not; the reason of this is, because the fugitive substance of its argentvive, making that crashing, is flown away. » [Modern chemistry ascribes the cry to friction of the crystalline particles.]

2. According to Geber, *op. cit.*, p. 166, « lead differs not from tin .... except that it hath a more unclean substance, commixed of the two more gross substances, viz. of sulphur and argentvive, and that the sulphur in it is burning, and more adhesive to the substance of its own argentvive; and that it hath more of the substance of fixed sulphur to its composition than Jupiter hath. »

3. The passage beginning *There is little doubt* is not easy to render literally, though the meaning is clear, *viz.* that the alchemists can artificially prepare substances which to all appearance are metals, though the apparent qualities are not absolutely identical with those of real metals. The Latin translation evades the difficulty of exactness with *Et artifices gelationem fere similem artificialiter faciunt, quamvis artificialia non eodem modo sunt quo naturalia.*

Prof. Stapleton, in his rough rendering, translates as follows: — « There is little doubt that experts can bring about by *various* alchemical devices coagulations, similar to those produced by the union of mercury and the sulphurs, although the artificial products *thus obtained* are not precisely identical with those occurring in nature, but *only* bear a more or less close resemblance to them. »

In this rendering, we think that Prof. Stapleton has been too much influenced by the Latin version: no doubt he would have revised it if occasion had arisen.

It will be seen from a later passage [p. 42] that Ibn Sînâ was of opinion that

place in this way or in some similar way, though alchemy falls short of nature in this respect and, in spite of great effort, cannot overtake her (1).

As to the claims of the alchemists (2), it must be clearly understood that it is not in their power to bring about any true change of species. They can, however, produce excellent imitations (3), dyeing the red [metal] white so that it closely resembles silver, or dyeing it yellow so that it closely resembles gold. They can, too, dye the white [metal] with any colour they desire, until it bears a close resemblance to gold or copper; and they can free the leads (4) from most of their defects and impurities. Yet in these [dyed metals] the essential nature remains unchanged; they are merely so dominated by induced qualities that errors may be made concerning them, just as it happens that men are deceived by salt, *qalqand*, sal-ammoniac, *etc.* (5).

I do not deny that such a degree of accuracy may be reached as to deceive even the shrewdest (6), but the possibility of eliminating or imparting the specific difference has never been clear to me. On the contrary, I regard it as impossible, since there is no way of splitting up one combination into another (7). Those properties which are perceived by the senses (8) are probably not the differences which

the sensible qualities — in the Aristotelian sense of the word — were perhaps not those which in reality distinguish one metallic species from another; hence his use of the word محسوسة.

1. But the general view of the alchemists was that expressed in a marginal note to one of the Trinity MSS. — *Natura nonnunquam operatur arte iuvante de qua hic non loquitur.*

2. Here begins the passage so famous in the Middle Ages.

3. تشبيهات حسنة.

4. *I. e.* lead and tin.

5. Ibn Sinâ seems to imply that artificial sal-ammoniac, *qalqand, etc.* are not identical with the natural products — a view which is paralleled to-day among the general public, who usually imagine that synthetic indigo, for example, is not veritable indigo but only a very good imitation.

6. القرهة.

7. لا سبيل الى حل المزاج الى المزاج الاخر.

8. الاحوال المحسوسة.

separate the metals into species, but rather accidents (1) or consequences (2), the specific differences being unknown. And if a thing is unknown, how is it possible for anyone to endeavour to produce it or to destroy it?

As for the removal or imparting of the dyes [above-mentioned], or such accidental properties as odours and densities, these are things which one ought not to persist in denying merely because of lack of knowledge concerning them, for there is no proof whatever of their impossibility.

It is likely that the proportion of the elements (3) which enter into the composition (4) of the essential substance (5) of each of the metals enumerated is different from that of any other. If this is so, one metal cannot be converted into another unless the compound is broken up and converted into the composition of that into which its transformation is desired (6). This, however, cannot be effected by fusion, which maintains the union and merely causes the introduction of some foreign substance or virtue.

There is much I could have said upon this subject if I had so desired, but there is little profit in it nor is there any necessity for it here (7).

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1. عوارض.
2. لوازم.
3. عناصر.
4. تركيب.
5. جوهر.
6. *Cf.* the Latin version of this passage. It will be seen that the Arabic says nothing of converting the substance into its prime matter, though perhaps this is implied.
7. The Latin version omits the last sentence: no doubt the sarcasm of it was unpalatable.

Text of the Latin Version

MAXIMI PHILOSOPHORUM ARISTOTELIS DE MINERALIBUS (1).

Terra pura lapis non fit quia continuacionem non facit sed commutacionem (2) Vincens tamen (3) in ea siccitas non permittit eam conglutinari Fiunt autem lapides duobis modis / conglutinacione / et congelacione. In quibusdam enim lapidibus dominans est terra / In alijs vero aqua Aliquotiens desiccatur lutum / fitque primum quod medium est inter lutum et lapidem / et deinceps fit lapis Lutum vero huic transitioni apparens (4) est unctuosum (5) / quod enim tale est (6) coniunctivum erit In ipso (7) quoque Gion visa est terra que dicitur in lapidem commuti (8) in spacio annorum centum (9) De aqua autem fiunt lapides duobus modis Unus quidem est quod congelatur aqua guttatim cadens Alius quando descendit de aqua currente aliquid quod (10) residet in superficie fundi ipsius / quod fit (11) lapis Sunt eciam certa loca que aque infusa convertuntur in lapides diversorum colorum Suntque aque que seorsum accepte non conglutinantur que si prope alveum suum fundantur / congelantur / fiuntque lapides.

1. TB *Mineralia Avicenne.*
2. TB *comminucionem,* which agrees better with the Arabic تفتت.
3. B, L *enim.*
4. TB *aptius.*
5. TB *viscosum.*
6. B, L *non est.* The sense requires the omission of the negative.
7. B, L *ipsis.* Theatrum Chemicum has, correctly, *in ripis,* in which it agrees with Artis Auriferae and Manget. TB illegible here.
8. B, L *converti.*
9. TB *in spacio xxxiii annorum.* The Arabic has 23 years. Gion is of course Jaiḥûn, Oxus.
10. B *quiddam*; L *quidam*; TB *quoddam.*
11. B, L omit *quod.* TB *fitque.*

Scimus quoque ([1]) quod in terra illa est visi vistal ([2]) que congelat ipsam ([3]) Principalia quoque ([4]) lapidum utrorumque ([5]) vel sunt ex substancia lutea unctuosa vel ex substancia in qua vivit ([6]) aqua / que virtute quadam ([7]) congelatur / vel vincit siccitas in ea ([8]) terre faciens eam congelari eodem modo quo coagulatur sal / salem enim non sufficit terrea vis permutare ([9]) sed adiuvat ipsum calor Calor enim adveniens congelat ipsum virtute occulta / et fortassis ([10]) fit virtute terrea frigida et sicca. Aqua enim fit terra cum vicerint eam qualitates terre et econverso Est autem res qua utuntur quidam ingeniosi qui ([11]) voluerunt rem siccatam coagulare que componitur ex duabus aquis et dicitur lac virgineus ([12]) / et hic eius est ([13]) certissimus effectus. Sunt eciam multa alia quibus coagulant et liquefaciunt ([14]) certissime. Fiunt ergo lapides ex luto unctuoso per calorem solis vel ex aqua coagulata ([15]) virtute terrea ex causa calida desiccativa similiter quoque quedam vegetabilia et quedam animalia vertuntur in lapides virtute quadam minerali lapidificativa / et fit in loco lapidoso vel discontinuantur subito virtute quadam que exit a terra in hora terre motus que convertit lapides quod consequitur in hora illa ([16]) Et hec transmutacio corporum animalium et vegetabilium eque propinqua est ([17]) sicut transmutacio aquarum Est autem impossibile

1. B, L *ergo*; TB *igitur.*
2. B, L *visi visial*; TB correctly *vis mineralis.*
3. TB *aquas.*
4. B, L *ergo*; TB *igitur.*
5. B, L *utraque*; TB omits.
6. TB correctly *vincit.*
7. TB inserts correctly *minerali.*
8. TB omits.
9. TB omits *permutare.*
10. B, L, TB *fortasse.*
11. B, L omit *qui*; TB *cum.*
12. TB *virginis.*
13. B, L *est hic eius*; TB *estque eius*, and *effectus certissimus.*
14. TB inserts *terre.*
15. TA. Page 9, *recto.*
16. TB omits *quod consequitur in hora illa.*
17. B, L omit *est.*

quod aliquid (1) complexionatum vertatur (2) in unum elementum / sed elementa mutantur adinvicem et sic transeunt in dominans / Unde quod cadit in salinas fit sal / et quod in ignem cadit fit ignis sed quedam cicius quedam tardius / et hoc est (3) secundum potenciam activarum et existenciam (4) passivarum. Est (5) locus in Arabia qui colorat omnia corpora in eo existencia colore suo / Panis quoque prope toracem in lapidem conversus est / remansit tamen ei color suus Sunt talia miranda (6) / quia raro accidunt Ceterum cause eorum manifeste sunt Sepe eciam fiunt lapides ex igne cum extinguitur / et sepe contingit corpora ferrea vel lapidea cadere cum corruscacionibus quia ignis fit frigidus et siccus cum extinccione sua Et in Parthia (7) cadunt eciam cum corruscacione corpora aerea ut (8) es ustum et similia sagittis hamatis (9) et non possunt liquefieri / quia per ignem evaporatum (10) est (11) fumum viriditati convenientem (12) Donec residuus sit (13) cinis / Cecidit quoque apud vergetos (14) frustrum (15) ferri centum librarum arenorum (16) quod pre duricia sua fere erat infrangibile / missa est tamen pars eius regi cuidam (17) / qui cum precepisset inde fieri enses erat infabricabile. Dicunt tamen arabes

1. B, L, TB *aliquod.*
2. TB *convertatur.* B, L, TB add *totum.*
3. TB omits *et hoc est.*
4. B, L, TB *resistenciam.*
5. B, L, TB *estque.*
6. B, L *una* (clearly an error for *mira*); TB *mira.*
7. TB *Persia.*
8. B, L *vel.*
9. TB *barbaricis.*
10. TB *evaporant.*
11. TB *in.*
12. TB *attingentem.*
13. B, L, TB *fit.*
14. B, L *vergeci*; TB *apudragem.*
15. L *frustum.*
16. TB illegible here. MS. 16142 of the Bibliothèque Nationale has *frustum ferri ponderis centum quinquagenta marcarum*, thus agreeing with the Arabic.
17. B, L *corvices*; TB illegible. Theatrum Chemicum *Torati.* [Arabic Khurâsân.]

quod enses Laniantii (1) qui optimi sunt de tali ferro fiunt cum autem ceciderit massa illa resilit a terra aliquotiens ut pila / erat enim (2) composita ex minimis frustulis cocuntibus adinvicem ad quantitatem granorum milii magnorum Similiter (3) quoque huic rei evenit apud tempestatem (4) / Sic ergo (5) fiunt lapides / eorum siquidem generacio vel subito fit per magnum calorem (6) accidentem lnto unctuoso / aut paulatim et successive indurescunt (7) Montes quoque quandoque fiunt ex causa essenciali (8) cum vehementi terre motu elevatur terra et fit mons. Accidentali vero (9) ut cum ex ventis vel ex aque ductu accidit arenatio (10) profunda et fit paulatim donec fit vasta profunditas et tunc erit (11) iuxta eam magna eminencia Et hec est precipua moncium causa. Sunt eciam quedam terre molles / et quedam dure / Molles in aqueductibus (12, 13) ventisque tolluntur Dureque remanent et sic (14) fit eminencia / fit eciam generacio moncium sicut lapidum / quia (15) aqueductus adducit lutum unctuosum (16) continue quod longitudine temporis (17) desiccatur et fit lapis / sed (18) vis mineralis

1. B, L *alamantii*; TB *alemanie*; Artis Auriferae *alemanici*. [Arabic al-Yamânî.]
2. B, L omit *enim*; TB *qualibet*.
3. TB *simile*.
4. B, L *trepastem*; TB *thorpasten* (?). [Arabic Tabaristân.]
5. TB *igitur*. [TA Page 9 *verso*.]
6. TB *maximam caliditatem*.
7. TB *vel paulatim vel per multum temporum*; B, L *aut paulatim temporis*.
8. TB adds correctly *quandoque ex accidentali*. Most printed editions read *Montes quoque quandoque fiunt ex causa essentiali, quandoque ex causa accidentali*.
9. B, L omit *vero*.
10. TB *continuatim* apparently. Most printed editions have, correctly, *cavatio*.
11. B, L *erit ergo*; TB *erit igitur*.
12. B, L *molles quoque aque ductibus*; TB *molles quoque ductibus*.
13. TA here has *quoque* scored through.
14. B, L *neque*; TB *fitque*.
15. TB *que*.
16. TB *illic viscosum*.
17. TB *per longitudinem temporum*.
18. B, L *et non longe qui fit*; TB *et non longe deficit quod (?) sit hec virtus*.

brevius (1) vertit aquam (2) in lapides Et ideo in multis lapidibus inveniuntur partes quedam quorundam animalium aquaticorum et aereorum (3). Montes vero per multa tempora facti sunt ut predixi de eis (4) sed iam (5) sunt decrescentes Vene autem lutee que reperiuntur in eminentibus locis non sunt de materia illa lapidea sed de eo quod (6) dimittitur (7) de montibus vel terrestris aliqua (8) substancia quam adducunt aque cum lutis et herbis que admiscentur cum luto montis vel forte antiquum lutum maris non est unius substancie que (9) pars eius fit lapis / et pars eius non sed mollitur et dissolvitur aliqua qualitate vincente. Maris quoque ascensus (10) quedam loca cavat (11) / quedam extollit quia (12) quandoque totam terram cooperuit / et inde quedam mollia abrasit / dura vero (13) reliquit / et ipsa in quibusdam (14) congessit mollia quedam quoque ab eo congesta cum abscinderet ea desiccata sunt et in montes conversa Hec materialia corpora (15) in quatuor dividuntur species / in lapides / liquefactiva / sulphurea / et sales Et horum quedam sunt rare substancie et debilis complexionis / et quedam fortis substancie (16) / quedam ductilia (17) et quedam non Et eorum que debilis substancie sunt / quedam sunt sales ut que

1. B, L, TB omit *brevius.*
2. B, L, TB *vertens aquas.*
3. B, L, TB correctly *aliorum.*
4. B, L *in eis*; TB omits *in eis* and has *ut prediximus.*
5. B, L, TB *nunc.*
6. TB *que.*
7. TB *devolvuntur.*
8. TB *aut.*
9. TB *quarum.*
10. TB *accessus et recessus.*
11. TB inserts *et.*
12. TB *quod.*
13. TB *et dura quedam.*
14. TB adds *locis.*
15. TB correctly, and in agreement with most printed editions, has *Corpora mineralia.*
16. B, L, TB insert *et.*
17. TA page 10 *recto.*

liquefiunt ex humido leviter ([1]) ut alumen calcantum et sal armoniacum Et quedam sunt unctuosa / nec liquescunt ([2]) solo humido ([3]) facile / ut sulphur et auripigmentum Sed argentum vivum de parte secunda ([4]) est quamvis sit elementum ductilissimum ([5]) sciencie ([6]) / aliquibus ductibilibus ([7]) sunt autem ductilia omnia liquabilia / et ut plurimum ([8]) non ductilia neque non liquabilia mollificantur nisi cum magna violencia Et materia liquabilium ([9]) est substancie aquea mixta cum substancia terrea mixtura forti nec potest unum separari ab altero ([10]) ut gelatur substancia aque illius ([11]) cum frigore post accionem caloris in ipsum ([12]) que est obtesis ([13]) et erit exemplum alumen ([14]) quod nondum gelavit propter suam unctuositatem et id est ductibile ([15]) Lapidea vero de substanciis mineralibus materialiter ([16]) sunt aque / sed non congelantur aqua sola / sed eciam cum siccitate que alterat aqueitatem ad terreitatem et non est in eis humor nimis unctuosus et ideo non ducuntur / et ([17]) quia eorum coagulacio est ex siccitate non solvuntur ut multum nisi par ingenia naturalia solvencia / Alumen autem et sal armoniacum sunt de genere salis nisi quia igne ([18]) inanimato ([19]) magis quam terrea / unde et totum sublimatur

1. TB *statim.*
2. TB *liquefiunt.*
3. TB *humore.*
4. TB adds *divisionis mineralium.*
5. B, L *ductissimum*; TB *ductilium.*
6. TB correctly *vel simile.*
7. TB *ductilibus.*
8. B, L *multum*; TB *et sunt multum ductilia non liquabilia* (correctly).
9. TB *ductilium.*
10. TB *altri*; B, L *et*; TB *et congelatur.*
11. TB *istius,* omitting *aque.*
12. TB *ipsa.*
13. TB *optesis.*
14. TB apparently *a vivo quod non.*
15. TB *et ideo est ductile.*
16. TB *natura.*
17. TB omits *non ducuntur et.*
18. TB *ignis.*
19. TB correctly *in sale armoniaco.*

et ipsum est aqua cum (1) admiscetur fumus calidus fumo subtili multo igneitati (2) est coagulatum ex siccitate Aquaitas vero sulphureorum mixta est (3) cum terra forti commixtione confeccione (4) caloris donec facta sunt unctuosa et postea coagulata ex frigore Attramenta vero composita sunt cum (5) sale et sulphure et ex lapidibus et est in eis vis aliquorum (6) corporum liquabilium Quod autem ex eis fuerit (7) ut calcantum et alachar generantur ex maioribus granis attramenti et non (8) solvitur nisi salsedo (9) eius cum eo quod est in eo sulphureum et postea coagulatur et illud (10) iam accepit (11) vim mineralem ab aliquibus corporibus quod autem accepit (12) vim ferream erit rubeum et croceum ut calcar Quod vero vim aeream accepit erit viride / unde impossibile (13) est (14) artificialiter ista duo fieri (15) Argentum vivum vero ut aqua (16) commiscetur (17) cum terra nimium (18) subtili sulphurea mixtione forti ne (19) quiescat in superficie plana / et hoc est ex siccitate magna que inest illi (20) et ideo non (21) adheret

1. TB *cui.*
2. TB incorrectly *aqueitatis.*
3. TB *per mixacionem.*
4. TB correctly *fermentacione.*
5. TB *ex.*
6. TB *aliorum.*
7. TB *fiunt.*
8. TA page 10 *verso.*
9. TB *adeo.*
10. TB *idem.*
11. TB *accidit.*
12. TB *ceperit.*
13. B, L, TB *possibile.*
14. B *et*; TB *erit.*
15. TB *a secundo artificialiter fieri.*
16. B, L, TB *que.*
17. B, L, TB *miscetur.*
18. TB *nimis.*
19. TB *donec non.*
20. TB *illa.*
21. TB omits, incorrectly, *non.*

tangenti / est quod (1) albedo eius ex claritate illius (2) aque / et ex albedine terre subtilis que est in eo / et eciam (3) admixtione (4) aeris cum eo quod proximum eius quod coagulatur ex vapore sulphuris (5) facile videtur autem quod argentum vivum et aque illi sunt similia ele (6) sit (7) elementum omnium (8) liquabilium / quia omnia liquabilia cum liquantur convertuntur ad ipsum (9) / ipsa tamen non liquantur prius (10) quam calefiant / cumque calefacta fuerint apparent rubea Sed plumbum procul dubio cum liquatur est argentum vivum sed non liquatur nisi prius calefiat Et cum calefactum (11) fuerit convertitur ad colorem communem omnibus liquabilibus ut igneum ruborem et ideo miscetur (12) argentum vivum cum illis corporibus quia est de substancia eorum Sed illa (13) corpora differunt in composicione sua ab eo illo (14) modo quo differt argentum vivum ad sua similia (15) et per commixtionem que (16) miscentur cum illis donec congelentur / et si (17) fuerit vivum argentum purum / coget (18) illud vis sulphuris albi et non urentis et istud (19) est (20) optimum (21) quod (22) possunt

1. B, L *est que* ; TB *Et quoque.*
2. TB *ipsius.*
3. TB inserts *ex.*
4. TB *immixtione.*
5. TB inserts correctly *et forte hoc modo gelatur per plumbum vel ex vapore sulphuris.*
6. TA has *et aque illi sunt similia ele* (sic) scored through. B, L, TB *et que illi sunt similia elementum sunt ...*
7. B, L *sint.*
8. TB omits *omnium.*
9. TB *ipsa.*
10. TB omits *prius.*
11. TB *liquatum.*
12. TB *promiscetur.*
13. TB *ista.*
14. B, L, TB *illo eo.*
15. TB *a suis similibus.*
16. TB *Et promixtiones alie.*
17. TB *cum.*
18. TB *et congelabit.*
19. TB *id*
20. TB inserts *res.*
21. TB *optima.*
22. TB *quam.*

reperire (1) illi qui operantur (2) alkimia (3) ut (4) convertant illud in argentum Et si fuerit sulphur nitidum (5) optimum cum rubore clarum et fuerit (6) in eo vis igneitatis simplicis non urentis / erit res optima quam recipere (7) possunt alkimiste ut ex eo fiat aurum Hoc enim ipsum convertit (8) / et si fuerit argentum vivum bonum et bone substancie et sulphur non purum quod non sit in eo vis adurens convertet ipsum in aes Argentum autem vivum si fuerit maculatum (9) non mundum (10) terreum porosum / et sulfur (11) non mundum fiet ex eo ferrum In stagno videtur esse argentum vivum bonum sulphur vero malum et non bene mixta (12) Plumbi vero argentum vivum est immundum luteum (13) et sulphur eius malum / multi (14) vaporis et fetidi (15) / unde non (16) bene congelatur Et artifices gelacionem fere similem (17) artificialiter faciunt quamvis artificilia non eodem modo sunt quo naturalia nec tam certa licet propinqua sint similia / et ideo creditur quod composicio eius naturalis hoc modo sit vel vicina huic / sed ars est debilior quam natura et non consequitur eam quamvis

1. TB *accipere.*
2. TA page 11 *recto.*
3. TB *alkimiam.*
4. TB *et.*
5. TB *Et fiunt sulphur mundum.*
6. TB *fiunt.*
7. TB *reperire.*
8. B, L *convertat*; TB *convertitur.* TB adds *in aurum.*
9. TB *malum.*
10. TB *immundum.*
11. TB adds *sicut.*
12. B, L *et haec si bene mixta.* TB adds *sed tanquam .... composita.* The printed editions usually have *sed tanquam per parva composita, et ideo non fit tale.* For the last phrase TB has *et ideo bene fit tale.* B, L have *et ideo fit sal.*
13. B, L *Plumbi vero grossi argentum vivum est male ponderosum luteum*: TB *Plumbi vero grossi argentum vivum est malum ponderosum et luteum.*
14. TB *mali.*
15. B, L add *et debilis.*
16. TB omits *non.*
17. B, L *sensibilem.*

multum laboret Quare sciant (1) artifices alkimie species metallorum (2) mutare (3) non posse / sed similia (4) facere possunt et tingere rubeum citrino (5) ut videatur aurum / aut tingere albo donec sit multum simile argento (6) / aut ere aut (7) plumbi immundicias abstergere possunt / verum tamen semper erit (8) plumbum quamquam (9) videatur argentum optinebunt tamen (10) in eo aliene qualitatis (11) Ceterum quod (12) differencia specifica aliquo tollatur ingenio (13) non credo possibile / quia in talibus (14) non est quod (15) complexio convertatur quia (16) ista sensibilia non sunt de quibus mutantur species sed sunt accidentalia et proprietatis (17). Differencie metallorum (18) enim (19) non sunt cognite / et (20) cum differencia non sit cognita quomodo poterit sciri utrum tollatur (21) nec ne vel quomodo tolli possit / sed expoliacio intus accidentum ut saporis coloris ponderis vel saltem

1. B, L, TB *sciant autem.*
2. B, L *vere*; TB *aeris.*
3. B, L *permutari*; TB *permutare.*
4. B, L insert *vel*; TB inserts *alia* (?).
5. TB *citrone.*
6. B, L *et album tingere colore quo volunt donec sit multum simile auro*; TB *et album tingere colore quo volunt donec sint simile materie aut auro.*
7. B, L omit the second *aut.*
8. TB *esset.*
9. B, L *etsi.* TB *quamvis.*
10. B, L *sed obtinebunt.* TB *optinebuntur in eo qualitates alienas.*
11. B, L *qualitates aliene.* B, L add *ne errent in eo homines nisi quia accipiunt in eo sal armoniacum*; TB adds *ut errent in eo qui accipiunt solem et salem et argentum. Cf.* the Arabic.
12. TB *que.*
13. B, L insert *ego.*
14. B, L omit *quia in talibus* and insert *et.*
15. B, L insert *una.*
16. B, L *quod.*
17. B, L *accidentia et proprietates,* agreeing with TB.
18. TA page 11 *verso.*
19. B, L *differentiae autem eorum metallorum.*
20. B, L omit *et.*
21. B *cola*; L *colla*; TB *tollitur.*

diminucio non impossibilis (1) quia tunc hec (2) ratio non stat Ceterum qui (3) proportio terrarum substanciarum compositis non erit in omnibus eadem Hec compositio (4) in aliam mutari non poterit compositionem nisi forte in primam reducantur materiam et sic in aliud quam prius erat permutatur (5) / Hoc autem per solam liquefactionem non fit sed acciduntur (6) ei ex hoc res quedam extranee (7) / etc. Finis.

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1. TB *sed expoliacio activum fieri potest ut colorum vaporum ponderum vel saltem diminucio non est possibile,* with *non est inpossibile* interlined.
2. TB *contra hoc.*
3. TA has *qui* scored through. TB *ceterum proposicio composicionis substantiarum istarum non erit in omnibus* (*eadem* omitted).
4. B, L omit *compositio* but add *ergo*; TB *igitur.*
5. B, L *permutetur*; TB *permutentur.*
6. L, TB *accidunt.*
7. B, L add *Explicit liber mineralium Aristotelis*; TB adds *Explicit capitulum mineralium Avicenne.*

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كتاب الشفاء

بسم الله الرّحمن الرّحيم

[A 144b] الفن الخامس من الطبيعيّات

فى الاثار العلويّة مقالتان [1] هذا الفن يشتمل على علل اكوان الكاينات التى لا نفس لها من المعادن والاثار العلويّة وما يشبهها [2]

المقالة الاولى فيما يحدث من ذلك بناحية الارض [3]

فصل فى الجبال لنبتدى اولا ولنحقق حال تكوّن الجبال والمباحث التى تجب ان تعلم فى ذلك اولها [4] حال تكون الحجارة [6] والثانى حال تكون الحجارة الكبيرة [5] او الكثيرة والثالث حال تكون [7] ما يكون له ارتفاع وسمو فنقول [8] اما فى الاكثر فان الارض الخالصة لا تحجر لان استيلاء اليبس على الارض لا يفيدها امتساكاً بل تفتتاً وانما تتكوّن [9] الحجارة فى الاكثر على وجهين من التكوّن احدها [A 145a] على سبيل التفخير والثانى على

1. C omits this phrase.
2. C omits وما يشبهها .
3. B فيما يحدث بناحية الارض من ذلك .
4. A اولهما .
5. C الجبال .
6. B الكثيرة او الكثيرة .
7. A omits تكون .
8. The Latin translation begins here.
9. B متكون .

سبيل الجمود فان كثيراً من الاحجار تتكوّن [1] من الجوهر الغالب فيه الارضيّة وكثيراً منها ما تكون [2] من الجوهر الغالب فيه المآئيّة وكثير من الطين يجف ويستحيل اولا شيئاً بين الحجر والطين وهو حجر رخو ثم يستحيل حجراً واولى الطينيات بذلك ما كان لزجاً فان لم يكن لزجاً فانه يتفتّت فى اكثر الامر قبل ان يتحجر وقد شاهدنا فى طفوليتنا مواضع كان فيها [3] الطين الذى يغسل به الراس وذلك فى شطّ جيحون ثم شاهدناه وقد [4] تحجر حجراً [5] رخواً وذلك فى مدّةٍ [6] قريبة [7] من ثلثة [8] وعشرين سنة وقد تتكوّن الحجارة من الماء السيال على وجهين احدهما ان يجمد المآء كما يقطر او كما [9] يسيل برمّته والثانى ان يرسب منه فى سيلانه شىء يازم وجه مسيله وقد [10] يتحجر وقد شوهدَتْ مياه تسيل [11] فما يقطر منها على موضع معلوم ينعقد حجراً او حصىً مختلفة الالوان وقد شوهد مآء قاطر اذا اخذ لم يجمد واذا انصب على ارض حجريّة تقرب من مسيله انعقد فى الحال حجراً فعلمنا ايضا ان لتلك

1. A يتكون .
2. C has تتكون for ما تكون .
3. A فيه .
4. A omits و .
5. B تحجر تحجرا ; A تحجرا تحجرا .
6. A, B والمدّة .
7. C غريبة .
8. C ثلث .
9. A omits this كما .
10. C و for وقد .
11. A يسيل .

الارض قوة معدنيّة مجمدة [1] تحيل السيال الى الجمود فمبادى تكون الحجارة اما جوهر طينى لزج واما جوهر يغلب فيه المآئية وهذا القسم يجوز ان يكون جموده من قوة معدنية مجمّدة ويجوز ان يكون قد غلب عليه الارضيّة على الوجه الذى ينعقد به الملح بان غلبت الارضيّة فيه بالقوة دون المقدار وان لم يكن على نحو كيفيّة الارضيّة التى فى الملح بل على كيفيّة اخرى ولكن تكون [2] مشاركة لها فى انها تتقلب [3] بمعاونة الحرارة فكما يصيبه [4] الحر يعقده او قوة اخرى مجهولة عندنا ويجوز ان يكون بالضدّ فيكون [5] ارضيته ينقلب [6] بقوّة باردة يابسة بعينه [7] وبالجملة فان المآء فى طباعه على ما علمت ان [8] يستحيل الى الارضية من غلبة قوة للارضية [9] والارض ايضاً كما علمت فى طباعها [10] ان تستحيل الى المآئيّة من غلبة قوة المآئية وهاهنا شيء يتخذه قوم بضلو فى حيلهم يسمونه لبن العذراء اذا شاؤوا وهو مركب من شيئين ينعقد جوهراً جاسياً [11] وذلك يدل على صحّة هذا ولهم اشياء كثيرة مما

1. B and C omit مجمدة .
2. A يكون .
3. B ينعقد ; C تتعلب .
4. C يصبّه .
5. C فتكون .
6. C تتغلب .
7. C تعيّنه .
8. C omits ان .
9. C الارض .
10. A, B طباعه .
11. A جاشيا or جائيا .

يتخذونه حلّاً وعقداً تصدق هذه الاحكام فتكوّن الاحجار اذاً امّا لتفخير الطين اللزج فى الشمس وامّا لانعقاد المآئيّة من طبيعة ميبّسة ارضيّة او سبب مجفف حارّ وان كان ما يحكى من تحجر حيوان [1] ونبات صحيحاً فالسبب فيه شدة قوة معدنيّة محجرة يحدث فى بعض البقاع الحجرية او ينفصل دفعة من الارض فى الزلازل والخسوف فيحجر ما يلقاه فانه ليس استحالة الاجسام الحيوانيّة والنباتية الى الحجرية ابعد من استحالة المياه ولا من الممتنع فى [2] المركبات ان يغلب عليه قوة عنصر واحد يستحيل اليه لان كل واحد من العناصر التى فيها ممّا ليس من جنس ذلك العنصر فشانه ان يستحيل الى ذلك العنصر ولذلك [3] ما يحستحيل [4] الاجسام الواقعة فى الملاحات الى الملح والاجسام الواقعة فى الحريق الى النار واما السرعة والابطآ فى الاستحالة فامر يجوز ان يختلف ايضاً بحسب القوى المختلفة فان كانت شديدةً جدا احالت فى زمان يسير وفى بلاد العرب حَرَّةٌ كل من يسكنها واى جسم يقع فيها يتلون بلونها وقد رايت رغيفاً على صورة الارغفة المحرقة المرققة [5] الوسط المرقومة بالسباع قد تحجر ولونه باقٍ واحد وجهيه عليه اثر التخطيط الذى يكون فى التنور ووجدته ملقى فى جبل قريب من بلدة من بلاد [6]

1. B, C حيوانات .
2. C من .
3. B لهذا .
4. C omits الى ذلك العنصر ولذلك ما يستحيل .
5. A المرقعة ; B المرفعة .
6. A بلدة .

خراسان يسمّى جاجرم وحملته معى مدّةً [1] وهذه الاشياء انما تستغرب [2] لقلة وقوعها فامّا [3] اسبابها فى الطبيعة فظاهرة موجودة [Page 145b] وقد يتكوّن انواع من الحجارة من النار اذا طفيت [4] وكثيراً ما يحدث فى الصواعق اجسام حديدية وحجريّة بسبب ما يعرض للناريّة ان تطفاء فتصير باردةً يابسةً وقد يقع فى بلاد الترك فى الصّواعق والبروق اجسام نحاسيّة على هيئة نصول السهام لها زايدة منعطفة الى فوق ويقع مثلها فى بلاد الجيل والديلم واذا وقعت غارت فى الارض ويكون جوهر جميع ذلك جوهراً نحاسياً يابساً [5] وقد تكلّفتُ اذابة نصل من ذلك بخوارزم [6] فلم يذب ولم يزل يتحلل [7] منه دخان ماوّن يضرب الى الخضرة حتى بقى منه جوهر رمادىّ وقد صحّ عندى بالتواتر ما كان ببلاد جوزجانان [8] فى زماننا الذى ادركناه من امر حديد لعله يزن ماية وخمسين منا نزل من الهواء فنفذ [9] فى الارض ثم نبا نبوة [10] او نبوتين [11] نبو الكرة التى يرمى [12] بها الحايط ثم عاد فنشب فى

1. C فبقى مدةً .
2. A يسنغرب ; B يسرب .
3. A, B واما .
4. A طفت ; B طفسب .
5. A omits يابساً .
6. C نحو اززم .
7. In C, by a copyist's error, the last sentence from جوهراً نحاسياً is repeated.
8. B حوزهاتان ; C حوزستان .
9. C فنفد .
10. C نباة .
11. C نباتين .
12. C يرما .

الارض وسمع الناس لذلك صوتا عظيماً هايلاً [1] فلما تفقّدوا امره ظفروا به وحمل الى وآلى جوزجنان ثم كاتبه سلطان خراسان فى عصرنا وهو الامير يمين الدولة وامين الملّة ابو القسم محمود بن سبكتكين المظفر المغلب يرسمه له انفاذه او انفاذ قطعة منه فتعذر نقله لثقله فحاولوا كسر قطعة منه فما كانت الآلات تعمل فيه الّا بجهدٍ وكان كلّ مثقبٍ وكل مقطع [2] يعمل فيه ينكسر لكنهم فصلوا منه اخر الامر شيئا [3] فانفذوه اليه ورام ان يطبع منه سيفاً فتعذر عليه وحكى ان جملة ذلك الجوهر كان ملتئماً من اجزآء جاورسيّة صغار مستديرة التصق بعضها ببعضٍ وهذا الفقيه ابو عبيد الله عبد الواحد بن محمد الجوزجانى صاحبى [4] شاهد هذا كله وحُدِّثتُ ان كثيراً من السيوف اليمانية الجليلة انما اتخذ من مثل هذا الحديد وشعراء العرب قد وصفوا ذلك فى شعرهم فهذا جنس من تكوّن الحجارة وحدثنى ثقة من مشايخ دولة اصبهان وهو ابو منصور هرمز ديار بن مشكزار قريب الامير الجليل ابى [5] جعفر محمد بن دشمنزار [6] رحمه الله [7] انه وقع فى جبال طبرستان من الهوآء ما صفة وقعه صفة وقع هذا الحديد الا انه كان حجارةً كبيرةً [8] فهذا جملة القول فى تكوّن الحجر * وامّا تكون حجرِ

1. C transposes these two words.
2. C omits وكل مقطع .
3. C شيئًا اخر الامر .
4. A inserts هذا after صاحبى .
5. A الامير ابى .
6. A دشمتريار ; B دسمرناز .
7. A omits ; B حرس الله عزه .
8. A, B كثيرة .

كبير فيكون اما دفعة وذلك بسبب حر عظيم يغافص طيناً كثير لزجاً وامّا ان يكون قليلاً قليلاً على تواتر الايام [1]

وامّا [2] الارتفاع فقد يقع لذلك سبب بالذات وقد يقع له سبب بالعرض امّا السبب بالذات فكما يتفق عند كثير من الزلازل القوية ان يرفع الريح الفاعلة للزلزلة طايفةً من الارض ويحدث رابية من الروابى دفعة وامّا الذى بالعرض فان يعرض لبعض الاجزآء من الارض انحفار [3] دون بعض بان تكون [4] رياح نسّافة او مياه حفارة تنفو لها حركة على جزء من الارض دون جزء فينحفر ما يسيل عليه ويبقى ما لا يسيل عليه راياً ثم لا تزال السيول تغوص [5] فى الحفر الاول الى ان يغور غوراً شديداً ويبقى ما انحفر عنه شاهقاً وهذا كالمتحقق من امور الجبال وما بينها من الحفور والمسالك وربّما كان المآء والريح متفق الفيضان الّا ان الاجزآء من الارض تكون مختلفة فيكون بعضها لينّة وبعضها حجريّة فينحفر الترابى اللين ويبقى الحجرى مرتفعاً ثم لا يزال ذلك المسيل يحفر ويحفر على الايام ويتسع ويبقى التنوء [6] وكلما انحفر عنه الارض كان شهوقهُ [7] اكثر فهذه هى الاسباب

1. This is the end of *Caput I*; *Caput II, De causa montium,* follows immediately.
2. A inserts تواتر .
3. B omits انحفار .
4. A يكون .
5. A تعرض .
6. A التنور ; B السو ; C التنوّ .
7. C سُمُوقه .

الاكثرية لهذه الاحوال الثلثة فالجبال تكوّنها من احد اسباب تكوّن الحجارة والغالب ان تكوّنها من طين لزج جف على طول الزمان ويحجر فى مدد لا يضبط فيشبه ان تكون هذه المعمورة قد كانت فى سالف الايام [1] غير معمورة بل مغمورة فى البحار فتحجرت اما بعد الانكشاف قليلا قليلا [Page 146 *a*] فى مدد لا تفى التاريخات تحفظ اطرافها واما تحت المياه لشدة الحرارة المحتقنة تحت البحر والاولى ان تكون بعد الانكشاف وان تكون تعينها طينتها على التحجر اذ تكون طينتها لزجة ولهذا ما يوجد فى كثير من الاحجار اذا كُسِرَتْ اجزآء الحيوانات المائيّة كالاصداف وغيرها فلا يبعد ان تكون القوة المعدنية قد تولدت هناك فاعانت ايضاً وان تكون مياه قد استحالت ايضاً حجارة لكن الاول ان يكون تكوّن الجبال على هذه الجملة وكثرة ما فيها من الحجريّة لكثرة ما يشتمل عليه [2] البحر من الطين ثم ينكشف عنه وارتفاعها لما حفرته السيول والرياح فيما بينها فانك اذا تاملت اكثر الجبال رايت الانحفار الفاصل فيما بينها متولداً من السيول ولكن ذلك امر انما تم وكان [3] فى مدد كثيرة [4] فلم يبق لكل سيل اثره بل انما يرى اثر الاقرب منها عهدا واكثر الجبال الآن انما هى فى الانرضاض [5] والتفتت وذلك لان عهد نشوْها [6]

1. C الزمان .
2. B omits ما يشتمل and has على for عليه .
3. C كان وتم .
4. A كثير .
5. B الامربرضاض .
6. A نشئها .

وتكوّنها انما كان مع انكشاف المياه عنها يسيراً [1] والان فانها فى سلطان التفتت الا ما شاء الله من جبال ان كانت تتزايد بسبب [2] مياه تحجر فيها او سيول تودى اليها طيناً كثيراً فيتحجر فيها فقد بلغنى كما احسبُ انه قد شوهد ذلك فى بعض الجبال واما ما شاهدتُه انا فى شط جيحون وليس ذلك الموضع مما يستحق ان يسمّى جبلا فما كان من هذه المنكشفات اصلب طينةً واقوى تحجراً واعظم حجماً [3] فانه اذا انهدم ما [4] دونه بقى ارفع واعلى [5] واما عروق الطين الموجودة فى الجبال فيجوز ان تكون تلك العروق ليست من صميم مادة التحجر لكنها من جهة [6] ما تفتت [7] من الجبال تترب وامتلا فى الاودية والفجاج وسالت عليه المياه ورطبته وغشته ارهاص الجبال او خلّلته [8] طينتها الجيّدة ويجوز ايضاً ان يكون القديم من طين البحر غير متفق الجوهر فيكون من ترتيبه [9] ما يتحجر تحجراً قويا ومنه ما لا يتحجر ومنه يسترخى تحجره لكيفيّة [10] ما [11] غالبة فيه او لسبب من الاسباب التى لا تعد ويجوز ان

1. C يسيراً يسيراً .
2. A بحجب .
3. B and C حجمها .
4. C انهدّ ما .
5. C اعلا .
6. A جملة .
7. A تفيت .
8. C جللته ; B وغشيته ارهاص الجبال او حللت به .
   A, marginal note خللت به .
9. C تربته.
10. A لكيفه ; B لكفه ; C لكيفيّه .
11. C مآء .

يعرض للبحر ايضاً ان يفيض قليلا قليلا على بر مختلط من سهل وجبل ثم ينصب عنه [1] فيعرض للسهل منه ان يستحيل طينا ولا يعرض ذلك للجبل واذا استحال طيناً كان مستعدا لان يتحجر عند الانكشاف ويكون تحجره تحجراً شافياً قوياً واذا اوقع [2] الانكشاف على ما تحجر فربما يكون المتحجر القديم فى حد ما استعدّ للتفتت ويجوز ان يكون ذلك يعرض له عكس ما عرض للتربة من ان هذا يرطب ويلين ويعود تراباً وذلك يستعد للتحجريه كما اذا انتقعت [3] اجرةً وتراباً وطيناً [4] فى الماء ثم عرضت الاجرة والطين الطيب على النار عرض للاجرة [5] ان زادها الانتقاع [6] استعداد التفتت [7] بالنار ثانياً وللتراب والطين ان استعدت لاستحجار قوى ويجوز ان ينكشف البر عن البحر وانعقد طينه [8] وقد يرى بعض الجبال كانه منضود سافاً فسافاً فيشبه [9] ان يكون ذلك قد كانت طينتها فى وقت ما كذلك سافاً فسافاً بان [10] كان ساف ارتكم اولاً ثم حدث بعده فى مدة اخرى ساف اخر ارتكم وكان قد سال على ساف جسم من [11]

1. C ينضب ; omits عنه .
2. A ارفع .
3. A اتفقت ; B تفقت ; C تقعت .
4. C طيباً .
5. C الاجرة .
6. B الاسفاع ; C الانتفاع .
7. B, C استعدادا. B للنفسد ; B للنقت .
8. C [عن البحر]وكل بعد طبقة.
9. C ويشبه .
10. A بان ; B بان ; C ان .
11. A عن .

خلاف جوهره فصار حايل بينه وبين السافل الاخر فلما تحجرت المادة عرض للحايل ان انشق وانتشر [1] عما بين السافلين وارض [2] البحر قد تكون طينته رسوبية وقد تكون طينته قديمة ليست رسوبية ويشبه ان يكون ما يعرض له انفصال الارهاص [3] من الجبال [4] رسوبيا فهكذا تتكون الجبال

[Here follow two *faṣls* not rendered into Latin. The first iss

١ فصل فى منافع الجبال وتكون السحب والاندية

and the second

٢ فصل فى منابع المياه وفى الزلازل

1. *On the uses of mountains, and on the formation of clouds and rain, etc.*
2. *On the gushing-forth of waters, and on earthquakes.*

1. A انتثر .
2. C inserts before ارض — وان حايلا من .
3. B الارهاص .
4. C inserts كان .

فصل فى تكوّن المعدنيات [Page 148 b]

وقد حان لنا ان نتكلم الآن [1] فى احوال الجواهر المعدنيّة فنقول ان الاجسام المعدنيّة بكاد ان [2] يكون اقسامها اربعة الاحجار والذايبات والكباريت والاملاح وذلك ان من الاجسام المعدنية ما هو سخيف الجوهر ضعيف التركيب والمزاج ومنه ما هو قوى الجوهر [3] فمنه ما ينطرق ومنه ما لا ينطرق وما هو ضعيف الجوهر فمنه ما هو ملحى تحله الرطوبة بسهولة مثل الشب [4] والزاج [5] والنوشادر [6] والقلقند ومنه ما هو دهنى لا يخل بالرطوبة وحدها بسهولة مثل الكبريت والزرنيخ واما الزيبق فهو من جملة القسم الثانى على انه عنصر المنطرقات او شبيه بعنصر المنطرقات [7] وجميع المنطرقات ذائبة ولو بالحيلة واكثر ما لا ينطرق لا يذوب بالاذابة الرسمية وانما يلين بعسر ومادة المنطرقات جوهر مائى يخالط جوهراً ارضياً مخالطة شديدة لا يبرا منه ويجمد الجوهر المائى منه بالبرد بعد فعل الحر فيه وانضاجه ويكون فى جملة ما هو حى بعد لم يجمد لدهنيته ولذلك ينطرق واما الحجريات من الجواهر المعدنية

1. A, B omit الآن. This *faṣl* forms *Caput III* of the Latin version.
2. A omits ان .
3. C inserts وما هو قوى الجوهر .
4. C السب .
5. C omits والزاج .
6. C والنوشادر .
7. C omits the phrase from او .

الجبلية [1] فمادتها ايضاً مائية ولكن ليس جمودها بالبرد وحده بل جمودها باليبس المحيل للمائية الى الارضية وليس فيها رطوبة حية دهنيّة فلذلك لا ينطرق ولاجل ان اكثر انعقادها باليبس فلذلك [2] لا يذوب اكثرها الا ان يحتال عليه بالحيل الطبيعية المذيبة واما الشب والنوشادر فمن جنس الاملاح الا ان نارية النوشادر اكثر من ارضيته فلذلك يتصعّد بكليته فهو ماء خالطه دخان حار لطيف جداً كثير النارية وانعقد باليبس واما الكباريت فانها قد عرض لمائيتها ان تخمرت بالارضية والهوائية تخمراً شديداً بتخمير [3] الحرارة حتى صارت دهنية ثم انعقدت بالبرد واما الزاجات [4] فانها مركبة من ملحية وكبريتية وحجارة وفيها [5] قوة بعض الاجساد الذابية وما كان منها مثل القلقند والقلقطار فكونها من حلالة الزاجات وانما تحل منها الملحية مع ما فيها من الكبريتية ثم ينعقد وقد استفادت قوة معدن احد الاجساد فما استفاد من قوة الحديد احمر واصفر [6] كالقلقطار وما استفاد من قوة النحاس اخضر ولذلك ما امكن ان يعمل بهذه الصناعة واما الزيبق فكانه مآء خالطته ارضية لطيفة جداً كبريتية مخالطة شديدة حتى انه لا ينفرد منه سطح [7] لا [8] يغشاه [9] من نلك اليبوسة شيء فلذلك لا يعلق [10] باليد

1. C الحليه .
2. C inserts ما .
3. B لتخمير .
4. C الرجاجات .
5. C omits و .
6. C اصفر واحمر .
7. C سطح .
8. A الا .
9. A نعشاء ; B يغشيه .
10. A يتعلق .

ولا يخصه
اللهم الا
التى فيه
الكباريت
ان يكون
تصير اليه
محمرا واما
قبل الحمى

النارية ولذلك [4] ما يعلق [5] الزيبق بهذه الاجساد كلها لانه من جوهرها لكن هذه الاجساد يختلف تكونها عنه بسبب اختلاف الزيبق اوما[6] يجرى مجراه فى نفسه وبسبب اختلاف ما يخالطه حتى يعقده فان كان الزيبق نقيا وكان ما يخالطه فيعقده قوة كبريت ابيض غير محرق ولا درن بل هو افضل مما يتخذ اهل الحيلة منه كان منه الفضة فان كان الكبريت مع نقائه افضل من ذلك وانصع وكان فيه قوة صباغة نارية لطيفة غير محرقة افضل من الذى يتخذه اهل الحيلة عقده ذهباً ثم ان كان الزيبق جيد الجوهر ولكن الكبريت الذى يعقده غير نقى بل فيه احتراقية كان منه مثل النحاس وان

1. A ممازجة .
2. C للهوائية .
3. A اذاب .
4. C كذلك .
5. A تعلق .
6. A, B و ما .

كان الزيبق رديا دنسا [1] متخلخلا ارضيا وكان كبريته نجسا [2] ايضاً كان منه الحديد واما الرصاص القلعى فيشبه ان يكون زيبقه جيّداً الا ان كبريته ردى وغير شديد المخالطة وكانه يداخل [3] اياه سافا فسافا فلذلك يصرّ واما الانك فيشبه ان يكون ردى الزيبق ثقيلة طينية [4] ويكون كبريته رديا منتنا ضعيفا فلذلك لم يستحكم انعقاده وليس يبعد ان يحاول [5] اصحاب الحيل حيلا يصير بها احوال انعقادات الزيبق بالكباريت [6] انعقادات محسوسة بالصناعة وان لم يكن الاحوال الصناعيّة على حكم الطبيعة وعلى صحتها [7] بل يكون مشابهة ومقارنة [8] لذلك فيقع التصديق بان جهة كونها فى الطبيعة هذه الجهة او مقاربة لها الا ان الصناعة تقصر فى ذلك عن الطبيعة ولا يلحقها وان اجتهدت واما ما يدعيه اصحاب الكيمياء فيجب ان يعلم انه ليس فى ايديهم ان يقلبوا الانواع قلباً حقيقياً لكن فى ايديهم تشبيهات حسنة حتى يصبغوا الاحمر صبغاً ابيض شديد الشبه بالفضة ويصبغوه صبغا اصفر شديد الشبه بالذهب وان [9] يصبغوا الابيض ايضاً ايّ صبغ شاؤوا حتى يشتدّ شبهه بالذهب او النحاس وان يسلبوا الرصاصات اكثر ما

1. A, B يابسا .
2. A نحسا ; B بحسا .
3. C مداخل .
4. B منتنة طمة ; C طينته .
5. A يحال .
6. A والكباريت .
7. A صحته ; C صحة .
8. A مقاربة .
9. C فان .

فيها من النقص والعيوب الا ان جواهرها تكون محفوظة وانما يغلب عليها كيفيات مستفادة بحيث يغلط فى امرها كما ان للناس ان يتخذوا الملح والقلقند والنوشادر وغيره ولا امنع ان يبلغ فى التدقيق مبلغا [1] يخفى الامر فيه على الفرهة واما ان يكون [2] الفصل المنوّع يسلب او يكسى فلم يتبين لى امكانه بل بعيد [3] عندى جوازه اذ لا سبيل الى حل المزاج الى المزاج الاخر فان هذه الاحوال المحسوسة يشبه ان لا تكون هى الفصول التى بها تصير هذه الاجساد انواعاً بل هى عوارض ولوازم وفصولها مجهولة واذا كان الشىء مجهولا كيف يمكن ان يقصد قصد ايجاده او افقاده واما سلخ هذه الاصباغ والاعراض من الروايح والاوزان او كسوها فهذا مما لا يجب ان نصرّ على جحده لفقدان العلم به فليس يقوم البته برهان على امتناعه ويشبه ان يكون النسبة التى بين العناصر فى تركيب كل جوهر من هذه المعدودة غيره فى التركيب الآخر واذا كان كذلك لم يعد اليه [4] الا ان يفك التركيب اعادة اياه الى تركيب ما يراد احالته اليه [5] وليس ذلك مما يمكن باذابة يحفظ الاتصال وانما يختلط به شىء غريب او قوة غريبة ولنا فى هذا كلام طويل لو شئنا لقلناه لكن الفايدة فى ذلك قليلة والحاجة عنه منقطعة فى هذا الباب

[تم الكتاب]

1. C مبلغ .
2. C omits ان يكون .
3. C بعد .
4. A عليه .
5. C omits اليه .

science nautique : Sindbad le Marin, Abou Zeïd, les Merveilles de l'Inde, Cheïkh Mâdjid, Ibn Mâdjid, Soléïman el-Mehri. — *Les grands voyageurs* : al-Bîrouni, Ibn Djobéïr, Ibn Batoutah. — *Les sciences exactes, l'arithmétique et l'algèbre* : Al-Khârizmi, Omar Khéyâm, — *la géométrie* : les Banou Mousa, Thâbit fils de Korrah, Nasïr ed-Dîn Tousi, — *la mécanique* : Ahmed fils de Mousa, Bédi'oz-Zéman el-Djazari, el Khâzini, — *l'astronomie* : Fazâri, al-Battâni, Abou'l-Wéfâ, Al-Birouni, Zarkali, al-Bitroudji, Jay-Singh, Ibn el-Haïtham, — *les sciences naturelles, la médecine* : Râzès, Avicenne, Ibn Zohr, Abou'l-Kassis, Ibn el-Beïthar, — *l'histoire naturelle* : Ibn el-'Awam, Damîri, — *minéralogie et alchimie* : Khâlid et Geber.

TOME III : *L'Exégèse, la Tradition et la Jurisprudence*, 423 pages, 1922.

La Perse avant l'Islam : Anochirvan, Hormuzd, Eperwïz, — *l'Arabie avant l'Islam, — vie de Mahomet* (forme traditionnelle), *critique de la vie de Mahomet, — critique du Coran, — la conquête arabe, — les Khalifes Oméyades* : Othman, Mo'âwiah, 'Abd el-Mélik et Wélid, el-Heddjâdj, — *la tradition* : Ibn 'Abbâs, Ayéchah, Bokhari Moslem, Néséfi, Ibn Firishtah, — *la jurisprudence, les grands imams, fondateurs de rites* : Abou Hanîfah, Mâlik, Chafi'i, Ibn Hazm, — *analyse d'ouvrages célèbres* : Abou Yousof, Mâwerdi, Sidi Khalîl, Gazali, Nawâwi, — *les commentateurs du Coran* : Tabari, Zamakhachari.

TOME IV : *La Scholastique, la Théologie et la Mystique. — La Musique*, 384 pages, 1923.

La Scholastique, Ecole orientale : El-Kindi, Farabi, Avicenne, — *Ecole occidentale* : Princes Almohades, Ibn Tofaïl, Averroès, — *les Sociétés de Philosophes* : les Sociétés secrètes, les Sabéens, les Frères de la pureté, — *la théologie* : le Kalâm, Motékallims et Motazélites, Ibn Hanbal, Ach'ari, Gazali, Néséfi, el-Idji, — *la mystique* : Hudjwïri et Suhrawerdi, El-Hellâdj et sa « passion », Ibn 'Arabi, Ibn el-Fârid, Vies de Soufis, — *les sceptiques* : Abou'l-'Ala de Ma'arrah, Omar Khéyâm, Hâfiz et les Ghazels, Fozouli, — *les poètes persans* : Sadi, Férid ed-Dîn Attâr, Djélâl el-Dîn Roumi, Djami, Welichi, — *la musique* : origines, le « Livre des Chansons », chanteurs et chanteuses, musique et religion, théorie de la musique arabe, Farabi, Safi ed-Dîn.

TOME V : *Les Sectes, le Libéralisme moderne*, 431 pages, 1926.

1re PARTIE : *Les Sectes, le Chiisme et ses dérivés : — Ali et le Chiisme, — les Ismaëliens, — les Druzes, — le Babisme.* — 2e PARTIE : *Pénétration des idées européennes dans l'Islam. Le libéralisme moderne : — la Turquie moderne, — les réformes, — la Jeune Turquie, — le haut enseignement, — l'Egypte moderne, formation de l'Egypte moderne* : Méhémet-Ali, Rifa'at Bey, — *l'Esprit moderne en religion* : el-Azhar, Cheïkh 'Abdo, Cheïkh Tantawi, — *le Nationalisme* : Mustafa-Kamel, Sa'd Zaghloul, — *Arabie et Afrique* : les Wahabis, le Soudan, Tombouctou, les Universités de Tunis et de Fez, — *l'Inde moderne* : les Sikhs, la révolte des Cipayes, Ecole du Brahmo-Samadj, Syed Ahmed Khan et l'Université d'Alygarh, — *la Perse, la Tartarie, la femme* : poètes franco-persans actuels, 'Inâyat Khan, Sadry Maksoudoff, — la musulmane moderne, Islam et Orient. — Notes. — Correspondance des dates musulmanes et chrétiennes.

FERRAND (G.). **Instructions nautiques et routiers arabes et portugais des XVe et XVIe siècles reproduits**, traduits et annotés :

TOME I : *Ibn Mâjid.* Le pilote des mers de l'Inde, de la Chine et de l'Indonésie, par Shihab ad-Dîn Ahmad bin Mâjid, dit « le lion de la mer », *texte arabe*, reproduction phototypique du MS. 2292 de la Bibliothèque Nationale publié par G. FERRAND, 362 planches en phototypie du texte arabe, III, 8 pp., in-8, 1923 . . . . . **250 fr.**

L'œuvre nautique de Ibn Mâjid qui a été rédigée entre 1462 et 1489-90, apparaît comme la somme des connaissances acquises de son temps tant dans la théorie que dans la pratique de la navigation. *C'est donc plus et mieux que le résultat d'une expérience et de travaux personnels : nous devons tenir ces documents pour une sorte de synthèse de la science nautique dans les dernières années du Moyen-âge.*

Ibn Mâjid est par ailleurs un personnage historique de marque. *Il sera établi par des documents décisifs qu'il fut le pilote arabe qui conduisit de Malindi, sur la côte orientale d'Afrique, à Calicut, l'escadre portugaise que commandait Vasco de Gama.*

Les œuvres d'Ibn Mâjid que nous intitulons « Le pilote des mers de l'Inde, de la Chine et de l'Indonésie » comprennent 22 traités en prose et en vers.

TOME II : *Sulaymân al-Mahrî et Ibn Mâjid.* Le pilote des mers de l'Inde, de la Chine et de l'Indonésie, par Sulaymân al-Mahrî et Shihab ad-Dîn Ahmad bin Mâjid, *texte arabe*, reproduction phototypique du MS. 2559 de la Bibliothèque Nationale de Paris, publié par G. FERRAND, 288 planches en phototypie du texte arabe, IX et 9 pp., in-8, 1925 . . . . . **200 fr.**

FERRAND (G.). **Le Tuhfat al-Albâb de Abu Hamid al Andalusi al Garnati** (texte arabe), édité d'après les Mss. 2167, 2168, 2170 de la Bibliothèque Nationale et le Ms. d'Alger (et traduction partielle du texte), 8 planches, 260 pp. in-8 (T. Journal Asiatique), 1925. . . . . **50 fr.**

Les manuscrits du *Tuhfat al-Albâb.* — Biographie d'Abû Hâmid. — Le *Tuhfat al-Albâb.* — Bibliographie. — TEXTE ARABE. — Résumé analytique et traduction partielle du texte. — Notes complémentaires. — Additions et corrections. — Index général. — Index des ouvrages orientaux.

Le *Tuhfat al-Albâb* a été rédigé en 1162, alors que l'auteur se trouvait à Mossoul. Abû Hâmid l'Espagnol est né à Grenade en 1080 et mort à Damas en 1170. Depuis son premier voyage (1115) en Egypte, il n'a pas cessé de voyager et séjourner à l'étranger, en Sardaigne, Cicile, à Alexandrie, au Caire, Damas, Bagdâd, en Perse, à Saksîn, Bulgâr de la Volga, Bactres, à Basgird (la Hongrie), dans le Khorâsân et enfin en Syrie. Les renseignements qu'il nous donne sur ces différents pays et particulièrement sur l'Egypte sont de première importance. La traduction complète de ce texte arabe paraîtra prochainement dans la *Bibliothèque des géographes arabes* que publie ma librairie.

GOLDZIHER (J.). **Le dogme et la loi de l'Islam** ; histoire du développement dogmatique et juridique de la religion musulmane, traduction de F. ARIN, VIII-315 pp., gr. in-8, 1920 . . . . . **50 fr.**

Muhammed et l'Islam. — Le développement juridique. — Développement dogmatique. — Ascétisme et sufisme. — Les sectes. — Formations postérieures.

GUIDI (I.). **L'Arabie antéislamique**, 108 pp., in-16, 1921 . . **12 fr. 50**

Les royaumes de l'Arabie septentrionale et centrale avant Mahomet. — Les progrès intellectuels chez les Arabes. — Les progrès matériels. — Les Arabes du sud et l'Abyssinie.

HOLMYARD (E.J.). **Kitab al 'Ilm Al-Muktasab fi Zira'at adh-Dhahab**, book of Knowledge acquired concerning the cultivation of Gold the arabic text edited with a translation and introduction. 62, 53 pp., in-8, 1925 . **40 fr.**

El-Muktasab contains an exposition of the theory of transmutation of metals and directions for compounding the elixirs required to turn silver, copper and the other metals into gold. All that seems to be known of El-Iraqi is that he enjoyed some considerable repute as a writer on alchemy and similar subjects. He is believed to have flourished in the seventh (thirteenth) century. His book is constructed on a methodical plan and written in plain language. A commentary on it by Jildaki eighth (fourteenth) century is in existence, and has been used in the preparation of this edition.

No one need feel surprised if he finds the directions impossible to carry out, but as material for the history of alchemy, El-Muktasab is clearly of considerable value. It compares very favourably with the obscure and enigmatical works, like those of Jabir, published by Berthelot, or the treatise of Ibn Bashrun, included by Ibn Khaldun in his Prolegomena, which make up a large proportion of the few Arabic alchemical books which have been printed hitherto. The theory and practice described both look as if they dated from pre-Islamic times, and it seems to be very difficult to discover any indication of independent practical knowledge on the part of the author. Mr. Holmyard will no doubt consider these questions in a later volume which he promises. He is to be thanked for a useful introduction and a carefully edited text. His translation ..., is generally very successful in conveying the meaning and overcoming a number of not inconsiderable difficulties. The edition altogether is a good sound piece of work (Review in *Journal of the Royal Asiatic Society*).

IBN KHALDOUN. **Histoire des Berbères et des dynasties musulmanes de l'Afrique Septentrionale**, traduite par le Baron DE SLANE, nouvelle édition autorisée, publiée avec notice sur Ibn-Khaldoun, bibliographie d'Ibn-Khaldoun et table générale par PAUL CASANOVA, 5 volumes, 1925-1928 . . **350 fr.**

Payable à la livraison des deux premiers tomes.

Tome Ier : LXVI et 452 pp., gr. in-8, 1925. — Tome II : 605 pp., gr. in-8, 1927. — Tome III : *Sous presse*. — Tomes IV-V : en préparation.

Il n'est accepté que des souscriptions à l'ouvrage complet.

La notice sur IBN-KHALDOUN, la bibliographie et les tables générales de l'Histoire des Berbères formeront le tome V. — Les tables des 4 volumes de l'édition ancienne seront réunies en une seule.

MASSIGNON (L.). **Essai sur les origines du lexique technique de la mystique Musulmane**, 303 pp. de texte et de 104 pp. de textes arabes, in-8 raisin . . . . . **100 fr.**

I : Liste alphabétique des termes techniques de la mystique relevés dans les œuvres d'al-Hallaj. — II : Analyse du Lexique. — III : Conclusions générales. — IV : Les premières vocations mystiques en Islam. — V : Les écoles du IIIe siècle de l'hégire.

MASSIGNON (L.). **La passion d'Al-Hosayn-Ibn Mansour- al-Hallaj martyr mystique de l'Islam exécuté à Bagdad le 26 mars 922.** Etude historique religieuse, 28 pl., 2 vol. in-8 raisin (I-100 pp.), 1922 . . **200 fr.**

TOME I : I : La biographie. — II : Les années d'apprentissage. — III : Les voyages et l'apostolat. — IV : La prédication publique et l'inculpation politique (la prédication publique à Bagdad) ; l'inculpation politique : la da'wat al-roboûbiyah, usurpation du pouvoir suprême de Dieu, du droit divin. — V : L'accusation, le tribunal et les acteurs du drame. — VI : Les procès. — VII : Le martyre. — VIII : Al-Hallaj devant l'Islam. — IX : Al-Hallaj devant le soufisme. — X : La légende.

TOME II : XI : Théologie mystique. — XII : Théologie dogmatique d'Al-Hallaj. — XIII : Les conséquences juridiques ; et les objections adressées à cette doctrine. — XIV : Les œuvres d'Al-Hallaj. — XV : Bibliographie hallagienne. — Index.

EN NACIRI (Ahmed ben Khaled, es-Slaoui). **Kitab el-istiqça li akhbar doual el-Maghrib el-Aqça.** (Histoire du Maroc). Tome premier, traduction de A. GRAULLE, VIII, 302 pp., in-8. Archiv. Maroc, XXX, 1923 . . **40 fr.**

Introduction (par A. GRAULLE) : Essai de reconstitution de l'histoire ancienne du Maroc, de l'époque légendaire à la conquête arabe. — Biographie de l'auteur par les Fils Ja'far en-Naciri et Mohammed en-Naciri. — Les Califes orthodoxes. — Les Berbères (origine et histoire). — Index alphabétique.

Tome deuxième. — Les Idrisides, traduction de A. GRAULLE. — Les Almoravides, traduction de G.-S. COLLIN, 1 tableau, 238 pp., gr. in-8, 1925. Archiv. Maroc. Tome XXXI.

Dynastie des Idrisites. — Dynasties zenètes. — Dynastie des Almoravides. — Index.

ROUSSEAU (G.). **La Mausolée des princes Sa'diens à Marrakech**, préface par EDMOND DOUTTÉ, texte arabe et traduction des Inscriptions par FÉLIX ARIN. Aquarelles, dessins et relevés de l'auteur.

Un volume de texte de 3 plans, XXII et 71 pp., gr. in-4, broché, 1925.

(Préface de M. EDMOND DOUTTÉ). — Description du Cimetière et des Qoubbas. — Les inscriptions arabes. — Répertoire des Tombeaux et des Inscriptions funéraires.

Un Atlas de IX pp., 16 planches en couleurs d'après les aquarelles originales reproduisant les aspects pittoresques des mausolées, le détail de la décoration murale et mosaïques, etc., 32 planches en phototypie, reproduisant les détails architecturaux et les motifs décoratifs des deux mausolées, 2 planches en similigravure et 33 planches en photolithographie reproduisant les dessins de l'auteur d'après estampages et les études d'après nature, soit 83 planches, gr. in-4, sous cartonnage, 1925 . . . . . **350 fr.**

Louvain (Belgique). — Imprimerie J.-B. ISTAS.