

## STEPHANUS OF ALEXANDRIA: PHARMACEUTICAL NOTIONS AND COSMOLOGY IN HIS ALCHEMICAL WORK

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STEPHANUS of Alexandria is known as a commentator on Plato and Aristotle in early seventh century Byzantium.<sup>1</sup> Among other non-philological works attributed to him is an alchemical one entitled: "On the great and sacred art, on the making of gold." This work is divided into nine "πράξεις", which are generally translated as "lectures". As it belongs to the category of so-called rhetorical<sup>2</sup> alchemy and especially to the commentaries<sup>3</sup> on earlier alchemical texts, many questions have arisen as to whether its author is really the above mentioned Stephanus; but in this article I will not take part in that debate.<sup>4</sup>

The only complete edition of the Greek text up to now is that of J. L. Ideler in 1842,<sup>5</sup> based on the transcription of the text in Cod. Monac. gr. 112 by Dietz. This MS. is a XV-XVIth century copy of that in the most ancient alchemical codex, namely the Cod. Marc. gr. 299 of the XIth century at Venice. The true end of the last lecture of Stephanus is not found in this famous MS., but in that in Cod. Paris. gr. 2327.<sup>6</sup> A Latin paraphrase rather than translation of the work exists in the edition of Pizimentus in 1573.<sup>7</sup>

When M. Berthelot published the texts of the Greek alchemists<sup>8</sup> in 1888, he did not include that of Stephanus in his edition because it had been already published by Ideler; moreover he considered it was of minor scientific interest. Thus he gave only a brief summary of the subjects treated in each lecture.<sup>9</sup> Late in the 'thirties F. Sherwood Taylor published a revised text of the first three out of the nine lectures, with English translation and commentary in *Ambix*.<sup>10</sup>

According to the publication programme of the new collection "Les alchimistes grecs", the work of Stephanus will appear in the sixth volume.<sup>11</sup> But until this critical edition of the Greek text, translated and annotated, appears, this alchemical work will only be accessible to scholars having a good knowledge of the early mediaeval Greek language.

This article has two parts: in the first I study the relation of Stephanus's work to pharmacy, and in the second, the cosmology presented in it.<sup>12</sup>

### A. RELATIONS BETWEEN ALCHEMY AND PHARMACY

The adoption of pharmaceutical methods in alchemy has already been recognized in the past.<sup>13</sup> Here we will study these relations in Stephanus's text, but we will also refer to passages from earlier alchemical texts, which have not been mentioned up to now.

The relation between alchemy and medicine-pharmacy in this work can be traced in the following data:

1. The use of the word φάρμακον (pharmakon) to indicate a chemical reagent for a special use.<sup>14</sup>
2. The use of the word βοτάνη (botane = herb, plants), both literally and figuratively.<sup>15</sup>
3. The materials used for a definite purpose, which belong to the materia medica of antiquity.
4. The practices used for the elaboration of these materials, so that they can be used.

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5. The references of some passages to the medicine and pharmacy as well as to their methods.

The word φάρμακον appears only ten times in the Stephanus's text.<sup>16</sup> Three times it is characterized as πύρινον (fiery),<sup>17</sup> and once as λευκόν (white).<sup>18</sup> As it results from the context, in the first case the adjective attributed is related to the burning effect of the "pharmakon" and in the second case it is related to its colour or its quality to dyeing "white". This may be related to the ἀργυροζώμιον (silver-liquid), also mentioned once.<sup>19</sup> In earlier texts we find two kinds of "pharmakon", one which dyes white and another which dyes yellow.<sup>20</sup>

If we wish to understand how the pharmakon works in the alchemical operations, we must study other important passages. The first one is translated by Sherwood Taylor as follows: "For he says this, that the rainwater(?) of the true art is burned and is fugitive in fire, but suffers from the fire and, crossing over, it is not melted. And (in) the roasting of the projections according to the Egyptian, which he uses, the drug is not melted in the tincture."<sup>21</sup>

I would comment that in this translation the explanation of the symbol ϗ as ὕδωρ ὑετοῦ (rainwater) seems to be wrong, although the word is neutral and the symbol like that referred to in CMAG (VIII, 18, signum 959), for three reasons. Firstly, the "rainwater" does not appear throughout in Stephanus's text.<sup>22</sup> Secondly, the same symbol exists also in the VIIIth lecture,<sup>23</sup> but in both cases the context does not favour this explanation. Thirdly, there is another symbol in CMAG, liking that in Stephanus's text and meaning ἄπυρον σύνθεμα (compound which has not been burned),<sup>24</sup> which I consider is the appropriate explanation in both cases.

Another comment on this translation concerns its last phrase, especially the verb συγχέω; I am of the opinion that in this case the verb means "confuse" rather than "melt", and the translation may be "the drug is not confused with the tincture".<sup>25</sup> This translation is not only favoured by what Stephanus has previously said about the ash of various substances and the power possessed by it, but also by the meaning of the following passage, given as an illustrative example of the phenomenon (trans. Taylor): "just as a sling passing by someone may wound him (that which is thrown is gone as a result of the strength of the thrower), so then is gone the wound of the man standing in the way. But he who has it, has it whoever he is, if indeed it truly is gone. So also the ash itself runs and tinges indelibly and makes indelible the cause of the tincture, or the drug is dissolved into its kindred fire and air, as being fugitive and burnt up in the bellies of its parents."<sup>26</sup>

I think that the meaning of these passages may be summarized in that the ash transmits to the drug its power and energy (activity), which become the cause of the colorations by dyeing. This idea is supported by another passage on the dyeing of copper, where it is said that the "body" alone cannot dye; the dyeing is done by "the good nature [existing] in the body itself, namely the ψυχικόν πνεῦμα (spirit of life) blooming and bringing in itself the colour of the tincture".<sup>27</sup> This spirit may be understood as "the quality which by passing made what is sought for".<sup>28</sup>

The word βοτάνη appears only five times. Two of them are related to each other; Stephanus mentions a passage of Zosimos referring to "the solids and liquids and plants", and comments upon it as "being not at all plants, except as far as their colour is concerned";<sup>29</sup> consequently Stephanus uses the word figuratively, to denote a chemical

reagent. The same figurative meaning we can attribute to the word βοτάνη found in the passage saying that “[the art] makes the multiplex matter of the plants to flourish by pulverization of the σωματᾶ (bodies)”,<sup>30</sup> because these “bodies” are substances used in alchemy.

A possible different case is that in which Stephanus refers to those people “who cook together the ash of common plants with the like and melt together the ashes of bodies and glasses with the like”.<sup>31</sup> It is evident that the persons doing such a work may be identified with the alchemists, but the “plants” are clearly distinguished from the so called “bodies”. Earlier texts mention ζωμοὶ (soups)<sup>32</sup> and χυλοὶ (juices) of plants, and they do not seem using the word figuratively.<sup>33</sup> Stephanus also mentions the following plants:<sup>34</sup> Ἴρις (Iris, because of the variety of colour of its flowers), κρόκος Κιλικίας (saffron of Cilicia), ἀναγάλλις (anagallis), πόντιον ῥᾶ (pontic rhubarb), δάφνη, δάφνινα ξύλα (leaves and wood of laurel),<sup>35</sup> ἄνθος τοῦ κνίκου (flower of safflower), χυλὸς τῆς ἀμπέλου (juice of vines). As follows from the context, only the name of Iris has been used figuratively here.

The ῥόδιον ἔλατον (oil of roses) is mentioned once,<sup>36</sup> but it is very doubtful if it was really used, as the same passage in earlier texts mentions the νιτρέλαιον (oil of natron) instead of it.<sup>37</sup>

According to Stephanus, a very important role is attributed to substances giving a white ash promising ἔργα μεγάλα (important results)<sup>38</sup> in healing and colorations by dyeing. Those mentioned by him are the following:<sup>39</sup> τέφρα (ash), καδμεία (cadmia), σποδὸς τῶν λευκίνων ξύλων (ash of white poplar wood), τὰ θειώδη (the sulfurous things), τίτανος (chalk), ἄσβεστος (lime), γύψος (gypsum), ἠφέκλη καλουμένη (what is called tartar), ἀφροσέληνον (aphroselenon), κρόνος (lead), λιθάργυρος (litharge) and ψάμμος (sand). All these bodies, when burnt to ashes and being mixed with the χρυσοζώμιον (liquor of gold), are operative for all sorts of colorations by dyeing, of ἔργων (works),<sup>40</sup> marbles, glasses, stones, woods, skins and of all χυτῶν<sup>41</sup> σωματῶν (fusible bodies).

Stephanus attributes the ability of these bodies to operate as mentioned above to their (intrinsic) nature, “lead back outside to the visible” by their incineration and reduction to ashes.<sup>42</sup> As follows from the context, the nature of these bodies is qualified by both Aristotelian δύναμις and ἐνέργεια and consequently “on the one hand they are active bodies, on the other hand a power, according to another discourse, displaying activity”.<sup>43</sup> Then Stephanus divides the bodies in two categories, according to the mode used so that they display these qualities. The one category includes bodies the ash of which is used by a physician in healing; the other category includes those the ash of which comes to “regeneration”, and which consequently relate to εὐσύνετος τέχνη (easily apprehended art), namely the art of making gold.<sup>44</sup>

The physical principle underlying the encouraging expression of an ancient alchemist that “there is no need to be afraid of burning and reducing to ashes all these bodies”,<sup>45</sup> is revealed and explained theoretically by Stephanus, according to the Stoic principle of συμπάθεια (sympathy, affinity). The bodies display power, energy and regeneration, because they have a nature imitating the world and its elements; the elements have the quality of regeneration and something like a communion with a ὑλαῖον πνεῦμα (material or vital spirit).<sup>46</sup> For this reason “all the elements have creations, destructions, changes and restorations from one to another”.<sup>47</sup>

If we take into consideration all that has already been said about the power and energy transmitted from the ash to the drug, and the fact that the latter works without being

confused with the tincture, it follows that the origin of both power and energy displayed by ash is the material spirit with which all things are in communion. I think that this transition from the qualities of some special materials to a material spirit giving the bodies the power and energy required for them to be transformed into one another, is very important, because it points to a uniform substratum of energy underlying matter all over the ancient cosmos. In this way, the ancient idea of the constitution of the world of the four cosmic elements (fire, earth, air, and water),<sup>48</sup> extended by the introduction of the Stoic material (or vital) spirit underlying all and being in communion with all things,<sup>49</sup> offers the alchemy the necessary theoretical background for the hypothesis of transmutation of metals to gold and the efficiency of alchemical operations.

The bodies used in the alchemical practices are subject to some elaborations.<sup>50</sup> One of them is λείωσις (pulverization), which can be reduced to the finest condition (ἐξίσχυωσις).<sup>51</sup> The pulverisation of a material body is compared to its "death", leading to the separation of body (matter) and soul, namely the liberation of the spirit. For this reason, the finer the matter is pulverized, the stronger is the activity displayed by the material spirit.<sup>52</sup> The kind of apparatus used for the pulverization is not mentioned by Stephanus, who dislikes alchemical apparatus and is more interested in the philosophy of the subject.<sup>53</sup> But research into the earlier alchemical texts reveals the use of mortar, pestle and millstones.<sup>54</sup>

As far as practices are concerned, an earlier text recommends that both pulverization and boiling, after the addition of some liquid of plants, be made medically;<sup>55</sup> in another passage "Agathodaimon recommends that the pulverization be made strongly, according to the method followed by the physicians for the collyria".<sup>56</sup> Stephanus refers to the medical practices only twice. First, when he speaks about ash, as we have already noted.<sup>57</sup> This means that the ash of various bodies was used for the preparation of drugs, as in Dioscurides.<sup>58</sup> Second, when he says that "[copper] is restored by tincture, whether divinely or medically".<sup>59</sup>

The word ξηρόν (xerion), called "elixir" after the arabic conquest, appears once in Stephanus's text.<sup>60</sup> In earlier texts it appears often<sup>61</sup> and means a dry powder, which may be another aspect of the "pharmakon", according to some indications.<sup>62</sup> As an example, the medical xeria are mentioned with the plasters, the unguents and the colours used in painting.<sup>63</sup> How much the alchemists imitated the physicians and the chemists becomes clear from Democritus's exhortation: "Become [like the] sons of physicians in order to understand the natures; at whatever time they want to prepare a medicine good for the health (ὕγιενὸν φάρμακον) they do not attempt to act upon inconsiderate impulse".<sup>64</sup> This is not to be considered as an exaggeration, because the alchemical practices on various materials were considered to be something like the medical practices on the patient; this is shown by a passage saying that "we laid hold of the genuine matter and we cured it through additional operations".<sup>65</sup>

Generally, alchemy is not a legitimate child of medicine or pharmacy; but it inherited from them a great part of its practices and terminology, just as also happened with the art of dyeing and metallurgy, especially of gold and silver. Stephanus refers once to goldsmiths,<sup>66</sup> but he makes allusion to them in his polemic against people needing an alchemical apparatus for making gold, and calls them pitiful etc.<sup>67</sup> On the contrary, Olympiodorus, who has written on the alchemical apparatus and practices, calls the goldsmiths "friends".<sup>68</sup> Their difference is due to the fact that Stephanus appreciates philosophy more, as we will see

in the second part. The branches of various arts which contributed to the development of alchemy have not been exhausted here. Another, disregarded till now, is cookery, if we take into account a passage saying that "the art of cookery has become needful to us in many cases".<sup>69</sup>

## B. THE ALCHEMICAL COSMOLOGY

The influence of the Pythagorean, Platonic, Aristotelic, Stoic and Neoplatonic philosophies on Stephanus's work has already been recognized.<sup>70</sup> This is not surprising, if the writer is really Stephanus of Alexandria, the known commentator on Plato and Aristotle. Among the negative aspects attributed to his work are included his rhetorical style, combined with an absence of original mathematical and physical ideas,<sup>71</sup> as well as his dislike for the alchemical apparatus and his polemic against people using it for the making of gold.

Such a valuation of the text is based upon present ideas, which differ greatly from those in Stephanus's time. On the other hand, in spite of all defects attributed to it in the last hundred years, this work has been much appreciated by Greek, Arab and Latin writers who have referred to it.<sup>72</sup> This was exactly what inspired me to study it anew, searching for its intrinsic principles, rather than the extrinsic ones used up to now. I think I have succeeded in tracing them in the text and classifying them by subject into three classes: two general (philosophy and science), and one special (chemistry).

In the first class (philosophy) are included:

1. The definition of philosophy as assimilation to God, as far as this is possible to man.<sup>73</sup> (Princi. i)
2. The research method of the philosopher. (Princi. ii)

According to Stephanus, the philosopher is a theoretician and able to comprehend natural phenomena directly. His method consists of an inquiry into all theories, (a) by examining their nature and suitably mixing them together, (b) by intellectually analysing their complications and innumerable compositions, (c) by ingeniously constructing one theory, taking all these into account. In this way he knows the theoretical and diagnostic accuracy of these theories.<sup>74</sup>

3. The lessons<sup>75</sup> considered as a kind of training of the soul, which guides us from material things to immaterial ones and from complex things to simple ones.<sup>76</sup> (Princi. iii)

In the second class (science) are included:

1. The definition of the two principles of the science, which are sensation and experience. The former gives the understanding of the phenomenon and the latter gives the practical wisdom.<sup>77</sup> (Princi. iv)
2. The intellectual nature of the science.<sup>78</sup> (Princi. v)
3. The faith in the omnipotence of wisdom, which "can see the unseen and do the impossible".<sup>79</sup> (Princi. vi)

In the third class (chemistry) are included:

1. The distinction between mythical and mystical (or secret) chemistry.<sup>80</sup> The former is confounded in a multitude of words,<sup>81</sup> while the latter deals with the world through the Word of creation, and its method consists in images (symbols). (Princi. vii)
2. The decipherment of the secrets of the ancient alchemists and their presentation to an audience.<sup>82</sup> (Princi. viii)

3. The unity of the world.<sup>83</sup> (Princi. ix)

4. The power, energy and regeneration of the bodies burnt to ashes, because of their nature imitative of the world and its elements, whence they have regeneration and communion with a vital spirit, which is again given to them by fire, with the contribution of the all-creating air.<sup>84</sup> (Princi. x)

5. The vital spirit as the essential factor working in the alchemical experiments rather than the tincture itself.<sup>85</sup> (Princi. xi)

After this outline of the general principles we can understand Stephanus's text better. The polemic of Stephanus against goldsmiths is due to the great difference between theory and practice, beliefs and experience: The goldsmiths practise "aurifiction",<sup>86</sup> as they either falsify gold, or gild metals by dyeing. Stephanus calls them uneducated, ignorant, uninitiated etc., because "they make gold irrationally, while saying it is difficult to make it".<sup>87</sup> His argument that it is the πάνσοφος ἀγγίνοια (all-wise sagacity) rather than the πολύτροπος επιτηδειότης (multiform ability) which plays the most important role,<sup>88</sup> as well as his references to the "art with intellectual science"<sup>89</sup> or to the "sweetly breathing flower of practical philosophers,"<sup>90</sup> show how much he believes in the theoretical hypothesis of "aurifaction". According to him, the work of the philosopher is an art combined with science, a practical philosophy,<sup>91</sup> a philosophical art of making gold.<sup>92</sup>

The transition from empirical knowledge to science needs the introduction of a theory. As alchemy deals with the transmutation of metals into gold, the theory must be both a mathematical and physical one. Stephanus, when speaking of the necessity that a mathematical theory be introduced for the description of the ἀτομα καὶ ἀμερῆ σώματα (indivisible bodies),<sup>93</sup> *i.e.* the four cosmic elements, attempts to introduce a relation of equivalence between them and the perfect ones (*i.e.* geometrical figures). It seems that he makes allusion to the Platonic theory exposed in *Timaios*,<sup>94</sup> but he also inserts Aristotelian ideas and notions, as ἀτμίς (moist vapour) and καπνώδης ἀνάθυμίασις (smoky exhalation).<sup>95</sup> Then he uses a theological argument: "After the reception of soul by body, God granted perfection to the being by again giving both of them a soul and ranging them in the same line".<sup>96</sup> On the other hand, when comparing the man as a perfect union of body and soul with the Whole (or Nature), which is both one and many, as seen in the art of making gold,<sup>97</sup> he refers to the well-known mystical relation between microcosm and macrocosm.

Why Stephanus needs all this becomes clear from the description of the passion of copper during the alchemical experiments. Stephanus affirms that "copper, like a man, has both soul and spirit";<sup>98</sup> but he knows that copper is not gold. What is missing from the "being" copper, is the perfection, which can be given to it, according to the principles x and xi. A basic principle in alchemy is that of the unity of the world, expressed by many passages of similar content referring to the one nature, identified with the whole. The physical bodies are said to be composed of the four cosmic elements, which are in a dynamic state having births, destructions, changes and reversions from one to another. This is the physical principle underlying the possibility of the transmutation of various metals to gold.

As far as the mathematical sciences are concerned, it is necessary that all the sciences of the quadrivium be introduced. Geometry offers its immaterial figures as a static model for the description of the structure of atoms or indivisible bodies<sup>99</sup> in the material world. Arithmetic, considered as mystical Pythagorean number theory, provides the correspondence between qualities of numbers and qualities of things in a dynamic state; this

is made through the exact calculation of the δύναμις τοῦ ὀνόματος (force of the name).<sup>100</sup> The mathematics referred to are not original, but they are necessary for the establishment of the theory; what is original is the extensive analysis of the riddle seeking the secret name of the philosophers' stone, composed of nine letters and divided into four syllables.<sup>101</sup> The known symbolism of "monad - the Whole" is now extended to the great work done (the Stone), which also symbolizes the unity of matter, the unity of nature. The four syllables correspond to the "tetrasomia",<sup>102</sup> *i.e.* the four basic substances used in the alchemical experiments.

The unity of the world also implies the introduction of a relation between alchemy and astronomy. The known correspondence between metals and planets is not sufficient; Stephanus unifies all partial correspondences in one, relating them to the path of the sun (symbol of gold) in the zodiac (symbol of the world): Thus he makes the four syllables of the secret name (and consequently the tetrasomia) and the four cosmic elements correspond to the four most important points of the sun's annual path (the ecliptic), *i.e.* the equinoctial and solstitial points; in earlier texts there is also a relation between colours of substances, stages of the work, and cardinal points.<sup>103</sup> Moreover, he shows the dynamic aspect of these correspondences by comparing the passages of the seven planets through the twelve signs with the appearances and disappearances of the seven bodies and colours in the composition of the tetrasomia.<sup>104</sup> Consequently, we may suppose that the tetrasomia as a whole corresponds to the zodiac.

The correspondence is further extended to parts of human body and colours as follows: The part from feet to knees corresponds to the element "earth" and the white colour; that from knees to navel corresponds to the element "water" and is τηλαυγές (far-shining) and διαυγές (translucent); the part from navel to heart corresponds to the element "fire" and is ξανθόν (yellow) and διάπυρον (extremely hot or fiery); the last part, from heart to neck, corresponds to the element "air" and is κροκῶδες (saffron-coloured).<sup>105</sup> It is noteworthy that the head is not included in these correlations. I think the reason is found later: the head regulates the change of the juices in the body, just as the alternation of the four cardinal points in the zodiac, and consequently the alternation of the seasons, regulates the change of the juices in nature.<sup>106</sup> It is therefore possible that he considered the head as corresponding to the whole zodiac, *i.e.* the world, or to the philosophers' stone, which is a perfect composition of the tetrasomia and a symbol of the world as the zodiac.

This view is supported by evidence found in an earlier alchemical text, where the human head corresponds to the heaven. But then the text continues in a quite different mode than that of Stephanus's, as it refers to the known astrological correspondence between zodiacal signs and parts of the body—the κοσμικὸν μίμημα (copy of the world)—showing the relation between macrocosm and microcosm.<sup>107</sup> Another κοσμικὸν μίμημα is the Ouroboros, whose body is spotted according to the arrangement of stars; I think, this arrangement may refer to the twelve zodiacal constellations, a view supported by an indication coming from Hellenistic astrology.<sup>108</sup>

Finally Stephanus compares the changes of the four primary elements from one to another (those of natural phenomena, as well as the change of juices in human body), with the alchemical phenomena occurring in the chemical apparatus.<sup>109</sup> (As far as music is concerned, Stephanus refers briefly to it, without giving any special relation between it and alchemy.<sup>110</sup>)

After all this I am of the opinion that Stephanus's work is neither worthless, nor yet

simply representative of the alchemy of his time.<sup>111</sup> I think his work points to the introduction of an alchemical cosmology, embracing microcosm and macrocosm. Although his research method [*i.e.* the philosopher's method mentioned as principle ii], being based upon known theories and pointing to a global idea of the world, does not always lead to a new original theory, we cannot deny that Stephanus succeeds in introducing some original explanations of alchemical phenomena, or in extending known correspondences to alchemy. Although his text is divided into nine lectures, I do not think his aim is a simple teaching of some alchemical notions or practices. I suppose rather that he desires to show the universal character of alchemy, transforming it into cosmology and including it in the broad field of science and philosophy. In this way, alchemy can share omnipotence with wisdom and gain assimilation to God through philosophy.

## NOTES

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2. C. A. Brown, Rhetorical and religious aspects of Greek alchemy, *Ambix*, 2 (1938), 129-137. (Here 129-131).
3. H. D. Saffrey, "Présentation", in: *Les Alchimistes grecs* (=AG), I (texte établi et traduit par R. Halleux), Budé, Paris 1981, VII-XV. (Here XIII-XIV).
4. Against the opinion that Stephanus of Alexandria is the writer of this alchemical work are: H. Usener, *De Stephano Alexandrino*, Bonn 1879 = Kl. Schriften III, Leipzig-Berlin 1914, 247-266, here 256. K. Krumbacher, *Geschichte der byzantinischen Literatur*, 1897, 621. K. H. Dannenfeldt, "Stephanus of Alexandria", *Dictionary of Scientific Biography* (=DBS), XIII, 37-38. Pro this opinion are: M. Berthelot, *Les Origines de l'Alchimie*, Paris, 1885, 100, 200. E. O. von Lippmann, *Entstehung und Ausbreitung der Alchemie*, Berlin 1919, 104. I. Hammer-Jensen, "Die ælteste Alchemie", *Kgl. Danske Vidensk. Selsk. Hist.-filol. Medd. IV/2*, København 1921, 146, 148. F. Sherwood Taylor (as in n.10) 116-117. R. Vancourt (as in n.1) 30. A. J. Festugiere, *La révélation d'Hermès Trismégiste*, I-IV, Paris 1944, I 239f. A. Lumpe, "Stephanos von Alexandrien und Kaiser Herakleios", *Class. and Mediaev. Dissertationes*, 9 (1973), 150-159, here 158-159. O. Neugebauer, *A History of Ancient Mathematical Astronomy*, I-III, Springer, Berlin, 1975, II 1050, 1051, n.53, 54. H. Hunger, *Die hochsprachliche profane Literatur der Byzantiner*, I-II, München, 1978, II 280. The question remains open for: L. G. Westerink (as in n.1), (1) XXV, (2) 22. E. Chauvon, "Étude sur le commentaire astronomique de Stephanos d'Alexandrie", *Mém. de licence dactylographié, Louvain-la-Neuve*, 1979-1980, 18. P. Lemerle, *Le premier humanisme byzantin; Notes et remarques sur l'enseignement et culture à Byzance des origines au X<sup>e</sup> siècle*, Paris, 1971/ Athens, 1985 (rev. Greek ed.) 335-336. H. D. Saffrey (as in n.3), XIII-XIV. G. Fowden, *The Egyptian Hermes*, Cambridge U.P., 1986, 178.
5. Stephani Alexandrini, "De magna et sacra arte", in: I. L. Ideler, *Physici et medici graeci minores* (=IDELER), II, Leipzig, 1842, 199-253.
6. The missing end of the text is contained in Cod. Paris. gr. 2327, f.740-13, as well as in Cod. Scorial. I.Φ.11., in: J. Bidez, F. Cumont, A. Delatte, J. Heiberg, O. Lagercrantz, F. Kenyon, J. Ruska, V. de Falco, *Catalogue des Manuscrits Alchimiques Grecs* (=CMAG), I-VIII, Bruxelles, 1924-32: I, 21; II, 5; V, 8, 99. O. Lagercrantz, "Ueber das Verhaeltnis des Codex Parisinus 2327 (=A) zum Cod. Marcianus 299 (=M)", in: *CMAG* II (1927), 341-358, IV (1932), 399-432.
7. *Democritus Abderita, De arte magna, sive de rebus naturalibus. Nec non Synesii, et Pelagii, et Stephani Alexandrini, et Michelis Pselli in eundem commentaria*. Dominicus Pizimentius ed., Padua, 1573. (Steph. p. 23-65).
8. M. Berthelot-Ch. Ruelle, *Collection des Anciens Alchimistes Grecs* (=CAG), I (Introd.)-II (text grec)-III (Traduction), Paris, 1888. (The Greek text will be given without reference to vol. II, while its French translation in vol. III as Trad.)
9. M. Berthelot, *Introduction à l'étude de la chimie des anciens et au moyen âge*, Paris, 1888, 288-295. E. Riess, "Alchemie", in: *Real Encyclopaedie der classischen Altertumswissenschaft*, Pauly-Wissowa, Bd. 1 Stuttgart, 1894, col. 1338-1355, hier 1349-1350. E. O. von Lippmann (as in n.4), 104-105. I. Hammer-Jensen (as in n.4), 146-154.
10. F. Sherwood Taylor, "The alchemical works of Stephanus of Alexandria" (=Taylor) [only three out of the nine lectures], in: *Ambix*, 1 (1937), 116-139 [1st and 2nd lecture], 2 (1938), 38-49 [letter to Theodoros and 3rd lecture]. The text corresponds to p. 199-2136 of that in Ideler's edition.



11. See n.3.
12. Papers presented to the 31st International Congress for the History of Pharmacy, Athens, Greece, April 15-18, 1989, and to the 18th International Congress for the History of Science, Hamburg-Munich, BRD, August 1-9, 1989, respectively.
13. I. Hammer-Jensen (as in n.4), 42-43: "Mit anderen Worten, das chemische Wissen des Altertums muss man bei den Aerzten suchen. Die Aerzte, die zugleich Pharmakologen waren, sammelten, reinigten, roesteten, pulverisierten die Mineralien, machten daraus Salben und Tinkturen"; 58, 59, 92, 93: "Die Alchymisten sind augenscheinlich bei den Aerzten mehr als bei den Handwerkern in die Lehre gegangen, ja man fragt sich hier oeffters, ob der erste Alchymist nicht ein griechisch gebildeter Arzt war"; 94, 96.
14. H. G. Liddell-R. Scott, *A Greek-English Lexicon* (=LS), Oxford, 1968, p. 1917: φάρμακον = I. drug, healing remedy, enchanted potion, poison, lye; II. remedy, cure; III. dye, paint, colour; IV. chemical reagent (in alchem. texts); used by tanners.
15. LS, p. 323: βοτάνη = I. pasture, II. fodder, III. herb, IV. (in pl.) plants, V. weeds.
16. Ideler, 210<sub>31,35</sub>, 2114, 236<sub>23,25,27</sub>, 238<sub>28</sub>, 240<sub>36</sub>, 241<sub>18</sub>, 245<sub>25</sub>. (Subscripts refer to lines.)
17. Ideler, 238<sub>28</sub>, 240<sub>36</sub>, 241<sub>18</sub>. CAG, 1034: Olymp. (Maria) πύρινον φάρμακον (Trad. 112<sub>7-8</sub>: préparation ignée); 201<sub>6</sub> Zos. (Maria). In most cases Berthelot translates the word φάρμακον as "préparation", thinking upon the result of alchemical practices rather than the term.
18. Ideler, 236<sub>23</sub>. CAG, 3117 Isis: Ταῦτα πάντα λείου σὺν ὄξει δρμητῶται λευκῶι καὶ ξηράνας ἔχεις τὸ φάρμακον λευκόν. 321<sub>10</sub>, 517 Democr.: ἐπιβάλλε οὖν τοῦ λευκοῦ φαρμάκου τὸ ἡμισυ καὶ ἔσται πρωτεῖον. (Trad. 352-3: Délaie tout cela avec du vinaigre blanc très fort et, après avoir fait sécher, tu obtiendras la préparation blanche. 332<sub>20-21</sub>: mêlez-y après le blanchiment une quantité égale de lie, afin qu'elle devienne très blanche.)
19. Ideler, 2134. Taylor, 45, 49, n.123.
20. CAG, 214<sub>41-43</sub>: χρυσὸν οὐ λαμβάνουσιν τὸ μεῖζον ὅτι ἐὰν τὸν χαλκὸν ἀσκίαστον ποιήσης, λευκαίνει τοῖς λευκαίνουσιν φαρμάκοις, καὶ ξανθῶσεις τοῖς ξανθοῦσιν φαρμάκοις, καὶ βάψεις τὴν καδμίον ἢ κιννάβαρον χρυσοῦ ποιεῖται. (Trad. 207<sub>12-16</sub>: qui n'ont pas produit de l'or véritable. Ainsi quand tu auras obtenu le cuivre sans ombre, tu (le) blanchiras avec des préparations blanchissantes et tu (le) jauniras avec des préparations jaunissantes; tu le teindras (avec) la cadmie ou le cinabre.)
21. Ideler, 210<sub>31-35</sub>. Taylor, 43, 47 n.96.
22. Stephanus refers only to the ἐνδρῶσον ὑπέταν, when speaking on pontic rhubarb: Ideler, 234<sub>25</sub>.
23. Ideler, 240<sub>37</sub>.
24. CMAG, VIII, 19, 63-64 (signum 1006).
25. LS, p. 1668: συγγέω-συγγέομαι.
26. Ideler, 210<sub>37-2116</sub>. Taylor, 43.
27. Ideler, 239<sub>6-8</sub>.
28. Ideler, 2171.
29. Ideler, 239<sub>16,24</sub>. CAG, 170<sub>6-7</sub>: Zos. Αἰ οὖν βαφαὶ αὐταὶ. εἶδη δὲ τοῦ καταλόγου στερεὰ καὶ ὑγρά, βοτάναι. (Trad. 169<sub>8-10</sub>: Voici les teintures: (elles comprennent) les espèces solides et liquides du catalogue, ainsi que les plantes.)
30. Ideler, 216<sub>20-22</sub>. I translated the πολυῦλον ὕλην as "multiplex matter", because according to LS, p. 1445: πολυῦλος = consisting of many kinds of matter. CAG, 58<sub>8-11</sub> Synes., 292<sub>4-12</sub> Komarios. Apart of the seven known metals termed σωματα (bodies), the Greek alchemists employed other substances with metallic lustre formed for the most part of mixtures or alloys of the metals and also termed σωματα. F. Sherwood Taylor gives a list of 38 such alloys and native minerals identified, in: "A survey of Greek alchemy", *Journal of Hellenic Studies*, 50 (1930), 109-139, here 123-124.
31. Ideler, 210<sub>3-5</sub>. Taylor, 41.
32. I. Hammer Jensen (as in n.4), 96: "Die Tinkturen (ζωμοί) sind, wie es scheint, Pflanzensaefte in saurem Wein, Essig oder Salzwasser geloest, und da Rhabarber (der Oxalsaeure enthaelt) vorzugsweise angewendet wird, scheint das ganze Mysterium nur in der Wirkung organischer Saecuren auf Metalle zu bestehen-wenn nicht die symbolischen Benennungen in diesen sechs Rezepten beibehalten sind; wenn es heisst, dass der kilikische Krokus dieselbe Wirkung hat wie Quecksilber, liegt jedenfalls die Vermutung nahe, dass der kilikische Krokus ein alchymistisches Praeparat vertritt."
33. CAG, 991<sub>6-1004</sub>: Πάλιν περὶ τῆς ξανθῆς οὐσίας φροντίζοντες κατάλογον ξανθῶν εἰδῶν ποιοῦνται. καὶ φησιν. "Δύο εἰσὶ λευκώσεις, ὡς καὶ δύο ξανθώσεις, καὶ δύο συνθέματα, ξηρὸν καὶ ὑγρὸν, τούτέστιν ἐν τῶι καταλόγῳ τοῦ ξανθοῦ βοτάνας καὶ μέταλλα, καὶ ζωμοὺς δύο, ἕνα ἐν τῶι ξανθῶι, καὶ ἕνα ἐν τῶι λευκῶι. καὶ ἐν μὲν τῶι ξανθῶι ζωμοί, τὰ διὰ τῶν ξανθῶν βοτανῶν, οἷον κρόκου καὶ ἐλυδρίου, καὶ τῶν ὁμοίων. καὶ ἐν τῶι λευκῶι πάλιν συνθέματι, καὶ ἐν μὲν τῶι ξηρῶι πάντα τὰ λευκά, οἷον γῆ κρητικὴ, κινωλία, καὶ ὅσα τοιαῦτα. καὶ πάλιν ἐν τῶι ὑγρῶι τοῦ λευκοῦ, ὅσα λευκὰ ὕδατα, οἷον ζῦθον καὶ χυλοῦς καὶ ὀπούς βοτανῶν 103<sub>25-1042</sub>: ποιήσαντες καὶ ζωμοὺς ἐκ βοτανῶν χυλῶν καὶ ὀπῶν, δένδρων καὶ καρπῶν καὶ ξύλων ξηρῶν καὶ ὑγρῶν. ἐκ τούτων ζωμοὺς καταστήσαντες συνεστήσαντο τὴν τέχνην ἐκ ταύτης τῆς μιάς. (Trad. 108<sub>14-1098</sub>: En s'occupant maintenant de la substance jaune, ils font le catalogue

des espèces jaunes. C'est pourquoi l'on dit: "Il y a deux blanchiments, l'une sèche, l'autre liquide", c'est-à-dire que dans le catalogue du jaune, tu trouveras des plantes et des minéraux. Tu trouveras aussi deux liqueurs: l'une dans le chapitre du jaune, et l'autre dans celui du blanc. Dans le chapitre des liqueurs jaunes, figurent les produits obtenus avec les plantes jaunes, telles que le saffran, la chélidoine et autres semblables. Dans la liste des compositions blanches, et parmi les matières sèches, sont toutes les (substances) blanches, telles que la terre de Crète (la craie), la terre de Cimole et autres analogues. 1136<sup>a</sup>: ils exposent aussi les liqueurs tirées de sèves et des suc des plantes, des arbres, des fruits, des bois secs et humides. En composant des liqueurs avec ces substances, ils ont constitué l'art.) See also n.46.

34. Ideler, 200<sub>2</sub>: ἡ πολλόχρωμος ἔξανθίζουσα ἴρις. Taylor (p. 121) translates it as "the many-coloured painted rainbow". It is true that ἴρις means rainbow, as well as various species of the botanic genus *Iris*, but the participle ἔξανθίζουσα (blooming) attributed to *Iris* shows that Stephanus refers to the plant *Iris* figuratively, because of the various colours of its flowers, making allusion to the various colours seen in the mixture during the alchemical experiments. LS, p. 836: ἴρις. See also n.104. Ideler, 2135, 23413-20 (figuratively), 23627, 24715-17. Taylor, 131, 138, n.57, 58, 59. CAG, 4816-23, 493-4 Democr., 668-9 Synesius.
35. I. Hammer Jensen (as in n.4), 93: "Die Kenntnis der Wirkung von Lorbeerblättern und Rinden rührt wohl auch von der Pharmakologie her."
36. Ideler, 210<sub>23</sub>. Taylor, 41, 47, n.94.
37. CAG, 1345, 1826, and other passages.
38. Ideler, 209<sub>18</sub>. Taylor (p. 41) translates it as "wonderful things", but as the passage refers both to colorations and healing, I prefer to translate it as "important results". LS, p. 683: ἔργον; p. 1088-9: μέγας.
39. Ideler, 209<sub>8</sub>. Taylor, 41. See also n.24.
40. Ideler, 209<sub>27</sub>. Taylor (p. 41) does αὔτη ἐστὶν τοῦ παντός ἐνέργεια. (Trad. 2110-11: la scorie représente l'acte accompli du Tout.) Berthelot translates here σποδός as a synonym of σκωρία. According to Taylor (46, n.86), "σκωρία seems to be used chiefly of mineral products". I. Hammer Jensen (as in n.4), 61: "Asche" hat aber auch eine spezielle Bedeutung in den alchemistischen Schriften, bedeutet oft ein Destillationsprodukt. LS, p. 1618: σκωρία = dross of metal, slag. p. 1629: σποδός = I. wood-ashes, embers; generally ashes; There seems to be no difference between σποδός and τέφρα. II. dust. III. oxide of certain metals, IV. metaphorically . . . V. lava.
44. Ideler, 210<sub>1-5</sub>. Taylor, 47, n.93. I. Hammer Jensen (as in n.4), 59: "Wenn sowohl Hermes als Agathodaimon und Maria darauf Gewicht legen, dass die Stoffe zu 'Asche' reduziert werden, haengt dies sicherlich mit der Gewohnheit der Aerzte zusammen, die zu Arzneien verwandbaren Metalle durch Reduktion zu 'Asche' zu reinigen."
45. Ideler, 210<sub>3-6</sub>. CAG, 9817-19 Zos.
46. Ideler, 2106-11. Taylor, 41.
47. Ideler, 21020-22, 24431-37, 2452-3. Taylor, 41. CAG, 2181<sub>3</sub>. Zos. περί τῆς τῶν τεσσάρων στοιχείων εἰς ἑαυτὰ μεταβολῆς. (Trad. 2111<sub>2</sub>: Sur la transmutation des quatre éléments entr'eux.)
48. Ideler, 22133-34, 2226-7, 2238, 12-13, 22-29, 2267.
49. S. Sambursky, *Physics of the Stoics*, Greenwood Pr., Westport, Connecticut, 1959, t. 3, 34, 36, 37.
50. Ideler, 20429-30, 20530-31, 20725-26, 21022-24, 21213-16, 280, and others. Taylor, 1 (129, 131, 133), 2 (41, 45).
51. CAG, 169<sub>14</sub> Zos. LS, p. 595: ἔξισχνωσις = thinning, refining.
52. Ideler, 2151<sub>8</sub>. I. Hammer Jensen (as in n.4), 93-94: "Von Galen erfahrt man, wie die Alchymisten darauf verfielen, ein Pulver zu machen und ueberhaupt in der Behandlung von Metallen den Aerzten nachzunehmen; er sagt naemlich an mehreren Stellen, dass man durch Pulverisieren und Brennen Metalle und Steine πολύ λεπτομερέστερα mache, so dass sie besser eindringen und besser wirken."
53. Ideler, 2069-14, 2325-30, 2336-13.
54. CAG, 552<sub>3</sub>, 761<sub>3</sub>, 1057, 2078, 2612, 2781<sub>2</sub>, 313<sub>2</sub>, 3150, 3188, 3501<sub>2,16</sub>, 3591<sub>4</sub>, 3841<sub>2</sub>, 4181<sub>7</sub>, 4192<sub>4</sub>: Chr. Γενόμενος δὲ λευκός, μάλλον δὲ ἄχρους, οὕτως ἐλαύνεται σφύρας παλιόμενος ἐπὶ μυλικῶν λίθων ἐν τῇ γῆι πεπηγότων, πυκνὰ μεταστρεφόμενος ἅμα τῷ ξυλαρίῳ ἐν ᾧ ἐνεπάγη, προθερμανθείς. (Trad. 4011<sub>4-17</sub>: [Le produit] devenu blanc, ou plutôt dépourvu de couleur, il est alors étiré, battu avec des marteaux sur des pierres meulières fixées en terre. On le retourne de temps en temps, ainsi que le morceau de bois dans lequel il a été encastré, après avoir été chauffé au préalable.)
55. CAG, 564-7: ὁπηνίκα δὲ λειώσεις ἰατρικῶς, ἐπιβάλλε ἐκ τοῦ ὑγροῦ τῶν βοτανῶν μετὰ ἀλός ἀνθείου, καὶ πράσου χυλόν. Εἶτα ἀνελόμενος εἰς πρὸς λίον ἐψει ἰατρικῶς σπαθίζων. (Trad. 601<sub>4</sub>: Lorsque vous aurez délayé à la manière des médecins, ajoutez quelque peu de la partie aqueuse des plantes, avec de l'efflorescence saline et du suc de poireau. Ensuite reprenant le produit, faites le cuire à la manière des médecins dans une cuiller, en agitant avec une spatule.)
56. CAG, 1831<sub>5-16</sub>: Zos. Ο Αγαθοδαίμων ἐν ταῖς λειώσεσιν ἰσχυρῶς καὶ ἰατρικῶς κολλούρια ἀγώγη εἶπεν λειοῦσθαι. (Trad. 1811<sub>2-13</sub>: Agathodémon prescrit de délayer fortement, en se conformant à la marche suivie par les médecins pour les collyres). AG, P. Leid., 100 #68: καὶ συλλέξων ἐπιμελῶς ὄξει ὄρμει ὡς κολλούριον ἰατρικὸν ἐπὶ ἡμέρας γ'. (Broyez ensemble avec soin dans du vinaigre fort comme un collyre médicinal pendant 3 jours).

57. Ideler, 209<sup>17</sup>-210<sup>1</sup>. Taylor, 41.
58. Pedanii Dioscuridis, *De materia medica*, ed. Kuehn (C. Sprengler), I, Lipsiae 1829, 75f. (Α ογ' στακτη), 801f. (Ε ρλδ' τέφρα), and others.
59. Ideler, 210<sup>27</sup>. Taylor, 41.
60. Ideler, 212<sup>34</sup>.
61. CAG, ξηρίον: 211<sup>3</sup>, 221<sup>0</sup>, 48<sup>2</sup>, 711<sup>3</sup>, 76<sup>4</sup>, 127<sup>8</sup>, 131<sup>9</sup>, 143<sup>8</sup>, 175<sup>22</sup>, 203<sup>5</sup>, 23<sup>2</sup>, 204<sup>1</sup>, 205<sup>2</sup>, 218<sup>6</sup>, 251<sup>22</sup>, 25<sup>23</sup>, 257<sup>5</sup>, 258<sup>2</sup>, 259<sup>9</sup>, 12<sup>2</sup>, 260<sup>4</sup>, 288<sup>18</sup>, 301<sup>5</sup>, 303<sup>23</sup>, 305<sup>2</sup>, 311<sup>6</sup>, 22<sup>2</sup>, 346<sup>20-21</sup>, 347<sup>2</sup>, 354<sup>20</sup>, 358<sup>18</sup>, 361<sup>20</sup>, 375<sup>3-8</sup>, 382<sup>14</sup>, 386<sup>14</sup>, 405<sup>5</sup>, 411<sup>2</sup>, 419<sup>23</sup>, 420<sup>10,16</sup>, 439<sup>10</sup>, 440<sup>13</sup>, 446<sup>9</sup>, 447<sup>1</sup>, 455<sup>13</sup>, 457<sup>11</sup>.
62. CAG, 311<sup>7</sup>: Isis (see n.18). 419<sup>23</sup>: Chr. ἦτοι γενέσεως ξηρόν καὶ φαρμάκου. (Trad. 402<sup>5-6</sup>: lorsqu'on veut obtenir toute sorte de couleur, préparer la poudre de projection et la composition [cherchée].)
63. CAG, 411<sup>1-4</sup>: Chr. αὶ δὲ ὡς ἀπὸ ξηρῶν ὡς ἐπὶ τῶν ἰατρικῶν ξηρίων, αὶ δὲ σύνθετον ἔχουσι τὴν φύσιν, ὡς αὶ μολυντικὰ τῶν ἐμπλάστρων, καὶ τὰ ἐπιχρίσματα καὶ τὰ ζωγραφικὰ πάντα. (Trad. 394<sup>7-11</sup>: Les autres comprennent les matières sèches: tel est le cas des [poudres] sèches médicinales. D'autres sont de nature composée, comme il arrive pour les classes des matières ramollies, telles que les emplâtres, les onguents et (généralement toutes) les couleurs employées en peinture.)
64. CAG, 1031<sup>2-14</sup>: Olymp. Πίνεσθε παιδες ἰατρῶν, ἵνα νοήτε τὰς φύσεις, ὀτηνικά αὐτὸ ὑγιεινὸν φάρμακον κατασκευάσαι βουλόμενοι, τοῦτο οὐκ ἀκρίτως ὀρημί πράττειν ἐπιχειροῦσιν. (Trad. 112<sup>17-20</sup>: Devenez tels que les fils de médecins, afin de comprendre les natures; en effet les fils de médecins, lorsqu'ils veulent préparer un remède salutaire, n'opèrent pas avec une précipitation inconsidérée.)
65. CAG, 4171<sup>0-20</sup>: Chr. Τῆς μὲν γνησίας ὕλης ἐπεδραξάμεθα, πλείους δὲ χειρουργίας αὐτὴν ἰατρούσαμεν. Cf. 72<sup>21</sup>: Ὁ γὰρ Ἑρμῆς φησὶν: "Ὅταν λάβῃ μετὰ τὴν μεγάλην θεραπείαν, τούτεστιν τὴν πλῆθυν τῆς ψάμμου". (Trad. 400<sup>10-12</sup>: nous avons décrit la matière authentique et, nous l'avons médicamentée par plusieurs manipulations. 792<sup>-3</sup>: Car Hermès dit: "Lorsque tu auras pris (quelque) substance après le grand traitement, c'est-à-dire le lessivage du minerai.")
66. Ideler, 212<sup>2</sup>.
67. See n.53.
68. CAG, 1061<sup>5</sup>: Olymp. ἴστε, τοῖνον, ᾧ φίλοι χρυσοτεχνῶνται (Trad. 115: Sachez donc, ô mes amis, vous les artisans de l'Or).
69. CAG, 415<sup>14</sup> Chr., and note to 78<sup>20</sup>.
70. I. Hammer-Jensen (as in n.4), 150-151. M. Berthelot (as in n.9), 291<sup>(1)</sup>, 292<sup>(5)</sup>, 293<sup>(1)</sup>.
71. E. O. von Lippmann (as in n.4), 104. E. Riess (as in n.9).
72. CAG, 425, 447, 450. M. Berthelot (as in n.4) 208. M. Ullmann, *Die Natur- und Geheimwissenschaften im Islam*, E. J. Brill, Leiden, 1972, 189. The work of Stephanus is also included among those translated in Latin during the XV-XVI centuries, as it is shown from the manuscripts: CMAG, IV, 57f. 60f, 68f, 140f, 196f, 203f.
73. Ideler, 224<sup>27-28</sup>.
74. Ideler, 224<sup>30-225</sup>.
75. CAG, 611<sup>7-18</sup>: Dem. Οὐ Διόσκορε, ἀλλὰ γυμνάσαι ὑμῶν τὸν νοῦν καὶ τὰς φρένας. οὕτω συνετάγησαν. ἄκουσον αὐτοῦ λέγοντος: Ὡς νοήμοσιν ὑμῖν ὁμιλῶ, γυμνάζων ὑμῶν τὸν νοῦν". 416<sup>2</sup>: Chr. γυμνάσαι ἄελοντες φρένας τῶν νέων. (Trad. 66<sup>7-10</sup>: Non, Dioscorus; mais il convient d'exercer notre esprit et notre pensée. Voici comment les choses ont été arrangées. Écoute le parler: "Je m'entretiens avec vous comme étant des gens intelligents, et j'exerce votre esprit". 399<sup>4-5</sup>: ils voulaient exercer les esprits des jeunes gens.) On the special meaning of lessons as the mathematical sciences, see LS, p. 1072: μάθημα.
76. Ideler, 231<sup>15-17</sup>.
77. Ideler, 226<sup>11-14</sup>.
78. Ideler, 215<sup>14</sup>.
79. Ideler, 232<sup>13-15</sup>.
80. Ideler, 208<sup>28-31</sup>, 209<sup>5</sup>. Taylor, 39.
81. Ideler, 208<sup>29-30</sup>, 212<sup>20-22</sup>, 214<sup>33-34</sup>, 234<sup>4-6</sup>.
82. Ideler, 213<sup>27-32</sup>, 214<sup>16-17</sup>, 216<sup>1-6</sup>, 217<sup>25</sup>, 219<sup>23-29</sup>.
83. Ideler, 200<sup>21,24</sup>, 201<sup>27</sup>, 206<sup>4-5</sup>, 214<sup>175</sup> and other passages.
84. Ideler, 210<sup>6-20</sup>. Taylor, 41.
85. See n.50.
86. On the introduction and distinction between the terms "aurifiction" and "aurifaction" see J. Needham, *Science and civilization in China: Vol. 5 Chemistry and chemical technology; Pt II Spagyrical discovery and invention, magisteries of gold and immortality*; Cambridge, U.P. 1974, 10. W. Strube, *Der historische Weg der Chemie*, VEB, Leipzig 1976/1984, 30: "Faelschung kann auch als Nachahmung von Naturstoffen und damit als Erzeugung von Kunstprodukten angesehen werden. Betrug war sicher mit im Spiel und auch ziemlich lange, doch er war wahrscheinlich nicht typisch fuer den chemisch-gewerblichen Stand." CAG, 581<sup>-2</sup>: Syn. ἀλλ' ἐξῶθεν διέχρηε τὰς οὐσίας, καὶ πυρῶν, εἰσέκρινε τὸ φάρμακον. 1771<sup>0-13</sup>: Zos. βουλόμενοι ἐπιδειξάει τὴν τοῦ φαρμάκου δύναμιν, σκευὴ τὰ ἀργύρου λαμβάνοντες, καὶ τὸ ἦμισον χρίσαντες, τὸ φάρμακον ὅπουσι καὶ ἐκφέρουσι τὸ σκεῦος κεχρυσωμένον τὸ μέρος τὸ χρυσοῦν. Τὸ δὲ ἕτερον ἀκέραιον μένει. (Trad. 612<sup>1-22</sup>: mais qu'il

- opérait sur les substances avec des enduits placés au dehors, et faisant agir le feu il effectuait la préparation. 176<sub>1-5</sub>: Ils agissent ainsi pour montrer la puissance de la préparation; prenant des objets d'argent et les couvrant d'un enduit jusqu'à la moitié, ils font chauffer la préparation; et lorsqu'ils enlèvent l'objet, il est doré dans la partie enduite, tandis que l'autre (partie) reste intacte). See also n.20. In Pap.Leid. there are many recipes to give objects of copper the appearance of gold; AG, 92 #27: Χαλκοῦ χρυσοφανοῦς ποίησις. 95 #41: Χαλκοῦ χρῶσις. Ἐάν θέλῃς χαλκὸν ἀργύρου χρώμα ἔχειν. 96 #46: Χαλκὸς χρυσοφανῆς. Χαλκοῦ χροιάν χρυσοῖ ἐμπερῆ εἶναι . . . ὁμοιον γὰρ εἶδος ἔχει τὸ ἐπιχρισθῆν ἢ γραφῆν. 97 #48, 50, 53, 55: Ἀργύρου χρῶσις (gilding of silver).
87. Ideler, 232<sub>12-13</sub>.
88. Ideler, 201<sub>34-35</sub>. Taylor, 125.
89. Ideler, 215<sub>14-15</sub>; cf. 206<sub>30</sub>.
90. Ideler, 200<sub>17</sub>. Taylor, 121.
91. Cf. Philosophy as acquisition of science (Plato *Euthd.* 288d) and as practice of suitable art (Stoic. in *Placit.* I. Prooem. 2).
92. Ideler, 241<sub>31</sub>. CAG, 70<sub>5-6</sub>: Olymp. τέχνης ἐμφιλοσόφου.
93. Ideler, 202<sub>30-2035</sub>, 223<sub>22-31</sub>, 224<sub>21-23</sub>, 226<sub>1-4</sub>. Taylor, 127, LS, p. 81: ἀμερῆς and p. 271: ἄτομος = indivisible.
94. Plato, *Timaeus*, 55e-56b. F. Cornford (as in n.41), 222-224. R. Halleux (as in n.41), 85-90.
95. Idler, 224<sub>1-16</sub>, 225<sub>1-4</sub>. Aristotle, *Meteorologica*, I. iii 340b24-25, iv 341b8-13; II. iii 358a20-24, iv 360b30-361a4; III. vi 378a17-378b6. R. Halleux (as in n.41), 97-101.
96. Ideler, 226<sub>5-8</sub>.
97. Ideler, 216<sub>31-37</sub>.
98. Ideler, 210<sub>11-12</sub>. Taylor, 41.
99. Ideler, 223<sub>22-28</sub>, 224<sub>21-23</sub>.
100. Ideler, 225<sub>22</sub>: ἵνα ἀπίαστον εὐρωμεν τοῦ ὀνόματος τὴν δύναμιν, 227<sub>12-14</sub>, 228<sub>11c</sub>. cf. *Novum Testamentum Graece* (ed. E. Nestle-K. Aland), *Apokalypsis*, ch. 13, 17-18.
101. Ideler, 225<sub>9-13</sub>, 19-20, 33-37, 226<sub>25-37</sub>, 227, 228. On the solution of the riddle see: H. Kopp, *Die Alchemie in aelterer und neuerer Zeit*, Bd. II, Heidelberg, 1886, 157, 293.
102. Alloy of four metals. CAG, 96<sub>2-3,6-7</sub>: Olymp. Τὸν γὰρ μολυβδὸν εἶπον ὦν τὸ ἐκ τῶν τεσσάρων σωμάτων, ὡς ποῦ φησὶν ὁ Ζώσιμος . . . Τὰ γὰρ τέσσαρα σώματα ἡ τετρασωμία ἐστίν. (Trad. 104<sub>12-13,17-18</sub>: J'ai dit que le plomb est l'oeuf (philosophique), composé des quatre éléments; Zosime l'expose aussi quelque part . . . En effet les quatre corps forment la tétrasomie.)
103. Ideler, 223<sub>9-13</sub>, 226<sub>34-35</sub>, 227<sub>1-2</sub>. R. Eisler, *Weltenmantel und Himmelszeit*, Muenchen, 1910, 451 Anm.4. CCAG, VII, 104<sub>14-29</sub> (Cod. 7 = Monac. 287, f.105<sup>v</sup>, l'). CAG, 87<sub>8-884</sub>: Olymp. Καὶ μύρια χρυσοφυχεῖα γεγραφήκασι, ἀλλὰ καὶ ἱεράτευσαν αὐτά, . . . ἀλλὰ καὶ θέσεις τῶν ἱερῶν τῆς εἰσβάσεως αὐτῶν πρὸς τὰ τέσσαρα κλίματα ἀφορώντες, ποῦ μὲν τὴν ἀνατολὴν διαδόντες τῆι λευκῆι οὐσίαι, τὴν δὲ ὄσον τῆι ξανθῆι . . . 218<sub>20-25</sub>: Zos. Διὰ τοῦτο καὶ οὐσία ἐκάλεσαν τὰ τέσσαρα γράμματα ὁ φιλόσοφος τῆι ἑνώσει τῆς οὐσιότητος ἔλκονσας τὸ ἔξωθεν διακριόμενον φάρμακον. Καὶ ὅτι ὡσπερ τὰ στοιχεῖα εἰς ἑαυτὰ ἀναλύόμενα πάντα κατεργάζεται, οὕτω καὶ ἡ τέχνη. καὶ ὡσπερ αἱ τέσσαρες τροπαὶ μεταβαλλόμεναι νικῶσιν τὰς προτέρας κράσεις, οὕτω καὶ αἱ τέχναι ταῖς μεταβολαῖς νικῶσι τὰς φύσεις. (Trad. 93<sub>21-942</sub>: Non seulement ils ont décrit mille procédés pour faire de l'or; mais encore ils ont réalisé ces choses. Ils ont donné les mesures des excavations et des intervalles et assigné les positions des entrées et des sorties de leurs temples, en considérant les quatre points cardinaux; attribuant le levant à la substance blanche, et le couchant à la substance jaune. 211<sub>19-25</sub>: C'est aussi pour cette raison que le philosophe appelait substances les quatre éléments. Pour unifier leur substantialité, elles attirent dans leur intérieur la préparation enduite à leur extérieur. De même que les éléments dissous en eux accomplissent toutes choses, de même aussi l'art; et de même que les quatre transformations triomphent des mélanges précédents, de même aussi nos arts, par les transmutations, triomphent des natures.)
104. Ideler, 221<sub>34-2229</sub>, and for the correspondence between metals and planets 247<sub>29-36</sub>; the whole text is found in *Cod. Paris. gr. 2327*, f.73<sub>v</sub> 12-23, as well as in *Cod. Scorial. I.φ.11*, f.69r: CMAG, V, 98 (col.1). J. R. Partington, "The Origins of the Planetary Symbols for the Metals", in the "Report of discussion upon chemical and alchemical symbolism", *Ambix*, 1 (1937), 61-64. R. Halleux, (as in n.41), 154-155.
105. Ideler, 222<sub>1-20</sub>. LS, 409: διάπυρος, 417: διαυγής, 998: κροκώδης, 1187: ξανθός, 1787: τηλαυγής.
106. Ideler, 245<sub>9-12</sub>.
107. CAG 100<sub>18-19</sub>, 101<sub>6-10</sub>: Olymp. Ἐρμῆς τοίνυν μικρὸν κόσμον ὑποτίθεται τὸν ἀνθρώπον, λέγων ὅτι ὅσα ἔχει ὁ μέγας κόσμος, ἔχει καὶ ὁ ἀνθρώπος . . . Ἐχει ὁ μέγας κόσμος τὸν οὐρανόν. ἔχει καὶ ὁ ἀνθρώπος τὴν κεφαλὴν. ἔχει ὁ οὐρανὸς τὰ δώδεκα ζῳδια ἀπο κρισθ τὴν κεφαλὴν ἕως ἰχθύων τοῦς πόδας. Καὶ τοῦτο ἐστὶ τὸ φημιζόμενον παρ' αὐτοῖς τὸ κοσμικὸν μίμημα ὃ καὶ ἐν τῆι βίβλῳ τῆς ἀρετῆς μείμνηται ὁ Ζώσιμος. (Trad. 109<sub>27-29</sub>, 110<sub>7-15</sub>: Hermès suppose que l'homme est un petit monde (microcosme), lorsqu'il dit: "Tout ce que possède le grand monde, l'homme aussi le possède . . . Le grand monde a le ciel; l'homme a la tête. Le grand monde a les douze signes du Zodiaque; l'homme a ces choses depuis la tête, c'est-à-dire depuis le Bélier, jusqu'aux pieds, qui répondent aux Poissons. C'est là ce que les

ancients experiment, en disant que l'homme est l'image du monde; ce que rapporte Zosime dans son livre de la Vertue. De même la terre est l'image du monde.)

108. CAG, 80<sub>B-12</sub>: Olymp. πάλιν τινὲς Οὐρανὸν αὐτὸν [Ἀγαθοδαίμονα] ἐκάλεσαν. καὶ τάχα ὡδε ἔχει λόγον διὰ τὸ κοσμικὸν μίμημα. Ἱερογραμματεῖς γὰρ τινες τῶν Αἰγυπτίων βουλόμενοι κόσμον ἐγχαράξαι ἐν τοῖς ὀβελίσκοις ἢ ἐν τοῖς ἱερατικοῖς γράμμασιν, δράκοντα ἐγκολάπτουσιν οὐροβόρον. τὸ δὲ σῶμα αὐτοῦ καταστικτὸν ὑπάρχει πρὸς τὴν διάθεσιν τῶν ἀστέρων. (Trad. 87<sub>14-18</sub>: D'autre l'ont appelé [Agathodémon] le Ciel, et peut-être tient-on ce langage parce que le serpent est l'image du monde. En effet, certains hiérogammates égyptiens, voulant retracer le monde sur les obélisques, ou l'exprimer en caractères sacrés, ont gravé le serpent Ouroboros. Or son corps est constellé d'astres.) See also H. J. Sheppard, "Egg symbolism in Alchemy", in: *Ambix*, 6 (1958), 140-148, here 141, 146; "The Ouroboros and the unity of matter in Alchemy: A study in origins", in: *Ambix*, 10 (1962), 83-96, here 83, 88, 94-95.
109. Ideler, 244<sub>31-37</sub>, 245<sub>1-7</sub>.
110. Ideler, 203<sub>6-14</sub>. E. Wellesz, "Music in the treatises of greek Gnostics and Alchemists", in: *Ambix*, 4 (1951), 145-158, here 153-154.
111. Taylor, 119.

ADDENDA AND CORRIGENDA. Some lines of text were unfortunately omitted from the notes to the article "Stephanus of Alexandria: Pharmaceutical Notions and Cosmology in his Alchemical Work" by Dr. Maria Papathanassiou, published in Vol. XXXVII No. 3 (November 1990), 121-133. Notes 40-43 (on p. 130) should read as follows:

40. Ideler, 209<sub>27</sub>. Taylor (p. 41) does not translate the word ἔργων (of works), because of its obscure meaning. I think it is possible that it means Xerion or Stone, as both are the "work done" by the philosophers, while the dyeing of other materials mentioned is the work of goldsmiths and dyers.
41. LS, p. 2013: χυτός. Plato, *Timaeus* 58d. F. Macdonald Cornford, *Plato's Cosmology*, Routledge & Kegan Paul, London 1937-Bobbs-Merrill Co., Indianapolis 1975, 246-250. R. Halleux, *Le problème des métaux dans la science antique*, Les Belles Lettres, Paris 1974, 87, 89.
42. Ideler, 209<sub>31-34</sub>. Taylor, 41.
43. CAG, 218<sub>12</sub>: ἡσποδός, αὕτη ἐστὶν τοῦ παντὸς ἐνέργεια. (Trad. 211<sub>10-11</sub>: la scorie représente l'acte accompli du Tout.) Berthelot translates here σποδός as a synonym of σκωρία. According to Taylor (45 n. 86), "σκωρία seems to be used chiefly of mineral products." I. Hammer Jensen (as in n. 4), 61. LS, p. 1618: σκωρία = dross of metal, slag. p. 1629: σποδός = I. wood-ashes, embers; generally ashes; There seems to be no difference between σποδός and τέφρα. II. dust. III. oxide of certain metals, IV. metaphorically . . . V. lava.