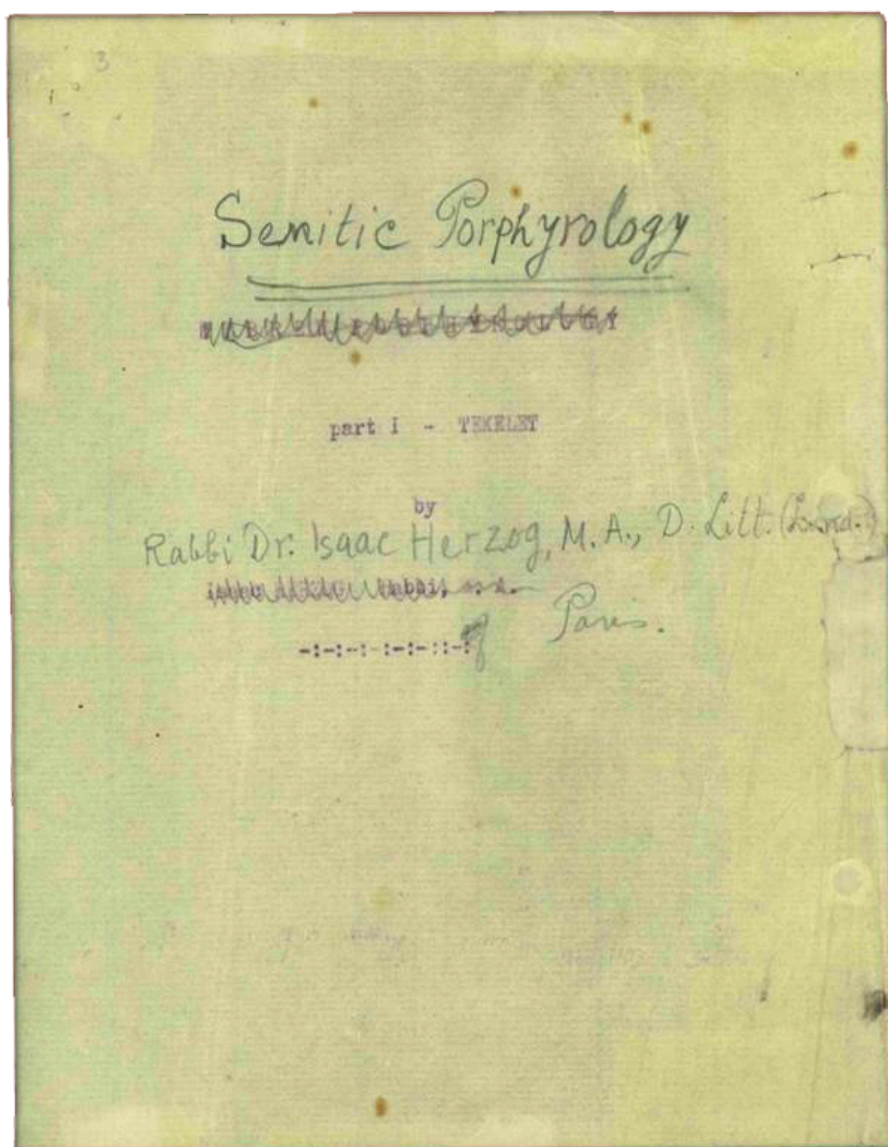


HEBREW/SEMITIC PORPHYROLOGY

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נשיא המדינה
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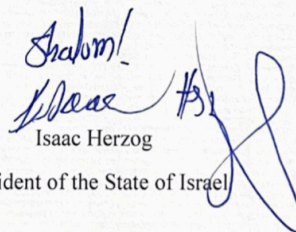
To the Hebrew Porphyrology Online Project team,

It has been over a century since my late grandfather, Chief Rabbi Yitzhak Isaac Halevy Herzog zt"l, wrote his ground-breaking doctorate, *Hebrew Porphyrology*, for the University of London. It is gratifying and meaningful to see that his work is not only still relevant but sought after as a fundamental source for Tekhelet research. The ideas he developed are crucially important as they relate to the ancient Biblical dye. The doctorate also provides a model for synthesis of so many diverse disciplines, old and new, Halachic and secular studies, of Torah and science.

The project of putting *Hebrew Porphyrology* online is to be highly commended in making the work available to a wide audience worldwide. The translations of the non-English sections, as well as the full Hebrew translation, will allow it to be accessible for so many who otherwise would not be able to read it.

I wish to thank Ptil Tekhelet for spearheading this project, the overall curator, Rafi Hecht, the project manager of translations, Gilad Sterman, and all those who gave of their time to contribute to this important project: Abraham Cohen, Daniel Sanders, David Yosef Aguirre, Meir Smullen, Menachem Davis, Michael Kaplan, and Yosef Malkiel.

Best wishes for a Shana Tova,

Shalom!

Isaac Herzog
President of the State of Israel

I. PURPLE DYEING IN ANTIQUITY

A. Preface

The aim of this chapter is not to give a more or less adequate account of the manufacture of purple in ancient times, but merely to discuss a certain number of facts, an acquaintance with which is calculated to assist the uninitiated reader in following intelligently the subsequent treatment of the various aspects of *Tekhelet*.¹

Purple dyeing is not really so wholly a thing of the dead past as most people are apt to suppose. The tainting of cloth by means of marine animal pigment is still practised, albeit in a crude, primitive form, by the natives on certain coasts of Central America.² But it is only the history of the art in oriental and classical antiquity which directly bears upon the inquiry forming the subject of the present work.

Dating from hoary antiquity the noble art of purple dyeing passed through a long and checkered career breathing out its last on the shores of the Bosphorus, amid the deafening din and clatter of the all-devouring arms of the victorious Turk (1453).

The ancients had no great variety of dyestuffs at their disposal, but of those available, the most highly prized was that obtained from the colouring matter secreted by certain marine snails. Upon the manipulation and application of this were exercised the skill and ingenuity of successive generations of craftsmen working under different conditions upon different shores of the mighty deep.

B. The Particular Species Used in the Manufacture of Purple

The question which most readily suggests itself is: which species were anciently employed in purple dyeing? Our chief authorities are Aristotle and Pliny. Unfortunately the statements of both authors leave much to be desired in point of particularisation.

¹The readers desirous of pursuing with anything like thoroughness the none too easy - study of the porphyrology will have been, I think, well advised, if he chooses the following works as his guides: (1) Die Griechischen Papyrusurkunden der Königlichen Bibliothek zu Berlin, pp. 96-212 (Die Purpurfärberei und der Purpurhandel im Alterthum), W. Adolf Schmidt, Berlin (1842); (2) "Purpura," Maurice Besnier in: Dictionnaire des Antiquités grecques et romaines, ed. Daremberg et Saglio T.IV, pp. 769-778. Paris (1908); (3) Ein Beitrag zur Purpurkunde, Alexander Dedekind, four volumes, Berlin (1898-1911).

² Cf. p. 13 and in Edward Schunck, "Purple Dyeing in Modern Time," *Journal of the Chemical Society*, vol. 37. *Transactions*, pp. 613-617, London (1880). E. von Martens, "Purpur Färberei in Central America," *Verhandlungen der Berliner Anthropologischen Gesellschaft*, October 22, 1895.

In Aristotle's History of the Animals reference is often made to a genus of marine snails bearing the name of *Purpura*. In the fifth book, chapter 15, we are informed that it is that genus which furnishes the pigment for the dyeing of purple.³

"There are, indeed, numerous kinds of *Purpurae*. Some are big, as those about the cape of Sigeum and Lectum (The coast of Troade at the entry of the Hellespont.) ; others are small, as those of the Euripus and about the coasts of Coria. Those who are found in harbours are big and rough, and for the greater part have their flower of a black colour, but some have it red and small. Of those that are big some attain the weight of a mina. Those which are upon the shores and in the proximity of promontories are small in size but have their flower red, at least in far the greater part. The *Purpurae* are caught in spring tide at the time when they make their wax. In the dog days they are not caught for then they do not feed but they hide and squat. Their flower is placed between the micon and the neck. The connection of these two parts is thick; the colour is like that of a white membrane which can be removed; on being squeezed it taints and colours the hand. There is something like a vein crossing it. It is this which is regarded as the flower, the remainder being like alum. The flower of the *Purpurae* is worst when they make their wax. The small *Purpurae* are crushed together with their shells, for it would be hard to detach their flower. From the bigger ones, on the other hand, the flower is separated after the shell has been removed. In this way the neck becomes separated from the micon; for the flower being placed between the two, over that which is called the stomach, its (i.e., the flower's) removal necessarily separates the two. Care is taken to crush the *Purpurae* while they are alive, for if the *Purpura* dies before that operation it ejects and vomits its flower. For this reason also, they are kept in nets until a sufficient quantity of them has been collected to allow of their being expeditiously bruised.

The ancients placed no nets beneath the baits with the result that the *Purpura* would often drop into the water after it had been caught up, but the moderns arrange matters in such a manner that even if the *Purpura* drops off, it does not get lost.

They most readily drop off when they are full but even when they are empty they are not easily drawn up.

These are the particulars relating to the *Purpurae*. The buccinae are born in the same way and at the same season. The buccinae and the *Purpurae* both have their opercula placed in the same

³ Aristotle, *Aristotelis De Animalibus Historiae*, L. Dittmeyer ed., Leipzig (1907), p. 175.

manner and have it since their birth like all other turbinatae. They feed by drawing out what is called their tongue beneath their operculum. This tongue of the *Purpura* is bigger than a finger. The animal makes use of it for feeding and for piercing the shells of other conchylia and even its own shell. The *Purpura* and the buccina both live very long. The *Purpura* lives about six years, and its growth can be annually watched on the intervals formed upon its helix."⁴

In chapter IV Aristotle says that the *Purpurae* belong to that class of conchylia which have their bodies completely hidden by the shell with the exception of the head, that they have a trunk doing service for a tongue which is so strong that they can pierce shells with it.⁵

It is absolutely certain that *Purpura* in Aristotle's nomenclature embraces the genus bearing that name in modern conchology. But it is really more comprehensive. When he says that "several species are distinguished by reason of their size and by the prickles with which they are furnished," Aristotle is plainly referring to species of the genus *Murex*.⁶

All the species belonging to the genera termed *Purpura* and *Murex* by the modern systematists furnish in varying quantities a colouring matter.⁷ This is contained in a kind of bandelet situated at the lower face of the mantle between the intestine and the respiratory organ. On being removed from this gland, the purpuric liquid is of a whitish hue. Submitted to the action of light, it becomes first of a puslike colour, turning next into greenish and then passing through a succession of tints; it finally settles into what is termed its definite tone which varies according to the species, climate, weather and other circumstances, but all these different tones may be roughly described as representing a range of colours varying between red and blue as their extremes. While the colour is developing, the matter emits a strong garlic-like smell.

We should, however, be naturally led to think, even in the absence of direct evidence, that out of this great number of possibilities, the ancients would fix upon a definite number of species as the better adapted for dyeing purposes, and that such would not be indiscriminately employed.

⁴ Idem, p. 175.

⁵ Idem, p. 175.

⁶ Idem, p. 176.

⁷ See especially Linnaeus, *Systema naturae*, Wien (1767), 13th ed., No. 1202, 12141216- and cf. LacazeDuthiers, "Memoire sur la Pourpre," *Ann. des Sciences Naturelles*, 4eme series, Zoologie, tome 1, Paris (1859). (Separate reprint Lille 1860, Paris.)

Aristotle, however, leaves us in the dark on this vital point. Here Pliny fills the gap but only to a limited extent.

"Concharum ad *Purpuras* et concylia... duo sunt genera: buccinum minor concha ad similitudinem ejus quae buccini sonus editur unde et causa nomini, rotunditate oris in margine incisa: alterum *Purpura* vocatur canaliculato procurrente rostro et canaliculi latere introrsus tubulato, qua proseratur lingua. Praeterea clavatum est ad turbinem usque, aculeis in orbem septenis fere, qui nonsunt bucino..."⁸

"There are two kinds of shells in relation to *Purpuras* and shellfish... one is a smaller shell similar in appearance to that which produces the sound of a trumpet, from which also comes the reason for the name, having a roundness with the edge of the opening notched: the other is called *Purpura*, having a protruding beaked channel and the side of the channel inwardly tubular, through which the tongue is extended. Moreover, it is studded with spines in a whirl up to the top, almost seven in a circle, which are not found on the trumpet shell."

The description of the buccinum leaves no doubt that the Roman naturalist designates by that name the genus *Purpura* of modern conchology, but there is nothing in the text which might lead to the identification of the particular species. We are placed in a more advantageous position with regard to *Purpura*. "Not only," "Non seulement," says the great French conchologist Lacaze-Duthiers,

"The channel description for the passage which he mistakenly calls by the language is in general, a character of the *Murex*, but still, the points he describes prove that Pliny certainly had the *Murex Brandaris* in his mind..." (Memory on the Purple, Ann. des Sciences naturelles, 4th Série Zoologie, tome 1., Paris 1859.)

"La description du canal pour le passage de ce qu'il appelle à tort la langue est un caractère des *murex* en général, mais encore les points qu'il décrit prouvent que Pline avait certainement en vue le *Murex brandaris*..."⁹ (Mémoire sur la Pourpre. Ann. des Sciences naturelles, 4ème Série Zoologie, tome 1., Paris 1859.)

⁸ Pliny C., *C. Plini Secundi naturalis Historiae*. C. Mayhofied. 5 vols. Leipzig (1909). V.II, pp. 199200-.

⁹ Lacaze-Duthiers, Felix Henri de, "Memoire sur la Pourpre," Ann. des Sciences Naturelles, 4eme series, Zoologie, tome I, Paris, 1859,

The *Purpura* of Pliny corresponds to *Murex brandaris*. With regard to the several varieties of *Purpura* (*murex* in modern nomenclature) enumerated by Pliny (*limonensis*, *algensis*, *calculensis*, *dialutensis*, etc.), Lacaze-Duthiers confesses his inability to refer them to their corresponding appellations in modern conchology.¹⁰ Dr. D.L. Germain, of the National Museum d'Histoire Naturelle, informs me that this is as impossible to the zoologists of today as it was to Lacaze-Duthiers in 1859. I doubt whether these varieties are all sub-species of *Murex brandaris*. Pliny's description of *Purpura* seems indeed to apply especially to the latter species, but it is difficult to tell how far Pliny may be trusted with regard to even major details, or to what extent his generalisations are meant to have a delimiting force.

In the literature of the subject of ancient purple dyeing the reader will often meet with the collocation of *Buccinum* of Pliny with *Kerux* of Aristotle. I forebear giving many references, but it is sufficient to instance W. Adolf Schmidt, op. cit. p. 107 par. 13. This author is a model of painstaking exactness, at least in his work on ancient purple, and in the correctness of his references to the classics yields, I think, to none of the authors I have come across in my study of the subject. The meaning of the respective terms is indeed the same in Greek and in Latin: *Buccinum* and *Kerux* trumpet, i.e., trumpet-like shell. Yet I cannot refrain from giving expression on my part to the suspicion that the *Kerux* of Aristotle is not identical with the *Buccinum* of Pliny. I have not been able to discover a single explicit reference in Aristotle to the *Kerux* being employed in purple dyeing, though it is generally associated with the *Porphyra* in that author. In the desire of learning the view of a specialist I consulted Dr. L. Germain on the *Kerux* or *Buccinum* of Aristotle. Here is the reply of the learned keeper at the Department of Malacologie, of the Musée National d'Histoire Naturelle:

"Buccinum. Aristotle defines them by saying, 'Buccines have rough shells.' (Hist. Anim. lib. IV. cap. IV.) It's as you see it as vague. But given that, on the one hand, the *Buccinum* as we understand them today (Type: *Buccinum undatum*

"Buccinum. Aristote les définit en disant: 'Les Buccines ont des coquilles raboteuses.' (Hist. Anim. lib. IV. cap. IV.) C'est comme vous voyez bien vague. Mais étant donné, d'une part que les *Buccinum* tels que nous les comprenons aujourd'hui

¹⁰ Idem, p. 77.

Linnaeus) are animals living in the English Channel and the Ocean, and that, on the other hand, Aristotle knew only the Mediterranean animals, I believe that we must consider under the name of Buccinum of Aristotle the great Ravella and Tritonium. "

(Type: Buccinum undatum Linné) sont des animaux vivant dans le Manche et l'Océan, et que, d'autre part, Aristote n'a guère connu que les animaux Méditerranéens, je crois qu'il faut considérer sous le nom de Buccinum d'Aristote les grands Ravella et Tritonium."

The *Buccinum* (*Kerux*) of Aristotle is thus quite different from the Buccinum of Pliny. The Buccinum of the latter which answers to the species of the *Purpura* of the moderns is comprised by Aristotle in his *Purpura* (*Porphyra*). But though there is no express statement in Aristotle about the use of the *Buccinum* (*Kerux*) in purple dyeing, it must not be concluded on that account that it was not really so employed. The sole inference that this silence warrants is that it did not occupy that prominent position in the craft that would have to be attributed to it on the assumption of its identity with Pliny's Buccinum; for, in the latter's account, the Buccinum is the counterpart of the *Purpura* (duo sunt genera, etc.).

Aristotle states that some of the *Purpurae* are big and weigh a mina, i.e. about 12 1/2 ounces.¹¹ Dr. L. Germain, in reply to a question I addressed to him with regard to the possibility of identifying these, says:

"Obviously, here is a question of the large Mediterranean shells belonging to the genera Tritonium (Trit. Nodiferum of Lamarck, An s / vertèbres, 1822, VII. P. 129) and Ranella (Ran. Gigantea of Lam. Id. 1822, VII, p. 150) which, living in the Mediterranean (corraloum zone, rather great depth) are picked up from time to time by the fishermen and they also secrete a purple liquor."

"Il s'agit évidemment ici des grandes coquilles Méditerranéennes appartenant aux genres Tritonium (Trit. nodiferum de Lamarck, An s/ vertèbres, 1822, VII. p. 129) et Ranella (Ran. gigantea de Lam. id. 1822, VII, p. 150) qui, vivant dans la Méditerranée (zone corraloum, profondeur assez grande) sont ramassées de temps à autre par les pêcheurs et sécrètent également une liqueur

¹¹ Aristotle, *ibid.*, p. 175.

pourprée."

Now, the Tritonium and the Ranella being identical, according to Dr. L. Germain with Aristotle's buccinum, it would thus appear that the buccina, though generally held distinct by Aristotle from the *Purpurae*, have been confounded with the latter in the passage dealing with the *Purpurae* as productive of pigment. The sentence, however, forming the transition from the *Purpurae* to the buccina,¹² would rather seem to imply that the buccinum has not so far been included. Pliny, in fact, makes it clear that there are two different genera bearing the name of buccinum.

The whelk is a smaller shell resembling	"Buccinum minor concha ad
the one that gives out the sound of a	similitudinem ejus qui buccini sonus
trumpet (Pliny; Natural History Book IX;	editur."
LXI. 132)	

The ancients used as trumpets shells of molluscs of huge size belonging to the genera Tritonium and Ranella of modern conchology. The genus which played such a foremost part in purple dyeing resembled the latter in shape but was of much smaller size "minor concha" by the way, would seem to have been incorrectly interpreted by even Lacaze-Duthiers:

"The smallest is the whelk".	"Le plus petit est le buccin". ¹³
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"Minor concha" should, I think, be taken with the following "ad similitudinem ejus etc.," the buccinum employed in purple dyeing is a smaller shellsnail than the genus from which it (the purple buccinum) derives its name on account of resemblance of shape.

In F. de Mély's edition of the *Cyranides*, a magico-medical work, *Variants et Additions*, p. 271, one reads: "The main *Purpura*, also called conchyliia, is smaller than the buccinum."¹⁴ How is this

¹² Aristotle, *ibid.*, p. 176.

¹³ Lacaze-Duthiers, *ibid.*, p. 21.

¹⁴ Mély, Fernand de, *Histoire des Sciences*. Paris (18963 .(1902 - vols. V. III "Lapidaires Grecs," p. 271.

to be reconciled with the current construe of Pliny's "minorconcha" as meaning that the buccinum is smaller than the *Purpura*? Has *Porphyra* in this text the same signification as, according to Dr. Germain, it has in Aristotle, designating the big sized *Ranella* and *Tritonium*?

have found no information regarding the intrinsic quality of the colouring liquid secreted by the big *Ranella* and *Tritonia* whether it yields a fugitive or a fast dye. Should it, however, on experiment, turn out to be the former, as I indeed anticipate, our gain will have been a twofold one. We shall first have been afforded light on a very obscure point in Pliny, and, what is not less important, we shall have been placed in a position to assert with a higher degree of confidence that at least certain species belonging to the above genera, though not among the more prominent varieties, figured among the molluscs anciently used for dyeing purposes.

Pliny says of the buccinum that it yields a fugitive dye: "buccinum per se damnatur quoniam focum remittit." Now the dye furnished by the genus *Purpura* which is the buccinum Pliny is characterized by its fastness. Though unsupported by textual evidence, Lacaze-Duthiers in his *Mémoires sur la Pourpre* hazarded the suggestion that the species now called *Purpura haemastoma* whose dye is particularly durable largely corresponds to Pliny's buccinum.¹⁵

Lacaze-Duthiers could not, of course, help charging Pliny with ignorance. The French naturalist was not really the first to have pointed out the error. Edward Bancroft had done so long before.¹⁶ Pliny is certainly wrong, but it would nevertheless be of some interest to trace the source of his blunder. If the dye furnished by the *Ranella* and *Tritonium* is, as I expect, not durable, Pliny will have erroneously transferred this information he had got about the quality of the dye secretion of a larger buccinum to that of the smaller *Purpura* of the moderns. Incidentally, we would learn that the former was also exploited for the dyeing industry.

C. The Archeology of the Purple

The study of the classical texts has been supplemented by archeological researches. It is now known beyond all possibility of doubt that at least the following species were anciently

By the way, the reader may note it., p. 34, No. 4.

On p. 57 de Mely is wrongly translated as: "Il est semblable à une coquille." The correct reading is, I think, "they are alike in shell," or, the *Purpura* resembles the buccinum in respect of its shell.

¹⁵ "Quant à l'espèce même, il est très probable que la *Purpura haemastoma* qui a la réputation de donner une couleur indélébile devait jouer un grand rôle dans la teinture." (Lacaze-Duthier, *ibid.*, p. 76)

¹⁶ Bancroft, Edward, *Experimental Researches Concerning the Philosophy of Permanent Colours*. London (1813), 2 vols., 2nd ed., v.I, pp. 7, 120 sequ.

employed: *Murex brandaris*. *Murex trunculus*, *Purpura haemastoma*. The identification of these species as such has quite an interesting little history of its own.

To Guillaum Rondelet (d. 1566), professor at Montpellier, belongs the credit of having first identified the *Purpura* of Pliny with the species now termed *Murex brandaris*.¹⁷

In 1616 the Italian Fabius Columna further suggested the *Murex trunculus* as one of the principal species utilized in ancient purple dyeing.¹⁸ Thomas Gage, in 1637, seems to have been the first to have informed the Old World of purple dyeing in the coasts of Nicoya.¹⁹

William Cole of Bristol was led by a fortunate circumstance to discover, in 1681, that a certain shell fish, a native of the British shores, secretes in a minute quantity a colourless liquid which, when exposed to the sun, passes through a certain progression of colours settling at last into a "fair bright crimson" which is practically unalterable. Identifying that mollusc, which is *Purpura lapillus*, with the purple shell-fish of the Phoenician, Cole, full of glee, announced his discovery to the world in the December issue of the Philosophical Transactions.²⁰ The learned world hailed the news with great enthusiasm, as may be gathered from the account given of it in the *Acta Eruditorum*.²¹

The importance of Cole's discovery is that through it the Old World learned, for the first time after the total extinction of purple dyeing, of the remarkable qualities of susceptibility to light and colour progression under its action possessed by the dye secreted by certain molluscs. The determination, however, of the exact species employed by the ancients cannot, in view of the fact that the *Purpura lapillus* is a non-Mediterranean mollusc, be said to have been materially advanced by Cole's labours.

In 1703, Père Plumer²² described several varieties of *Purpura lapillus* found on the coasts of the Antillian Islands of the Grenadines identifying them with the species anciently employed:

"*Cochla vera fundens Purpuram*."

¹⁷ Lamarck, Jean Baptiste, *Système des Animaux sans Vertèbres*. Paris (1822), v.IX, pp. 559560.

¹⁸ Columna, Fabius, *Opusculum de Purpura*. Rome, 1616.

¹⁹ Gage, T., *A new survey of the West Indies, etc.*, London (1637), pp. 437438.

²⁰ *Philosophical Trans.*, 1685, pp. 127886.

²¹ *Acta Eruditorum*, Lipsiae (1686), p. 620.

²² *Mémoires pour l'Histoire des Sciences et des Beaux Arts*, Trévoux, Sept. 1703.

Reamur next discovered in 1710 a dye-yielding species on the coast of Poitou which he described in the Mémoires de l'Acad. Royale des Sciences, 1711. The Italian G. Mariti²³ discovering (1760-1768) on the Tyrian coasts several varieties of the *Aplysia* a mollusc yielding a coloured liquid identified that species with the purple shellfish of the Phoenicians. Du Hammil²⁴ in 1736 gave an account of his interesting experiments upon the dye secretion of species of *Purpura* found on the coast of Provence.

Thomas Gage had merely made a cursory reference to purple dyeing in Central America. A complete and scientific account was given in 1772 by the learned Spaniard, Antonis de Ulloa, based upon personal observation and study on the coast of Ecuador in the district of Santa Elena, in the year 1744.²⁵

The year 1777 saw the appearance of the interesting researches of the Danish pastor, Hans Ström, on *Purpura* lapillus, chiefly remarkable for their thorough treatment of the anatomical aspect of the subject.²⁶

In 1779 the Spaniard, P. Juan Pablo Canal y Marti published a treatise dealing with purple dyeing in Central America.²⁷

In 1786, the Italian C.D.M. Rosa, gave the world an account of his studies of the dye furnished by *Murex brandaris* and *Murex trunculus*.²⁸

Olivier recounted in 1804 his experiences on a voyage in the Orient, giving a description of certain varieties of *Janthina* picked by him on his way from Tyre to Alexandria. On account of the brilliant dye yielded by these animals, Olivier hastened to the conclusion that the genus *Janthina* was that employed in the Tyrian dye-houses.

Real progress was made by the discoveries of the Frenchman Boblaye and the Irishman W.R. Wilde, both working independently.

²³ Mariti, G., Reisen durch die Insel Cyprien: 1760-1768, German translation by C.H. Hage, Altenburg (1877).

²⁴ Du Hammil, Memoirs de l'Academie des Sciences, Paris (1736).

²⁵ Ulloa, Antonis de, Noticias americanas sobre la America meridional y la septentrional oriental, Madrid (1772).

²⁶ Adrien, Robert, Sur une Monographie ancienne de *Purpura* lapillus.

²⁷ Canal y Marti, Juan Pablo, Memorias sobre la *Purpura*, Madrid (1779), Cf. Lacaze-Duthiers, Mem. sur la Pourpre, Paris (1889).

²⁸ Rosa, Michele, Della Porpore, Modena (1786).

No one had hitherto thought of making a search for relics of shells in a locality known to have anciently harboured a purple factory.

An account of Boblaye's discovery appeared in "Expédition Scientifique de Morée." ("Scientific Expedition of Morea.")²⁹ Boblaye was in no way on the lookout for archeological discoveries.

M. Boblaye, part of the scientific expedition to Morea, was astonished to find at certain points, not far from the sea, considerable accumulations of a single species of *Murex brandaris*. He had first assumed that these deposits were due to a geological phenomenon; but a closer examination of the places and circumstances made clarified that these deposits are still placed in the vicinity of ruined establishments, among which there are some whose remains were sufficiently preserved to recognize in them the remains of old factories.

M. Boblaye, faisant partie de l'expédition scientifique de Morée fut étonné de rencontrer sur certains points peu éloignés de la mer des amoncellements considérables de la seule espèce de *Murex brandaris*. Il avait supposé d'abord que ces dépôts étaient dues à un phénomène géologique; mais un examen plus attentif des lieux et des circonstances lui fit découvrir que ces dépôts sont toujours placés dans le voisinage d'établissements ruinés, parmi lesquels il s'en trouve dont les vestiges étaient assez conservés pour reconnaître en eux les restes d'anciennes usines à teinture.

A scientific traveller and keen observer, W.R. Wilde, exploring the shore of ancient Tyre, the home of purple dyeing par excellence, was rightly led by internal evidence to identify a certain locality as the site of an ancient purple dyeing establishment. Carefully examining a huge conglomeration of broken shells in that vicinity, which, from the manner in which they had been

²⁹ "Expédition Scientifique de Morte," *Annales de l'Academie des Sciences, Section de Sciences Physiques*, v.III (1902), p. 190.

broken, Wilde correctly thought to represent the remains of molluscs utilized for dyeing purposes, he soon identified that enormous mass as belonging to the species *Murex trunculus*.³⁰

The year 1857 is marked by the appearance of the memorable "Mémoire sur la Pourpre" ("Memory on the Purple") by Lacaze-Duthiers embodying his epoch-making experiments on the dye secretion of *Murex trunculus*, *Murex brandaris*, *Murex erinaceus*, *Purpura haemastoma*, and *Purpura lapillus*. Unaware of Wilde's discovery, Lacaze-Duthiers suggests as probable that *Murex trunculus* was one of the principal species made use of by the ancients for purple-dyeing. *Murex brandaris* having long been recognised as one of those species, Lacaze-Duthiers adds:

"The discovery that was made in Pompeii about piles of Shells of the <i>Murex brandaris</i> near the dyers' shops proves that this is the species they are talking about."	"La découverte que l'un a faite à Pompéi de tas de coquilles du <i>Murex brandaris</i> près des boutiques des teinturiers prouve assez que c'est de cette espèce qu'ils s'agit."
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He further suggests as "highly probable" that *Purpura haemastoma* played a most important role. Three net results stand out prominently in Lacaze-Duthiers' mémoires:

The species anciently employed belong to the genera *Purpura* and *Murex* of modern zoology.

Purpura Pliny *Murex* Linné, *buccinum* Pliny *Purpura* Linné.

Murex brandaris was certainly, *Murex trunculus* and *Purpura haemastoma* were probably employed.

The great French naturalist significantly remarks:

It is very likely that the species used were more numerous than the one discussed in	"Il est très probable que les espèces employées étaient plus nombreuses que
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³⁰ Wilde, Sir William Robert, Narrative of a Voyage ... along the Shores of the Mediterranean, Dublin (1840), 2 vos. v.II, pp. 148488-468 ;151-.

this brief; but it would only be possible through research on sides of Tire that would give some more precise data."

celle dont il a été question dans ce mémoire; mais ce ne serait que par des recherches sur des côtés de Tyre que l'on pourrait peut-être arriver a quelques données plus précises."³¹

Through the omission on Boblaye's part of an exact specification of the localities on the Grecian coasts where his discoveries had been made, it was left to Fr. Lenormant to rediscover those deposits of shells of *Murex brandaris* on the coasts of Crigo and Gythiven.³²

Between 1842 and 1861 fall the important researches of Bartolomeo Bizio dealing with the chemical constitution of the secretions of *Murex brandaris* and *Murex trunculus*.

In 1864, on January 3rd., F. de Saulcy discovered in the vicinity of the ancient Sidon (Saida) a colossal mass of broken shells of *Murex trunculus*, the remains of molluscs used in purple-dyeing.

"Moving south to the fortress of the Middle Ages, known as the Castle of St. Louis, we began to climb a cliff of embankments, on the side of which outcrops a huge cluster of shells invariably belonging to a single species of the genus *murex*, the *murex trunculus*. This cluster has colossal dimensions of more than a hundred meters in length and six to eight meters in height, and a width that it is not possible to recognize, because the vegetal that covers it is lined

"Remotant vers la sud jusqu'au-dessus de la forteresse du moyen âge, connu sous le nom de château de Saint-Louis, nous nous mîmes à escalader une falaise de remblais, sur la flanc de laquelle affleure un amas immense de coquilles appartenant invariablement à une seule et même espèce du genre *murex*, le *murex trunculus*. Cet amas présente des dimensions colossales plus de cent mètres de longueur sur six à huit mètres de hauteur, et une largeur qu'il n'est pas

³¹ Lacaze-Duthiers, *ibid.*, p. 77.

³² Saulcy, Louis Felicien de, *Voyage en Terre Sainte*, Paris (1865), p. 283.

with grasses and brush of all kinds.

possible de reconnaître, parce que le terrain végétal qui le recouvre est garni d'herbes et de broussailles de toute nature.

I quickly filled my pockets with samples of the precious shell and was able to make sure that all the individuals who make up this remarkable cluster, without exception, offer the same peculiarity. Their test was rigorously started on a grinding wheel, on the first and second turns, to allow the generator pocket to be extracted from the mollusk. This cannot be the effect of chance, and there is evidently here the trace of the industrial process, with the help of which the Sidonian dyers obtained the basis of their so famous purple reowns. "

J'emplis bien vite mes poches d'échantillons de la précieuse coquille et je pus m'assurer que tous les individus qui constituent cet amas remarquable offrent, sans exception, la même particularité. Leur test a été rigoureusement entamé d'un coup de meule, sur la première et la seconde tour de spire, pour permettre d'extraire la poche génératrice du mollusque. Ceci ne peut être l'effet du hasard, et il y a là évidemment la trace du procédé industriel, à l'aide duquel les teinturiers sidoniens se procuraient la base de leur pourpre si renommée."³³

At a small distance from that deposit of *Murex trunculus* shells a French physician Gaillardot³⁴ discovered remains of *Murex brandaris* and of *Purpura haemastoma*.

Oskar Schmidt, a Strasbourg professor, found in 1867 remains of *Murex brandaris* and *Murex trunculus* on the site of a former dye-house in *Aquileja*.

On the site of the ancient Troy remains of *Purpura haemastoma* were afterwards discovered.

³³ Idem., p. 284.

³⁴ Gaillardot, *Globus*, 26 (1874), 237-238.

"According to Schliemann, the *Purpura* haemastoma was also used for the same purpose in other Mediterranean localities as it resulted from the excavations made in the site of Troi."

"Le *Purpura* haemastoma était également employé au même usage dans d'autres localités méditerranéennes ainsi qu'il résulta des fouilles faites dans l'emplacement de Troi d'après Schliemann."³⁵

Professor Nowack thus inaccurately states in the Encyclopedia (art. "Purple") that no archeological discovery has yet been made proving the employment of *Purpura* haemastoma in purple-dyeing.

Evidence of the use of *Murex brandaris* and *Murex trunculus* in the African factories was brought to light in 1874 through the discovery by H. de Villefosse of engravings on a column found in the vicinity of Fegonsia between Batra and el-Kantata representing the figures of the shells of these two species and bearing the inscription "*Purpurorum*."³⁶ In 1878 A. Papier exhibited before the Academy of Hippone an engraving from Gaetulia showing the figure of *Purpura* haemastoma (ib.).

Professor Raphael Dubois states on the authority of a certain author, Rémy Vidal:

"*Murex brandaris* provided 'shiny' or 'Tyrian' purple and fished mainly in Tire: *Murex trunculus* gave 'amethyst' purple,' so called because of its purplish reflections. The latter was being prepared in Sidon. This indicates," remarks Professor Dubois, "that the two species of the murex did not live side by side as in

"*Murex brandaris* fournissait la pourpre 'rutilante' ou 'tyrienne' et se pêchait surtout à Tyre: le *Murex trunculus* donnait la pourpre 'amethyst,' ainsi appelé à cause de ses reflets violacés. Cette dernière se préparait à Sidon. Ceci semble indiquer," remarks Professor Dubois, "que les deux espèces du murex ne vivaient pas côte à

³⁵ Dubois, Raphael, *Recherches sur le Pourpre*, Paris (1909), p. 518.

³⁶ Papier, A., *Bulletin de l'Académie d'Hippone*, No. 14, p. 378.

Toulon."

côte comme à Toulon."³⁷

I have not been able to verify the source of Vidal's assertion.

In conclusion, mention should be made of the discovery of a number of Tyrian coins bearing the figures of both *Murex trunculus* and *Murex brandaris*, thus indicating their importance for Phoenician manufacture and industry.³⁸

D. Differentiation of the Colours Produced with the Dye-Secretions of the Various Specimens Used in Purple Dyeing.

Aristotle states that some of the *Purpurae* have a red flower, others a black one. As the dye secretion of the *Purpurae* and murices is really a whitish liquid when in the animal and only colours on being exposed to light, Aristotle must be referring to the final tone which the matter settles into after passing through that progression of colour with which the modern world has become acquainted since William Cole's experiments on the British coasts.

The susceptibility of the purple dye to light was, of course, known to the ancients: it is self-evident. Dr. Dedekind, moreover, adduces in support of this several passages from Pliny, Pollux and Philostrate ³⁹(Beitrag zur Purpurkunde, I. Berlin, 1898, pp. 84-85).

It is perhaps, I think, alluded to in Hist. Anim.: 'On the first emission of the purpurigenic matter it only stains but afterwards under the action of light it colours.'⁴⁰

The reader will have noticed the important statements made by Aristotle in the text quoted at the outset of this chapter regarding the variation of the colour of the flower of the *Purpura* between red and black, according to the size of the animals, the nature of the locality inhabited by them, and their geographical position. It is highly regrettable that Lacaze-Duthiers in confining his attention to Pliny made no attempt to deal with the data supplied by the incomparably greater man. How are those data to be coordinated with our present day knowledge of the subject? I

³⁷ Dubois, R., *ibid.*

³⁸ Schmidt, W.A., *ibid.*, p. 108.

³⁹ Dedekind, Alexander, *Ein Beitrag zur Purpurkunde*, Berlin (18984 ,(1911- vols. v.I, pp. 8485.

⁴⁰ Aristotle, *ibid.*, p. 175.

addressed myself with this end in view to Dr. L. Germain, of the Musée National d'Histoire Naturelle. It affords me real pleasure to quote his illuminating reply:

... This new question arises concern about Aristotle's text. But there are various kinds of purples; and the one found in the gulfs is large and rough and most of them have a black color, but a few have a small red flower, etc. Aristotle certainly did not mean that the same species gave a black or red tint depending on whether it lived in a gulf or in the sea. The Greek author had in mind two very distinct species; one living in the gulfs and giving a black purple, (I think we should interpret black by very dark red), the other living in the sea and giving a red purple, that is to say lighter. In this he is right, because we know perfectly well today that the dark red purple is given by the *Purpura haemastoma* L., and the *Murex trunculus* L., which live in the littoral zone, stuck against the rocks; and that the lighter purple is supplied by *Murex brandaris* L., which live at greater depth and further from shore. This explains, in my opinion, Aristotle's phrase: those who live in the gulfs, that is to say on the shore, have a black flower, etc.

... Cette nouvelle question concernant le texte d'Aristote. Mais il y a diverses espèces de pourpres; et celle qu'on trouve dans les golfes sont grandes et rudes et la plupart ont une fleur (teinte) noire, mais quelquesunes ont une fleur petite et rouge, etc. Aristote n'a certainement pas voulu dire qu'une même espèce donnait une teinte noire ou rouge suivant qu'elle habite dans un golfe ou dans la mer. L'auteur grec a eu en vue deux espèces bien distinctes; l'une vivant dans les golfes et donnant une pourpre noire, (je crois qu'il faut interpréter noire par rouge très foncé), l'autre vivant dans la mer et donnant une pourpre rouge, c'est-à-dire plus claire. En cela il a raison, car on sait parfaitement aujourd'hui que la pourpre rouge sombre est donnée par la *Purpura haemastoma* L. et la *Murex trunculus* L. qui vivent dans la zone littorale, collés contre les rochers; et que la pourpre plus claire est fournie par la *Murex brandaris* L., qui vit à une plus grande profondeur et plus loin du rivage. Ainsi s'explique, selon moi, la phrase d'Aristote: celles qui vivent dans les golfes c'est-à-dire sur le rivage? ont une fleur noire, etc.

Aristote:

"some of the small purples are found on the shore and by the coasts have a red flower."

There are obviously several species of small sizes, usually stuck on the rocks and especially, of *Murex erinaceus* Linnaeus.

The distinction made by Aristotle against black-flowered purple and red-flowered purple applies to the final color of purple obtained after the usual treatments. Like us, the Greeks and Phoenicians perfectly knew that, during the lifetime of the animal, purpuriferous juice is yellowish if not colorless; but they had perfectly distinguished the species which subsequently gave a dark purple from those giving a light purple."

"quelques unes des pourpres petites se trouvent sur le rivage et par les côtes et ont une fleur rouge."

Il s'agit évidemment de plusieurs espèces de petites tailles, vivant collés ordinairement sur les rochers et surtout probablement, de *Murex erinaceus* Linné.

La distinction faite par Aristote contre pourpre à fleur noire et pourpre à fleur rouge s'applique à la couleur finale de la pourpre obtenue après les traitements d'usage. Comme nous, les grecs et les phoeniciens savaient parfaitement que, sur le vivant de l'animal, le suc purpurifère est seulement jaunâtre sinon incolore; mais ils avaient parfaitement distingué les espèces qui donnaient par la suite une pourpre sombre de celles donnant une pourpre claire."

Aristotle certainly never meant to imply that only two colours, black and red, are producible by means of the purple dye. In the treatise of colours he states in fact that purple comprises a variety

of shades.⁴¹ We should understand with Dr. Germain, black as standing for dark or sombre purple inclining to black, and red as denoting brighter or clearer purple inclining to red.

Dr. Germain further says:

" You say: 'by purple with black flower does he (Aristotle) designate Murex trunculus? Aristotle, under this name, certainly has M. trunculus in mind, but probably also some other species including P. haemastoma. But it seems obvious to me that this term applies mostly to Murex trunculus. "

"Vous dites: 'par pourpre à fleur noire veut-il (Aristote) désigner le Murex trunculus? Aristote, sous ce nom, a certainement en vue le M. trunculus, mais probablement aussi quelques autres espèces notamment P. haemastoma. Mais il me semble évident que ce terme s'applique surtout au Murex trunculus."

Great as is the amount of light thrown upon the point by my learned friend's remarks there still remains some obscurity.

What light is thrown by modern conchology upon the dictum of Aristotle that the Porphyra living in the northern parts mostly give a black dye while those of the southern regions furnish a red one?

The exact words of the great Stagyrte are as follows: "Again, in the northern parts they are for the most part black, but in the southern parts red."⁴² At first sight this might be understood as referring to the colour of the molluscs themselves, but a comparison with Vitruvius will at once show that it is of the colour of the dye secretion that Aristotle speaks here:

⁴¹ Aristotle, De Colonibus, III.

⁴² Aristotle, De Animalibus Historia, p. 175.

"I shall now begin to speak of purple... That which is found in Pontus and Gaul is black, because those countries are nearest to the north. As one passes on from north to west, it is found of a bluish shade. Due east and west, what is found is of a violet shade. That which is obtained in southern countries is naturally red in quality, and therefore this is found in the island of Rhodes and in other such countries that are nearest to the course of the sun. (Translation: Project Gutenberg)"

"incipiam nunc de astro dicere... Id autem excipitur ex conchylio marino a quo *Purpura* inficitur... quod habet non in omnibus locis quibus nascitur unius generis colorem sed solidi cursu naturaliter temperatur. Itaque quod legitur Ponto et Gallia, quod hae regiones sint proximae ad septentrionem, est atrum, progredientibus inter septentrionem et occidentem, invenitur lividum. Quod autem legitur ad aequinoctialiem, orientem et occidentem, invenitur violaceo colore; quod ver meridiariorum regionibus excipitur rubra procreatur potestate etc."⁴³

In how far do these data modify the preceding statements concerning the variation of the colour according to the size of the animals and according to the nearness or distance of their habitation from shore and promontory? Curiously enough, Pliny is silent about these highly important matters. No one, as far as I know, has as yet made a thorough study of the varieties produced by the secretions of the different species of the *Purpurae* and murices, or indeed of any other genus of dye-secreting molluscs.

The following passage in *Recherches sur la Pourpre*, by the distinguished physiologist Professor Raphael Dubois, of Lyons, is worthy of note in this connection:

"The colour varies according to the species of mollusc which produces it. It is

"La couleur est variable suivant l'espèce du mollusque qui la produit. Nous ne nous

⁴³ Vitruvius, *De Architectura*, Libr. VII, p. 13.

chapter, we will not deal with the variations in hue due to particular processes of industrial or other preparation but simply with those given by the secretion of the purple gland spontaneously either to light or to darkness. However, remember that the coloration can vary for the same species depending on the localities, the nature of the food, season, climate, the fasting, and also for reasons still undetermined. This was known to the ancients. Without the help of light, *Murex trunculus* gives a dark purple pigment ... *Murex brandaris*, after A. and Negri, gives a very delicate pink purple pigment which is quite clear. I found it rather binder of amaranth wine. *Murex erinaceus*, a purple color sometimes tending to red; other times in azure blue without knowing why. *Purpura haemastoma*, according to Lacaze-Duthiers, provides a blood-red color pulling on purple. That of *Purpura lappillus*, according to Letellier, is a beautiful red purple: it returns in the eye the red, blue and purple rays." With reference especially to *Murex brandaris*, Professor Dubois also remarks: "The color we have obtained by our process with *Murex brandaris* is redcurrant amaranth.

occuperons pas dans ce chapitre des variations de teinte dues à des procédés particuliers de préparation industrielle ou autre mais simplement de celles qui sont données par la secretion de la glande à pourpre spontanément soit à la lumière, soit à l'obscurité. Rappelons toutefois que la coloration peut varier pour une même espèce d'après les localités, la nature de la nourriture, la saison, le climat, le jeûne, et aussi pour des raisons encore indéterminées. Cela était connu des ancients. *Murex trunculus* donne sans le concours de la lumière un pigment violet foncé très azuré ... *Murex brandaris*, d'après A. et de Negri, donne un pigment violet rose très délicat assez clair. Je l'ai trouvé plutôt lie de vin amaranthe. *Murex erinaceus*, une couleur violette tendant parfois au rouge; d'autres fois au bleu azuré sans que l'on sache pourquoi. *Purpura haemastoma*, d'après Lacaze-Duthiers, fournit une couleur rouge sang tirant sur le violet. Celle de *Purpura lappillus*, d'après Letellier, est d'un beau violet rouge: elle renvoie dans l'oeil les rayons rouges, bleus et violets."⁴⁴ With reference especially to *Murex brandaris*, Professor Dubois also remarks: "La couleur que nous avons obtenue par

⁴⁴ Dubois, *ibid.*, p. 518.

But it is obvious that by mixing with murex trunculus one could obtain the most varied purple hues." (ib.)

notre procédé avec Murex brandaris est amaranthe tirant sur la groseille. Mais il est évident que par des mélanges avec murex trunculus on pourrait obtenir les teintes pourpres les plus variées." (ib.)

William Cole, of porphyrologic fame, gives the following table of the progression of colour through which the purpurigenic matter obtained from species of *Purpura lapillus* L. passed under his observation in 1683:-

- (1) Light green.
- (2) Deep green.
- (3) Sea green.
- (4) Watchet blue.
- (5) Purple red.
- (6) Very deep purple red "beyond which the sun can do no more."

Cole further adds: "Note, that these changes are made faster or slower according to the degree of the sun's heat. But then the last or most beautiful colour (after washing in scalding water and soap) will the matter being again put out into the sun or wind to dry be a much differing colour from all those mentioned, i.e., of a fair bright crimson, or near to the Prince's colour; which afterwards (notwithstanding there is no use of any styptic to bind the colour) will continue the same, if well ordered."⁴⁵ Cole was making proper arrangements for the transmission of a number of living individuals of this species to "his late Majesty ... to the end his Majesty, the great Patron and Founder of their Society, might have the pleasing diversion of seeing the experiment made in his Royal presence; but a stop was put to this design by a calamity too great and public to be mentioned" (ib.).

⁴⁵ Cole, ibid.

The labours of Lacaze-Duthiers mark the next turning-point and, as Dr. Adrian Robert, *Chef de Travaux Pratiques* at the Sorbonne (*Laboratoire de Zoologie*) informs me, have not yet been surpassed.

Lacaze-Duthiers' experiments were made upon species of *Murex brandaris*, *Murex trunculus*, *Murex erinaceus*, *Purpura haemastomea*, and *Purpura lapillus*.

"En suivant," says the experimenter,

"the development of color, either of *Murex trunculus*, or of other species, by a cloudy sky, one sees, curiously enough, the successive development of simple colors which, by their mixture, form composed colors. Thus from white matter becomes yellow: here is a first simple color; then it is the blue which develops, and then, with the yellow which already exists, it obviously appears green. The blue is always increasing, while the yellow seems to disappear, so it gets darker; and this is marked for the material of *Murex trunculus*. At this moment, therefore, the material, after having been light yellow, greenish yellow, then green, bluish green, becomes dark bluish. The red occurs in the last place, and together with the blue color forms violet, which, we understand, will be all the more close to blue or red the less or more developed it is."46

"le développement de la couleur, soit du *Murex trunculus*, soit des autres espèces, par un ciel nuageux, on voit, chose curieuse, le développement successif des couleurs simples qui, par leur mélange, forment les couleurs composées. Ainsi de blanche la matière devient jaune: voilà une première couleur simple; puis c'est le bleu qui se développe, et alors, avec le jaune qui existe déjà, il apparaît évidemment du vert. Le bleu va toujours augmentant, tandis que le jaune semble disparaître, aussi se fonce-t-il; et ceci est très marqué pour la matière du *Murex trunculus*. A ce moment donc, la matière, après avoir été jaune clair, jaune verdâtre, puis vert, vert bleuâtre, devient bleuâtre sombre. Le rouge se produit endernier lieu, et forme avec la couleur bleue le violet, qui, on le comprend, sera d'autant plus voisin de bleu ou du rouge que celui

sera moins ou plus développé."⁴⁶

The great zoologist further records a considerable variety of tones in the final development. *Purpura* haemastoma yielded rather sombre shades. Upon this Professor Raphael Dubois remarks:

"Indeed, according to Lacaze-Duthiers... the purple of *Purpura* haemastoma or 'blood-mouthed purple' is dark purple, closer to red than blue. It would therefore be intermediate between the purple of *Murex trunculus* and that of *Murex brandaris*." ⁴⁷

"En effet, d'après Lacaze-Duthiers... la pourpre du *Purpura* haemastoma ou 'pourpre à bouche de sang' est violet sombre, plus voisin du rouge que de bleu. Elle serait intermédiaire par conséquent, entre la pourpre du *Murex trunculus* et celle du *Murex brandaris*."⁴⁷

Of the *Murex brandaris* in particular Lacaze-Duthiers observes:

"It should be noted however that the *Murex brandaris* gives a tone sometimes more rosy and extremely delicate, and much clearer; at least this is what was presented in the experiments carried out in Lille, with the animals that M. Alfred Lejourdan had kindly addressed me from

"Il faut remarquer toutefois que le *Murex brandaris* donne un ton parfois plus rose et extrêmement délicat, et beaucoup plus clair; du moins c'est ce qui s'est présenté dans les expériences faites à Lille, avec les animaux que M. Alfred Lejourdan avait bien voulu m'adresser de Marseille.

⁴⁶ Lacaze-Duthiers, "Memoire sur la Pourpre," *Ann. des Sci. Naturelles*, 4eme Series, Zoologie XII, Paris, 1859, pp. 71-72.

⁴⁷ Dubois, *ibid.*, p. 518.

Marseilles. The sky of Flanders is far from having this' dazzling light of the South and one can wonder if the action of the light a little different would not have a part in the variation of the color? "48	Le ciel de Flandre est loin d'avoir cette 'blouissante lumière du Midi etl'on peut se demander si l'action de la lumière un peu différente n'aurait pas une part dans la variation de la teinte?"48
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The previous experiments had been made at Mahon in the Balaeres.

The colour furnished by Murex trunculus is defined by Lacaze-Duthiers as

"bleuâtre avec des parties tout à fait bleues." bluish with quite blue parts.

Though the order in the succession of colour is the same in all species, in Murex trunculus, as already quoted from LacazeDuthiers, the stage of blue is emphasized by its intensity. The great naturalist gives the following register for Murex trunculus:

Light yellow.	Jaune clair.
"greenish."	" verdâtre.
Green.	Vert.
Bluish green.	Vert bleuâtre.
Dark bluish.	Bleuâtre sombre.
Red-purple.	Rouge-violet.
Dark purple heavily loaded with blue.	Violet foncé très chargé de bleu.

⁴⁸ Lacaze-Duthiers, *ibid.*, p. 71.

One sub-species of *Murex trunculus*, in fact, yielded a colour which Lacaze-Duthiers qualifies as blue, but he adds that at another time it also produced violet (ib.).

On the grounds of the experiment carried out by him with the above species (*Murex trunculus*, *Murex brandaris*, *Murex erinaceus*, *Purpura haemastoma*, *Purpura lapillus*) Lacaze-Duthiers arrives at this vitally important conclusion: The basic colour is always violet, the variation consisting only in the extent to which the violet tends towards red, on the one hand, or towards blue on the other. This applies only to the natural colour: by certain artifices the ancients may have also produced red purple.

From this position Lacaze-Duthiers never retreated, and when in 1896 Dr. Dedekind, keeper of the Imperial Egyptian Museum in Vienna, tried to identify certain red fabrics of Egyptian origin as dyed with purple secretion, Lacaze-Duthiers once more insisted:

"... the primitive hue, the natural color of Purple, the one produced by the exposure of matter to the influence of sunlight WAS AND COULD ONLY be purple." 49	"... la teinte primitive, la couleur naturelle de la Pourpre, celle produite par l'exposition de la matière à l'influence de la lumière du soleil ETAIT ET NE POURRAIT être que le violet." 49
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The question had in 1861 involved the French scientist in an unpleasant literary polemic with another eminent worker in the newly discovered field of porphyrology, Professor Bartolomeo Bizio of Venice. Contrary to Lacaze-Duthiers, Bizio maintained that *Murex brandaris* furnished and could furnish no other but red purple:

"It is true that I have not studied the murex fished in the Adriatic, but if the murex of the adjoining Mediterranean,	"E vero che io non ho studiato ehe i murici pescati in questo Adriatico, ma se i murici del contiguo Mediterraneo, o di
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⁴⁹ Idem, *Archives de Zoologie experimentale et générale*. Paris (1896), p. 490.

or of any other sea, are identical to these, the species brandaris being identical, I would not hesitate to affirm that they do not contain blue matter, and therefore they can provide only red-purple."

altro mare qualunque, sono identici a questi, essendo identica la specie brandaris, io non dubito di affermare ehe non contengono materia azzura, e che quindi non possono fornire ehe sola porpora rossa."⁵⁰

Dr. Dedekind, who is an enthusiastic admirer of Lacaze-Duthiers, admits that Bizio was right.

"Our transfigured master, Professor Henri de Lacaze-Duthiers, had made the drawings himself, respective paintings with different basic colors of purple (paintings with argaman and paintings with thekeleth) and still considered everything to be violet. You can see how you often suffer from an auto suggestion!.. '5' The source of these errors, as mentioned above, has been an autosuggestion. And this is what happened to our dear master Henri de Lacaze-Duthiers, one of the greatest purple researchers of all time! Even in the last months of his life (in July 1901) he denied to me in his apartment in Paris (7, rue de l'Estropade) that purple should be addressed differently in the definitive tone than as purple."

"Unser nun verklärter Meister, Professor Henri de Lacaze-Duthiers, hat ja selber Zeichnungen, respective Malereien vermöge verschiedener Grundfarben von Purpur (Malereien mit *Argaman* und Malereien mit thekeleth) angefertigt gehabt und hat trotzdem alles für violett gehalten. Da sieht man wie man oft unter einer AutoSuggestion leidet!..⁵¹ Die Quelle dieser Irrtümer ist, wie schon weiter oben gesagt ward, eine Autosuggestion gewesen. Und das ist unsem lieber Meister Henri de Lacaze-Duthiers geschehen, einem der grössten Purpurforscher aller Zeiten! Sogar noch im Letzten Monate seines Lebens (im Juli 1901) hat er mir gegenüber in seiner Wohnung zu Paris (7, rue de l'Estropade) bestritten, dass Purpur

⁵⁰ Bizio, Bartolomeo, *Atti delil.R. Istituto Veneto di Scienze, Lettere ed Arti*, Venezia (1860-61-), p. 880.

⁵¹ Idem, p. 82.

im Definitivton anders anzusprechen sei
denn als violett."⁵²

Without venturing to pronounce an opinion on the matter I may mention in this connection that the Sumerians, the earliest inhabitants of Babylonia known to history, appear to have had very nearly the same conception of purple as Lacaze-Duthiers. Tekhelet and *Argaman*, the only two known varieties of ancient Semitic purple seem to have been designated in their language by terms denoting "dark sky-blue" and "red or bright sky-blue" respectively. We should add, however, that we do not know with certainty out of which species the two purple varieties were produced which the Sumerians so designated. The subject has really not yet been thoroughly investigated. It is only when scientific experiments have been carried out in sufficient number upon the Phoenician, Grecian, Italian, French, African, and other coasts known to have anciently been centres of purple; when these have been scientifically coordinated and systematized and in addition have been carefully compared with the data supplied by Aristotle and Vitruvius referred to above and also with many other indications either expressly given or indirectly inferable from classical, Semitic and other sources that a firm base will have been secured for the future inquirer to operate upon.

Dr. Dedekind who maintained a long correspondence on various *porphyrologic* questions with the eminent scientist whom he often styles "the Nestor of Porphyrologic research" is in possession of a considerable number of samples prepared by the master himself. In the interest of science let us hope that exact colour reproduction of these will soon be made accessible to the public.

"The agitated drawings and photographs made by Monsieur Henri de Lacaze-Duthiers as early as 1858 using purple matter, which the great purpurologist from Paris to Vienna had the kindness to send me in 1896, show at

"Die beregten, von Monsieur Henri de Lacaze-Duthiers bereits im Jahre 1858 vermöge Purpurmaterie hergestellten Zeichnungen sowie Photographien, welche mir der grose Purpurolog aus Paris nach Wien im Jahre 1896 zu schicken die

⁵² Idem, v.I, p. 94.

least 40 nuances, of the most magnificent, truly different Sky blue begins all the way to carmine and such a darkening of this shade of color that it was almost black, as one of Dr. Eder, rightly noticed in the institution. The color designations of porphyreos found in Papis, Handwörterbuch der Griechischen Sprache II, 649, as dark red, blue-red, violet are therefore extraordinarily appropriate, but by far do not exhaust the immense scala of purple nuances." ⁵¹ 'Furthermore, those purples (without prejudice to their decidirt pronounced two primary colours carmine and violet, or red and blue, depending on the presence of purple from P.haemastoma or M.brandaris or M.trunculus) certainly confirmed Goethe's (derived from his theory of colours). The purple floats on the border between red and blue and soon tends to scarlet fever, soon to violet 'and the blue red by the purple lick.' However, as noted, the two main categories of purple were denied, namely: 1. bluthroth purple or oxylblatta and 2. janthin or hyacinth — or amethyst purple in not a single purple sample before me, provided that the process of the color change had progressed to the end. " ⁵⁴

Güte hatte, zeigen zumindest 40 Nuancen, vom herrlichsten, wahrhaft tropischen Himmelblau angefangen bis hinüber zu Carmin und so einer derartigen Verdunkelung dieses Farbentones, dass dies wie ein Arbeiter in der Anstalt Herrn Begierungsrathes Dr. Eder sehr richtig bemerkte fast schon schwarz war. Die in Papis, Handwörterbuch der Griechischen Sprache II, 649, anzutreffenden Farbenbezeichnungen von Porphyreos als dunkelroth, blauroth, violett sind also ausserordentlich treffend, erschöpfen jedoch bei Weitem nicht die immense Scala der Purpurnüancen." ⁵³ "Ferner bestätigten diese Purpuroben (unbeschadet ihrer decidirt ausgesprochenen zwei Grundfarben Carmin und violett, oder roth und blau, je nachdem Purpur von P.haemastoma oder M.brandaris oder M.trunculus vorlag) durchaus Goethe's (aus seiner Farbenlehre herrührende) Aussprüche. Der purpur schwebt auf der Grenze zwischen Roth und Blau und neigt sich bald zum Scharlach, bald zum Violetten 'und das Blaurothe durch die Purpurschneck.' Dabei verleugneten sich aber wie bemerkt die zwei Hauptkategorien des Purpurs, nämlich: 1. der bluthrothe Purpur oder

⁵³ Idem, v.I, p. 94.

Oxylblatta und 2. der Janthin oder Hyacinth — oder Amethyst purpur bei keiner einzigen mir vorgelegenen Purpurproben, sofern nämlich: der Process des Farbenwandels bis zum Abschluss gediehen war."⁵⁴

Another important passage bearing on this question appears at p. 30:

"I would have liked to have reproduced other purple drawings by Monsieur Henri de LacazeDuthiers presented to me on the color sprinkled than those that are now on panels 19 and 20 in the Arch, de Zoologie exp. et gén. 3ème série, 1, IV, 1896. But even if only those two panels have been achieved, a great deal has also been achieved. In the carmine of *Purpura haemastoma* and in the violet of *Murex trunculus*, they show for the time being enough the poles of an incredibly rich abundance of nuances, which showed themselves in a very special variety on those canvas stuccoes that were colored with purple matter of *Murex trunculus*. On such a stucco there were even numerous light brown tones, of which the original of the reproduction on panel XX l.c. had no trace. On the other hand, the color stripes of *Purpura haemastoma* were consistently carmine darkening almost to

"Gerne hätte ich andere mir vorgelegene Purpurzeichnungen von Monsieur Henri de LacazeDuthiers auf das Farbengetrengt reproduziert als jene die nun auf Tafel 19 und 20 in den Arch, de Zoologie exp. et gén. 3ème série, 1, IV, 1896 reproducirt erscheinen. Doch auch nur vermöge jener beiden Tafeln ist sehr viel erreicht. Sie zeigen im Carmin von *Purpura haemastoma* und im Violett von *Murex trunculus* vorläufig zur Genüge die Pole einer unglaublich reichen Fülle von Nuancen, welche sich in ganz besonderer Mannigfaltigkeit auf jenen Leinwandstücken zeigten, welche mit Purpurmaterie von *Murex trunculus* gefärbt waren. Auf einem solchen Stuck zeigten sich sogar zahlreiche hellbraune Töne, von denen das Original der Reproduction auf Tafel XX l.c. keine Spur aufwies. Dagegen die Farbenstreifungen von *Purpura haemastoma* waren

⁵⁴ Idem, p. 23-24.

the black."

durchgängig carmin bis fast in das
Schwarze hinüberdunkelnd."⁵⁵

Dr. Dedekind indeed maintains the same standpoint with regard to the Cardinal or Fundamental tones of purple in its natural state in his latest publication whenever occasion requires:

"Guhl and Renner .." The life of the
Greeks and Romans "; " About purple
dyeing: II, page 233 to page 235. (The
passage on page 234 is incorrect: 'The
purple juice, on the other hand, had two
main natural colors, one blackish and one
a red. "It should be correct: either 1. a red
or carmine, or 2. a violet or blue. These
two cardinal tones, basic tones of all
definitive purple that occur at all, are at
the end of Volume I of my contribution
zur Purpurkunde (Berlin 1898)
reproduced true to color. "56

"Guhl und Renner.."Das Leben der
Griechen und Römer"; "Über
Purpurfärberei: II, 233 ff. bis Seite 235.
(Unrichtig ist der auf Seite 234
vorkommende Passus: 'Der eigentlich
Purpursaft hatte hingegen zwei natürliche
Hauptfarben, eine schwärzliche und eine
rothe.' Richtig sollte es heissen: entweder
1. eine rote, beziehungsweise Karmine,
oder 2. eine violette, beziehungsweise
blaue. Diese beiden Kardinaltöne,
Grundtöne von allem überhaupt
vorkommenden Definitif-Purpur, sind am
Schluss des I. Bandes von meinem
Beitrag zur Purpurkunde (Berlin 1898)
farbentreu reproduziert."56

For information contained in the older literature Dedekind refers to Martini, Neues
Systematisches Conchyliencabinet, vol .III, Nürnberg 1777, p. 300.

"The best way to upskill someone about
shades of purple is to use panels XIX and
XX in the Arch, ce Zool. Exp. Et gén.,

"Über Farbentöne von Purpur orientiert
man sich jetzt wohl am besten vermöge
der Tafeln XIX und XX in den Arch, ce

⁵⁵ Idem, p. 30.

⁵⁶ Idem, v.IV, p. 415.

3ème Série, I, IV, 1896. From the older literature cf. on the nuances of Purple especially Martini l.c. p. 300: Each of the snails used for this gave its own juice of special shades, i.e. either a sky-blue, slate-blue, or simply purple, or sometimes with carmosine, sometimes with fiery red, etc. "57

Zool. exp. et gén., 3ème Série, I, IV, 1896. Aus der älteren Literatur vgl. über die Nuancen von Purpur namentlich Martini l.c. S. 300: Jede von den dazu verbrauchten Schnecken gab einen eigenen Saft von besonderen Schattirungen, also entweder eine himmelblaue, schieferblaue, oder einfach violette, oder bald mit Carmosin, bald mit Feuerrothe vermischte Farbe etc. "57

Having verified the reference to Martini, I find it rather difficult to decide whether his data are based upon actual experiments carried out by himself or by others or are simply derived partly from direct statements in the ancient authors and partly from classical allusions in prose and in verse.

In illustration of Martini's mention of a purple colour presenting a mingling of fire red, "Feuerroth," Dr. Dedekind makes the following observation:

"As a parellel to the last used value 'Feuerroth' I may perhaps cite a passage from a letter from myself, where I, even before Martini's words became known to me, referring to the ones in the KK Lehrund Veruschanstalt für Photography und Reproductionsanstalt (In Vienna) of the government councilor Dr. SM Eder made the first attempts to reproduce the original purple drawings by Monsieur HH

"Als Pendant zu dem letztgebrauchten Werte 'Feuerroth' darf ich vielleicht einem Passus aus einem Briefe von mir selber hier mit anführen, wo ich, noch bevor mir Martini's Worte bekannt geworden waren, unter Bezugnahme auf die in der K.K. Lehr - und Veruschanstalt für Photographie und Reproductionsverfahren (Zu Wien) des Herrn Regierungsrathes Dr. S.M. Eder gemachten ersten Versuche, die

⁵⁷ Idem, v.I., p. 93, v.2.

de Lacaze-Duthiers true to color, wrote to the government councilor Eder on October 3, 1896, among others, the following: '... but at that time the specific fiery tones came. "From this one sees the exact correspondence of Martini's centuries old description of fire-like glowing purple (Cfr. Valerius Flaccus 3178 ὃ: jam frigidus orbes purpureos somnus obit) with the freshest, most labile, and most burning shades of color of the purple drawings were borrowed from our French nestor of purple researchers. "58

Originalpurpurzeichnungen von Monsieur H.H. de Lacaze-Duthiers farbengetreu zu reproducieren, an Herrn Regierungsrath Eder am 3. October 1896 unter Anderen Folgendes schrieb '... doch kamen damals die specifischen feurigen Tone nicht heraus'. Man sieht daraus die genaue Übereinstimmung von Martini's vorhundertjähriger Schilderung von feuerähnlich glühenden Purpur (Cfr. Valerius Flaccus 3, 178: jam frigidus orbes purpureos somnus obit) mit den am frischesten, labhaftesten, brennendsten sich zeigenden Farbentönen der mir geliehenen Purpurzeichnungen unseres französischen Nestors der Purpurforscher."

58

It is interesting to contrast this with the following statements by two other learned contemporaries:

"It must be figured in mind that the purple colours preserved from antiquity and the Middle Ages are not all the same; They are never fiery or scarlet (The italics are my own),* perhaps, they much more show a dull-red, soon a more redish-violet, and soon a bluish-violet

"In Betracht gezogen muss dabei werden, dass die aus dem Altertum und dem Mittelalter erhaltenen Purpurfarbungen nicht alle gleich sind; niemals sind sie feurig *oder scharlachrot* (the italics are my own),* viel mehr zeigen sie eine stumpf-rote, bald mehr rotlich-violette,

⁵⁸ Idem, v.I, p. 94.

color"⁵⁹

"The most valuable were the double-colored Tyrian or laconic purple and the so-called amethyst janthine or hyanzinthpurple, and there is no doubt that these were very dark, almost black tones, which only showed a blue-violet to red-violet glow in the overview... This coloration, which was produced with the undiluted boiled snail matter, apparently had no resemblance to what we understand today by purple"⁶⁰ (Professor P. Friedlaender). "The remnants of fabrics and parchments that have come to us have apparently suffered greatly over the many centuries they show very different nuances from black violet to light blue or red violet, but I would like to emphasize here that it has not yet been proven in any single case by chemical analysis whether they are really with purple and not rather with the different, surrogates that were already practicable in antiquity were dyed."⁶¹

bald bläulich-violette Farbe"⁵⁹ (Professor Richard Meyer).

"Am wertvollsten waren der doppelt gefärbte tyrische oder der lakonische Purpur und der sogenannte Amethyst-Janthin oder Hyanzinthpurpur, und es kann keinem Zweifel unterliegen, dass es sich hier um sehr dunkle, fast schwarze Töne handelte, die nur in der Übersicht einem blavioletten bis rotvioletten Schein zeigten... Diese Färbung die mit der unverdünnten gekochten Schneckenmaterie hergestellt wurde, hatte offenbar gar keine Ähnlichkeit mit dem was wir heute, unter Purpur verstehen"⁶⁰ (Professor P. Friedlaender). "Die auf uns gekommene Reste von Stoffen und Pergamente haben offenbar im Laufe der vielen Jahrhunderte sehr stark gelitten sie zeigen sehr verschiedene Nuancen von Schwarzviolett bis Hellblau oder Rotviolett doch möchte ich hier ausdrücklich hervorheben, dass es noch in keinem einzelnen Fall durch chemische Analyse erwiesen ist, ob sie auch wirklich mit Purpur und nicht vielmehr mit den verschiedenen, schon im Altertum gangbaren Surrogaten gefärbt wurden."⁶¹

⁵⁹ Idem, v.IV, p. 532. Dedekind citing Richard Meyer, 1910.

⁶⁰ Friedlaender, P., "Über Antiken Purpur," Verhandlungen der Gesellschaft Deutscher Naturforscher und Ärzte (1903), pp. 6-7.

⁶¹ Idem, p. 6.

The colour produced by the coccus (Cochineal) is likened to fire in Philo and in Josephus. On the other hand, Pliny states that this scarlet hue was presented by a principal purple variety:

Notice that these are three main ones.	"Has animadverto tris esse principales.
The red as in scarlet, which is somewhat	Rubentem, ut in cocco: qui a rosis
attracted by the grace of migrant roses	migranti gratia nonnihil trahitur suspectu,
when held up, and in the Tyrian and	et in <i>Purpuras</i> Tyrias dibaphasque, ac
Laconian purple..... excessively	Laconicas." ⁶² Of the buccinum-dye Pliny
dark-hue... scarlet	expressly says that it had the lustre of
	cochineal: "dat austeritatem . . . cocci," ⁶³

but he adds that the buccinum is not employed by itself because its dye-secretion lacks durability,

The whelk itself is not approved of, as it	("buccinum per se damnatur quoniam
does not make a fast dye	fucum remittit," ib.)

With regard, on the other hand, to the *Purpura* Pliny gives the impression that his conception of its dye-secretion is that it produces rather a dark colour inclining to black.

The buccinum of Pliny as we now know corresponds to our *Purpura*. Pliny's statement that the dye-secretion yielded by the buccinum produces a fugitive colour has accordingly been condemned on all hands as crass error (cf. above). Strictly speaking, however, Pliny in this instance ought to be pronounced very probably, rather than certainly, wrong. It is generally assumed that the dye-secretion yielded by both genera *Purpura* and *Murex* is characterised by very great durability. I am not quite sure that the assumption is correct in so far as it is meant to embrace all the species belonging to the genus *Purpura*: it certainly fails to hold good universally

⁶² Pliny, C. Plinii Secundi Naturalis Historia. D. Detlefsen ed., Berlin (1868). v.III, p. 262. (book XXI, chap. 8).

⁶³ Idem, v.II, p. 115, (Book IX, chap. 38).

with reference to *Murex trunculus*.⁶⁴ May not Pliny be referring to a species of *Purpura* yielding a red fugitive dye? The fact that the dye secretions of *Purpura haemastoma*, *Purpura lapillus* and *Purpura patula* have each been proved to be very fast to light, to washing and to corrosives of various kinds offers no fatal objection. It is just sufficient to compare the case of murex. Taking, however, into consideration that *Purpura haemastoma* is known to have been actually used in ancient purple dyeing and, to judge by the high qualities of its dye-stuff must have been, if not the only one, at least one of the principal species so employed and combining this with the fact that the other genus used in purple dyeing besides the buccinum (our *Purpura*) corresponds to our murex, we are forced to admit as improbable that Pliny would in treating of purple leave out all mention of *Purpura haemastoma*, singling out some obscure species instead.

Why, however, we are entitled to ask, was the *Purpura haemastoma* employed rather than the *Murex brandaris* for adding, as Pliny says, an element of lustre to the colour of the darker purple in the manufacture of the fabric known as dibapha? The *Murex brandaris* furnishes, as we have seen above, considerably brighter or redder tones than *Purpura haemastoma*. There is evidently here very great confusion on the part of the half-moralizing, half-philosophizing naturalist, who, feeling no interest in purple manufacture, in his opinion a pandering to human vanity, appears to have taken no pains to obtain exact information on the subject.

In a preceding section of this chapter I have made an attempt to have the source of Pliny's mistake with regard to the dye-secretion of buccinum. Mention should certainly be made of another suggestion in the same direction by Lacaze-Duthiers: contrary to what one might expect, the *Murex trunculus* yields a dye which is far from fast.⁶⁵ Pliny may have misapplied to his buccinum (our *Purpura*), Lacaze-Duthiers therefore thinks, information relating to a species of his *Purpura* (our murex) that is *Murex trunculus*. May not then Pliny, I venture to surmise, have in some way muddled up *Murex brandaris* with *Purpura haemastoma*? Pliny divides the purple fabric imitating the colour of certain flowers into the following three genera:

- Tyrian, Laconian and double-dyed in which red was prominent;
- Amethystan more or less closely resembling the colour of the amethyst, a gem still known by that name;

⁶⁴ Lacaze-Duthiers, *ibid.*, p. 71 : "Quant à *Murex trunculus*, voici ce qui m'a frappé: à Mahon, il est connu des pêcheurs pour donner un teinte bleuâtre, et surtout pour ne pas fournir des marques fixes résistant au lavage," and p. 76: "Le *Murex trunculus* donne une couleur plus bleuâtre et qui n'est pas solide."

⁶⁵ *Idem*, p. 45.

- Conchylian purple, vestes conchyliata.⁶⁶

The dibapha consisted of a double dyeing, first with half nature purple of Pliny's *Purpura*, and next with red purple of his buccinum; the amethystina, of a dyeing with a mixture in certain proportions of the dark purple of the *Purpura* with red purple of the buccinum⁶⁷; the conchyliata, of a dyeing with the dark purple of the *Purpura* alone, mixed in varying proportions with water, urine, fucus marinus and the like. The real facts may have been somewhat like this;

1. The principal species employed were Murex trunculus. Murex brandaris and *Purpura* haemastoma.
2. The Murex trunculus, giving a fugitive dye would not be regularly employed by itself.
3. For this dibapha would be used on the one hand dark purple from Murex trunculus, or *Purpura* haemastoma or from both, and on the other red purple from Murex brandaris.
4. For the amethystina would be used a mixture of Murex trunculus or *Purpura* haemastoma, or of both, with the dye of Murex brandaris.
5. For the conchyliata would be employed the dye obtained from Murex trunculus mixed with water, urine, etc. To give the colour a certain fastness Cretan fucus marinus would be used as a mordant.

Lastly, there would also be the purple-dyed either with the dye of Murex brandaris alone or with that of *Purpura* haemastoma alone, both being fast dyes.

The geographical variation in the colour of the *Purpurae* spoken of by Aristotle and Vitruvius, due, according to these authors, to varying distance from the sun, would apply to such species as *Purpura* haemastoma, Murex brandaris, etc., rather than to Murex trunculus, which as will be seen later, is not dependent on light for developing its colour.

By the way, it may be remarked that the statement in Pliny and others of the Tyrian purple being red, agrees with Aristotle and Vitruvius that the *Purpurae* of the Southern Seas give a red dye.

E. The Inalterability of the Purple Dye.

The durability of purple dye is almost proverbial. In all the works dealing with ancient purple which I have read I have seen this stated as something universally acknowledged, the only exception being made in the case of the red dye of the buccinum on the authority mainly of Pliny.

⁶⁶ Pliny, *ibid.*, v.IV, p. 83, (Book XXI, ch. 8).

⁶⁷ Idem, v.II, p. 115. (Book IX, chap. 38-39).

Yet in ransacking the classics I have come across a certain passage which has furnished food for thought on the point. "Thou knowest that the dyers, when they wish to dye wool so as to give it the colour called alourges chose first among wool of different colours that which is white: then they prepare it with very great care so that it may imbibe as much of the dye as possible: after that they dye it. Thus prepared, the dye never passes off, and the fabric, whether washed with or without corrosives preserves its colour in its full strength. But if wool of another coloration is used instead, or even the white wool without proper preparation, thou knowest what the result is? Yes, a fugitive colour and an unpleasant one."

"Thalassion id est fucus marinus lactucae similis, qui conchyliis substernitur etc." ⁶⁸	[The sovereign remedy, however, for this complaint is] phycos thalassion, or seaweed, which is like lettuce, and is used as a ground-colour for the purple of the murex; it is sovereign etc.
"Qui conchyliis, hoc est cujus colore lana primum imbuatur cum vestis conchyliatae tinctura praeparatur." ⁶⁹	This shell, that is, the color of which wool is first saturated, is prepared with the dye of scarlet cloth.

(https://www.loebclassics.com/view/pliny_elder-natural_history/1938/pb_LCL393.343.xml)

Pliny indeed makes mention of the cleansing of the wool prior to immersion into the bath, but that is all ("Vellus elutriatum"⁷⁰ [Fleece]). He nowhere hints that this was indispensable for the durability and fastness of the colour. Modern experimenters say nothing of the kind. The language of Plato would seem to imply, I think, more than mere cleansing of the wool.

Does not this rather refer instead to the treating of the wool with certain mordants or styptics for binding the dye to the fibre? But does the purple dye require mordants?

May not Plato be referring here to Murex trunculus whose dye applied by itself is a

⁶⁸ Harduin, Jean, *Caii Plinii Secundi Historae Naturalis*, Paris (1723), v.II, p. 406.

⁶⁹ Beckmann, *Beitrag zur Jachinthe*. Leipzig (1786), v.I, p. 336.

⁷⁰ Pliny, *ibid*.

fugitive one? May not purple dyeing in Greece in Plato's time have been mainly confined to *Murex trunculus*?

Of modern experimenters William Cole states with regard to the flower or dye secretion of *Purpura lapillus* that it is fast to washing though it be ever so many times repeated, but he is careful to add that nevertheless the first washing "somewhat allayed" the colour (ib.).

Note: Plato's statement that only white wool is fit for purple may perhaps throw light on a difficult point. The epithet *purpureus* often taxes the ingenuity of commentators. But the following are veritable *erreis interpretum* (veritable, but erroneous, interpreters): (1) *Pedo Albinoramus*, *Eleg. ad Mareen*. Gl:

I am mindful (and I remember art) so I draw wands, purple arms brighter than snow	"sum memor (et arte memini) sic ducere thyrsos Brachia purpurea candidiora nix." (2)
---	--

Horace C. IV. 1. IV.:

Flying with purple swans, you will more seasonably revel in the house of Paulus Maximus.	"Tempestirius in domum Pauli purpureis alis oloribus conmisolata Mationis."
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There never was such a thing as white purple, purplish snow! purplish swans! I should take *purpureus* in these instances in the sense of fit for purple. Nix is poetic for snow-white wool (Cf. Plato, cf. Pliny *vellus ellutiatum*): "whiter than snow-like wool, fit to be dyed with purple."⁷¹ Similarly for the swans.

⁷¹ I scarcely need emphasize the purely hypothetical character of this explanation. I know in reality of no modern attempt to dye with the purple juice absolutely raw wool unwashed and uncleansed. The following passage appearing in L. Lartet's "La Syrie d'aujourd'hui," p. 127, should also be taken into account: "Les murex à pourpre sont très comuns non seulement sur toute la côte, mais dans le port même. Les gamins de Tyre savent encore aujourd'hui teindre des chiffons de pourpre en fixant la couleur, du mollusque avec un peu de carbonate de soude et de jus de citron. Ces guenilles colorées en pourpre, leur /pouvent/ de drapeaux lorsqu'ils jouent au soldat comme font les enfants de nos jours." Which "mollusque" is here spoken of? *Murex trunculus*?

F. The Chemical Constitution of the Purpurigenic Matter.

The chemical analysis of the purpurigenic matter is mainly associated with the names of Bizio (1833-35), the brothers A. and C. de Negri (1875), Schank (1879), Lettelier, Friedlaender, and Dubois. The researches of these eminent scientists can hardly be properly understood and appreciated by non-chemists, including the writer of these lines. It is, however, of special importance for our study to underline the following results: (1) Already Bizio had ascertained that the dye-secretion of *Murex trunculus* contains an element of blue very analogous to indigo:

I was only sent an ounce of the liquid	"Del liquore del <i>Murex trunculus</i> non mi
from the <i>Murex trunculus</i> to Florence.	fu dato di portarme a Firenze che solo
However, the liqueur of this murex was	un'oncia. Tuttavia il liquore di questo
separated from me into two different	murice fu separato da me in duo sostanze
substances, an absurdity ... it has a strange	diverse, una assurda ... ha sostanza assurda e
substance and totally analogous to indigo!	in tutto analoga all'indace!" (2)

The researches of Prof. August Lettelier into the chemical constitution of the purpurigenic matter of *Purpura lapillus* have shown that it contains at least three substances: a yellow not susceptible to light, an applegreen developing into deep blue under the action of light, a gray-green developing under the same action into a crimson red. (3) Professor Friedlaender in analysing the dye furnished by *Murex brandaris* succeeded in isolating from it the 6'.6' dibromoindigo (reddish violet); in the dye secretion obtained from *Murex trunculus* he discerned in addition a blue dye, the constitution of which he has not yet established.⁷²

Last but by no means least comes Professor Dubois' work (*Recherches sur la Pourpre*, etc.) which besides presenting the results of technical research in a form as intelligible to the general reader as possible, also contains many an illuminating remark bearing upon purple in antiquity. Professor Dubois replying to me from Lyons under date of May 20th, 1913 writes inter alia (among other things):

⁷² Friedlaender, *ibid.*: "Untersuchungen haben ergeben, dass aus den Dursen von *Murex trunculus* neben dem rotvioletten Farbstoff auch noch ein blauer von noch nicht aufgeklärter Zusammensetzung erhältlich ist."

"Studies have shown that in addition to the red-violet dye, a blue of unex elucidated composition is also available from the durses of *Murex trunculus*."

"As I indicated in my work on Purple and some other animal pigments in the Archives of Experimental and General Zoology, Paris, 5th Series, V.II, 1909, purple is a mixture of two pigments, red and blue. The latter especially is very close to indigo from a chemical point of view. It is much more abundant in Murex trunculus and for an artifice one could, I believe, obtain pure blue with this last marine gasteropod. "

"Ainsi que je l'ai indiqué dans mon travail sur la Pourpre et quelques autres pigments animaux en Archives de Zoologie expérimentale et générale, Paris, 5ème Série, V.II, 1909, la pourpre est un mélange de deux pigments, un rouge et un bleu. Ce dernier surtout se rapproche beaucoup de l'indigo du point de vue chimique. Il est beaucoup plus abondant dans Murex trunculus et pour une artifice on pourrait, je crois, obtenir du bleu pur avec ce dernier gasteropode marin."

Next after its intrinsic quality of stability, the new play of colour which it produces upon the fabric in sun-light is said in the ancient writers to have secured for the purple dye the high esteem in which it was held (See especially W. Adolf Schmidt op. cit. p. 157.) It must have come to many a reader as a surprise to be told by Professor Friedlaender:

"The results confirm the expectations of nuance and authenticity that were justified by Kirtian reading of ancient literature, but they are likely to cause great disappointment to modern audiences. We are used to livelier and pure tones now, and I do not think they are today's mankind that can understand the enthusiasm of our ancestors. If I am wrong, the ancient colors are now available to us at a price that would be more than 1000 times lower than the old world; ... / We have a poor illusion; that

"Die Resultate bestätigen durchaus die Erwartungen hinsichtlich Nuance und Echtheit, zu der die kirtische Lektüre der alten Literatur berechtigte, aber sie dürften dem modernen Publikum eine grosse Enttäuschung bereiten. / Wir sind gegenwärtig an lebhaftere und reine Tone gewöhnt, und ich glaube nicht, dass die heutige Menschheit die Begeisterung unserer Vorfahren auch nur wird verstehen können. Sollte ich mich irren, so standen uns jetzt die antiken Färbungen zu einem Preise zur Verfügung, der uns

the shine and the beauty of the antique purple are no longer able to spark our spoiled eyes. "

mehr als 1000 mal niedriger käme als der alten Welt;... /Wir sind um eine Illusion armer; der Glanz und die Schönheit des Antiken-Purpurs vermögen unser verwöhntes Auge nicht mehr zu blenden."

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As a set-off against this disillusioning information, I should draw attention to the following passage in Dr. Dedekind's Beitrag -

"About the magnificent color effect of these purple samples, her maker wrote to me: 'on silk the reflections are magnificent on the thread the color is beautiful, but does not have the admirable transparency that it offers on silk.' In fact, these purple samples, especially those on silk, showed the delightful play of colors so rightly praised by the ancients, that miraculous, delicious shimmer for which the expressions are available: : Angé, pheggos lumen, nitor, splendor, fulgor, color in suspectu refulgens, versicolor, splendens, sublucens, micans, ardens, etc."

"Über die prächtige Farbenwirkung dieser Purpurproben schrieb mir ihr Anfertiger: 'sur la soie les reflets sont magnifiques sur le fil la couleur est belle, mais n'a pas cette admirable transparence qu'elle offre sur la soie.' In der Tat zeigte sich bei diesen Purpurproben, insbesondere jenen auf Seide, das von den Alten mit Recht so gepriesene entzückende Farbenspiel, jener wundersame, köstliche Schimmer, wofür die Ausdrücke vorliegen: Angé, pheggos lumen, nitor, splendor, fulgor, color in suspectu refulgens, versicolor, splendens, sublucens, micans, ardens, etc."⁷⁴

Compare also in this connection another passage in Friedlaender

⁷³ Idem, p. 10.

⁷⁴ Dedekind, *ibid.*, v.I, p. 23.

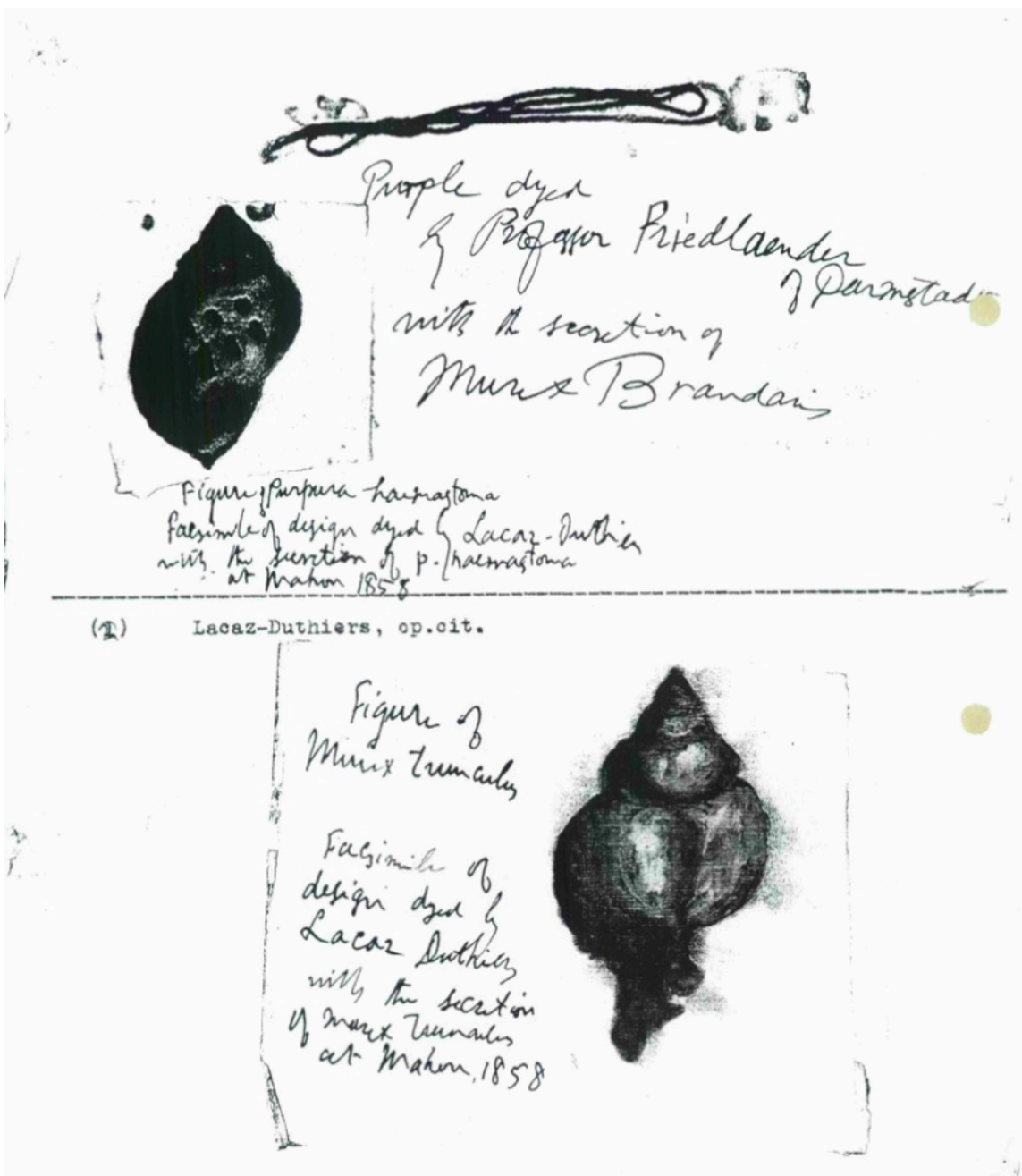
"They are also praised for a play of colors that emerges in the sun by name, presumably similar to the coppery shine that can be observed in intense indigo colors, And which we now call bronzing for several other dyes."	"Gerühmt wird ferner an ihnen ein namentlich in der Sonne hervortretenden Farbenspiel, vermutlich ähnlich dem kupfrigen Glanz, der bei intensiven Indigofarbungen zu beobachten ist, Und den wir bei zahlreichen anderen Farbstoffen jetzt mit Bronzieren bezeichnen." ⁷⁵
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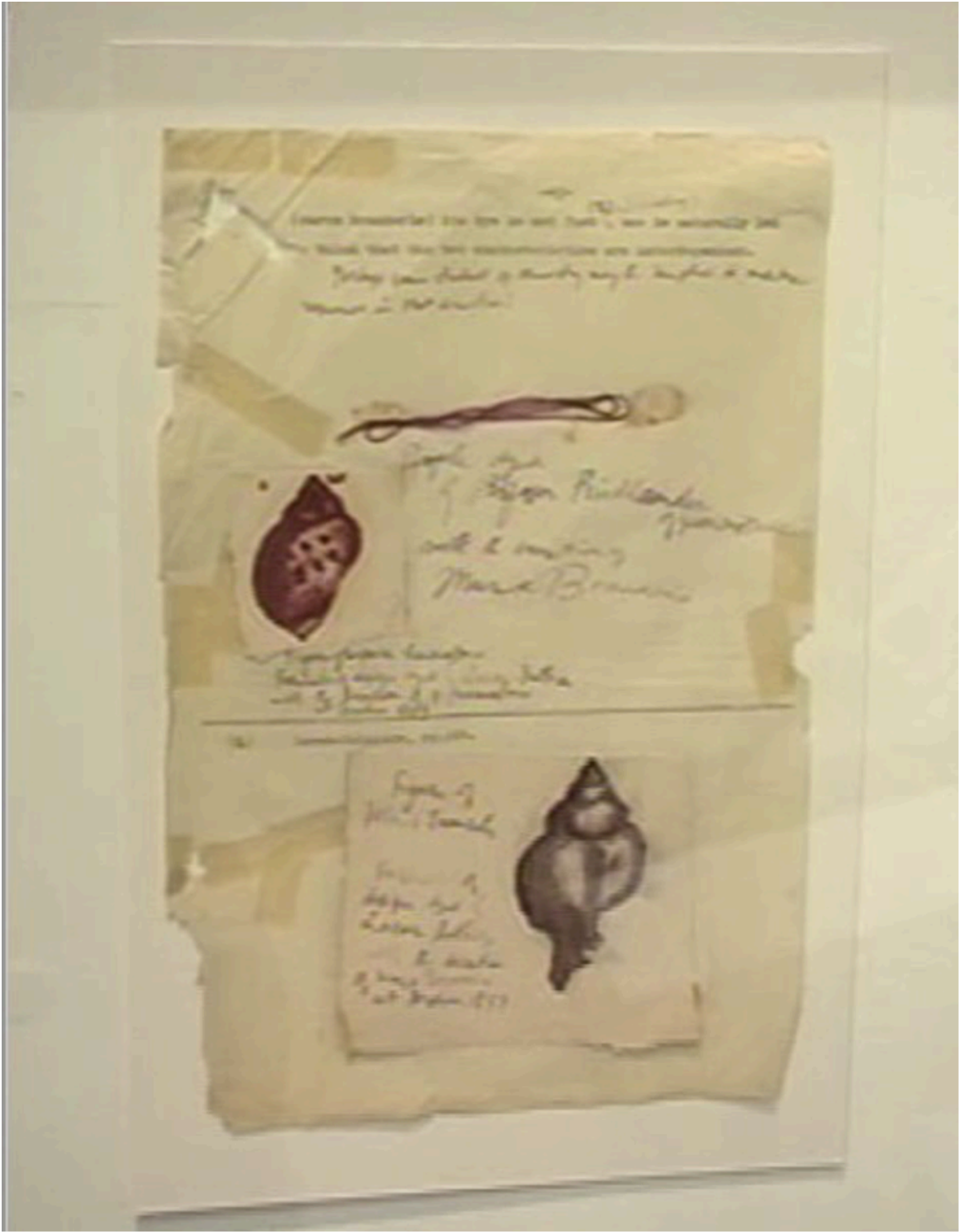
In conclusion I may be permitted to observe that the case of *Murex trunculus* tends to show that there is a distinct relationship between the fastness of the purple colour and its development through the action of light. When one considers that the *Murex trunculus* develops its dye in darkness as well as in day light,⁷⁶ and that contrary to its congeneric species (*Murex brandaris*) its dye is not fast,(76a - *Lacaze-Duthiers, op. cit.*) at least to washing, one is naturally led to think that the two characteristics are interdependent.

⁷⁵ Friedlaender, *ibid.*, pp. 6-7.

⁷⁶ R. Dubois, *op. cit.*, p. 518: "On a prétendu que la lumière exerçait une action photographique sur le mucus purprigène de cette espèce (sc. *Murex trunculus*) c'est une erreur, partagée cependant par de Lacaze-Duthiers. D'autres ont dit que la lumière active a avivé le couleur la couleur de ce pigment. Les expériences de A. et G. Nègré sont contraires à cette opinion, etc."

"It has been claimed that light exerts a photographic action on the purprigenic mucus of this species (sc. *Murex trunculus*) it is an error, shared however by de Lacaze-Duthiers. Others said that the active light brightened the color of this pigment. The experiences of A. and G. Nègré are contrary to this opinion, etc."





II. THE ORIGIN OF PURPLE DYEING

A. Legend of Hercules and His Dog.

The discovery of purple dyeing is generally attributed to the Phoenicians. Well known is the legend of Hercules and His Dog, and how the hero was led to the discovery of the purple dyeing in consequence of his dog's mouth having become stained with a beautiful red dye on crushing with his teeth some purple-giving sea-snail.

A variant version ascribes the discovery to a shepherd. Professor Paul Friedlaender, referring to the fable, remarks:

"This is quite practically impossible to someone who has held a purple snail in their hand only once." ⁷⁷

"Die praktische Unmöglichkeit leuchtet jedem ein, der nur einmal eine Purpurschnecke in der Hand gehalten hat." ⁷⁷

We may well believe the eminent chemist, seeing that he has manipulated thousands of purple snails in the course of his world-famed researches. He is not, however, the first to have drawn attention in this direction. Others before him had very nearly done so, but "in their reluctance to part with the pet story altogether" have contrived somehow to save a portion through a re-statement of it.

An anonymous writer in an article dealing with purple, advances the view that it is probably to *Aplysia* rather than to a genuine purple mollusc that the old tale refers. The same writer also puts forth the suggestion that in the earliest times the species employed in purple dyeing may have been the *Aplysia* and also the *Janthina*.

"In the production of the lower quantities, the Phoenicians probably did not use the mollusca from the *Buccinida*

"Bei der Herstellung der geringeren Quantitäten verwandten die Phönizier die Mollusca aus der Familie der *Buccinida*

⁷⁷ Idem, p. 4.

family, but took the substance from those from other families, which also provide a coloring liquid. The Janthina is common on the Syrian coast, and Caillardet is found at the rocks near Saida, often covered with aplysia in the spring; they had been played by the waves and exuded a large amount of already violet liquid. Perhaps the use of this has led to the discovery of the true purple. The colored liquid of the aplysia separates itself as soon as you have removed the shell from the Thiere, and still does not require any precautions, while that of the Murex requires all kinds of operations until you get the desired color nuance. As it is well known, the ancient writers say that the discovery of purple is one! Shepherd dogs, and it is quite believable and easy to understand, that when enjoying an Aplysia, the muzzle and hair have dyed violet; but that can't happen on a Murex: the dog had to bite through the shell and even then, the mollusk wouldn't have given him a colored liquid."

wohl nicht, sondern nahmen den Stoff von solchen aus anderen Familien, die gleichfalls eine färbende Flüssigkeit liefern. Die Janthina kommt an der Syrischen Küste häufig vor, und Caillardet hat am Frühjahr die Felsen bei Saida häufig mit Aplysien bedeckt gefunden; sie waren durch die Wellen angespielt worden und Hessen eine grosse Menge schon violetter Flüssigkeit aus. Vielleicht hat die Verwendung gerade dieser auf die Entdeckung des wahren Purpurs geführt. Die farbige Flüssigkeit der Aplysien sondert sich von selber, sobald man dem Thiere die Muschel abgenommen hat, und bedarf weiter keiner Vorkehrungen, während jene von dem Murex allerlei Operationen verlangt, bis man die gewünschte Farbennuance erhält. Bekanntlich erzählen die alten Schriftsteller, dass man die Entdeckung des Purpurs einen! Schäferhunde verdanke, und es ist ganz glaublich und leicht begreiflich, dass beim Geniessen einer Aplysia sich Schnauze und Haar violett gefärbt habe; aber auf eine Murex kann das nicht passieren: der Hund musste die Schale durchgebissen und das Mollusk hätte ihn auch dann keine farbige Flüssigkeit gegeben."

(77a - Globus, 26 (1874); Braunschweig, pp. 237-238. The author of this article, it may be remarked, appears to have had no profound knowledge of conchology; the Aplysia, as Dr. Dedekind already observes (Beitrag IV, p. 313), is really a shell-less mollusc. Nor is the last objection of any force. To colour the purple juice requires no manipulation whatever, but simply exposure to light wherever on cloth or on a dog's snout.)

An earlier writer, Martin Ziegler, had likewise put forth a claim for Aplysia or, to be more precise, Aplysia depilans:

"Cuvier believes that this coloring matter is the true crimson of the ancients. Indeed, the history of the shepherd's dog is better explained with a large known mollusk, containing a ready-made color, than with a shell in which the color is not yet developed. "78	"Cuvier croit que cette matière colorante est la véritable pourpre des anciens. En effet, l'histoire du chien du berger s'explique mieux avec un grand mollusque connu, renfermant une couleur toute faite, qu'avec un coquillage dans lequel la couleur n'est pas encore développée. "78
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George Tryon, a noted American conchologist, gives a similar interpretation:

"Pliny states that in his time the purple dye was obtained from the buccinum and the *Purpura*. The mollusk now known as *Murex trunculus* is generally supposed to have been that principally used by the ancients in obtaining the Tyrian purple. It is related that the discovery of the dye is due to the dog of a Tyrian nymph which crushing some of these shells in its teeth its mouth became stained with purple. It is possible that the fragile *Janthina* may have been thus crushed. "79

But however uncritical a procedure it would doubtless be to accept this story of the dog as genuine tradition, to ignore it completely in a study of the origin of purple dyeing would perhaps savour of the hypercritical. Pullex ascribes it to the Phoenicians. Like everything else, the legend must have had its beginning, taking rise at a definite time, in a definite circle of humanity. Where, indeed, would it be more likely to originate than among the Phoenician dyers who, excelling all others in their technical skill, would easily come to regard themselves and be regarded by others

⁷⁸ Ziegler, Martin (cf. the above remark), Bulletin delà Société Industrielle de Mulhouse(Juilliet, 1867).

⁷⁹ Tyron, George W., J R Manual of Conchology, Philadelphia (1880), v.II, p. 43.

as the creators of purple dyeing, and who would, naturally, be pressed by foreign visitors and admirers of the art for an explanation of its origin. If there existed no tradition really dating from the earliest times, one would automatically spring up sooner or later.

Yet the utter disregard for reality which the dog-story betrays - quite apart from its association with a mythical hero (witness Professor Friedlaender's remark) argues strongly against it having arisen in quarters where the manipulation of the *Purpura* and the murex formed a daily occupation. The explanation is probably to be sought in the direction pointed out by the above authors. It may be that this account of the origination of purple-dyeing was simply suggested by the frequent sight of dogs with violet stained mouths in consequence of their having fed upon *Aplysia* or *Janthina* cast ashore by storms. On this hypothesis though, the tradition would not warrant the inference that the *Aplysia* and *Janthina* preceded the *Murex* and the *Purpura* in the purple manufacture. It would, I suppose, carry with it the corollary that species belonging to these genera were employed, at least to some extent, at a certain state, in the development of the industry. For otherwise the story would owe its origin to circles totally uninitiated in the art. It would hardly have so fully satisfied the adepts as to rid them from the necessity of inventing a rival one, and would have scarcely gained such wide-spread currency.

The following passage in Dr. Dedekind may well be quoted as tending to afford support to the view expressed here:

"As with all other disciplines that arise in a very specific historical spirit, the broad context must never be disregarded when explaining the history of the purple being. For example, the relevant reports by Aristoteteles and Pliny must definitely not be based on an insulating stool but must also be considered in connection with the purple beings of the Semites and with many other moments. Anyone who is only reasonably familiar with the doctrine of	"Wie bei allen sonstigen, in ganz spezifisch historischem Geiste sich anlassenden Disziplinen darf auch bei der Darlegung der Geschichte des Purpurwesens nie der grosse Zusammenhang ausser acht gelassen werden. Denn, zum Beispiel, die einschlägigen Berichte von Aristoteteles und Plinius dürfen entschieden nicht auf einem Isolierschemel gestellt, sondern müssen im Zusammenhänge auch mit den
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marine dyes en bloc reads clearly between the lines of the relevant digressions of Aristotle and Pliny that Aristotle, where he implicitly speaks of boys who are put into the world by alleged purple snails 'on which one meets the boys', alludes to *Helix janthina* (with which one wants to compare all the relevant reports of the unforgettable Forskal: 'Post mortem auctoris edidit Carsten Niebuhr, etc., Haunia, 1775'), while Pliny speaks of *Aplysia* (sea hare) where he speaks of the animal algae as an alleged purple snail. Likewise, Pliny 80 meant the dye, the deep purple one, of *Aplysia* in the passage: 'Buccinum per se damnatur quoniam 'focum remittit'. This has never been clearly recognized until now, but it must finally be stabilized." 81

Purpurwesen der Semiten und mit zahllosen sonstigen Momenten betrachtet werden. Wer nur einigermaßen mit der Lehre von den marinen Farbstoffen en bloc bekannt ist, der liest ja doch zwischen den Zeilen der betreffenden Exkurse von Aristoteles und Plinius deutlich heraus, dass Aristoteles dort, wo er implicite von Jungen spricht, welche von angeblichen Purpurschnecken 'an welchem man die Jungen antrifft,' in die Welt gesetzt werden, auf *Helix janthina* anspielt (womit man alle einschlägigen Berichte des unvergesslichen Forskal vergleichen wolle: 'Post mortem auctoris edidit Carsten Niebuhr, etc., Haunia, 1775'), während Plinius dort wo er von dem animal algense als einer angeblichen Purpurschnecke spricht, von *Aplysia* (Meerhase) redet. Ebenso hat Plinius⁸⁰ bei dem Passus: 'Buccinum per se damnatur quoniam "focum remittit" den Farbstoff, den tiefvioletten, von *Aplysia* gemeint. Dies war bis jetzt noch niemals klar erkannt worden, muss aber endlich stabilisiert werden."⁸¹

⁸⁰ Pliny, *ibid.*, Book 9, chap. 38.

⁸¹ Dedekind, *ibid.*, v. IV, p. 85.

I would add that to say, for instance, that Aristotle included among the *porphyra* species not really answering to his description of the type of these sea snails involves no disparagement of his scientific exactness. The great naturalist may well have been misled by statements occurring in earlier authors no longer extant, with whom the term "*Porphyra*" stood for all dye-yielding molluscs of whatever genus. The fact that among the *porphyra* known to him at first hand he found no corroboration of such data would not weigh much with Aristotle, seeing that he was only acquainted with the genera of Mediterranean molluscs and hardly with all of these either.

B. Tradition Attributing to the Phoenicians the Discovery of Purple Dyeing.

The belief in the Phoenician origin of purple dyeing, so widely current in antiquity, repeatedly occurs in writings on purple even in recent times. An illuminating hint thrown out by Pietschmann, who cannot be certainly suspected of a tendency to belittle the achievements of the Phoenicians, the subjects of his great history, does not seem to have generally met with the appreciation it deserves.

"Many of the results of the culture of the Orient, which the people of the West first became aware of through the mediation of Phoenician traders, and some skills which the Phoenicians only learned from foreign peoples, but in which they finally achieved independent proficiency, are from the ancients wrongly regarded as achievements and inventions of the Phoenicians It is still uncertain whether those arts which, according to the judgment of the ancients, the Phoenicians were best at, the preparation of the purple color and the coloring with it were first practiced in Phenicia . " 82

"Viele Ergebnisse der Kultur des Morgenlandes, die den Völkern des Westens zuerst durch Vermittlung Phönizischer Handelsleute bekannt wurden und manche Fertigkeiten, welche die Phönizier zuerst fremden Völkern nur abgelernt, in denen sie es jedoch schliesslich zu selbstständige Tüchtigkeit gebracht hatten, sind von den Alten mit Unrecht als Errungenschaften und Erfindungen der Phönizier betrachtet worden.... Unsicher ist selbst ob diejenigen Kunstfertigkeiten, auf welche nach dem Urtheil der Alten die Phönizier sich am besten verstanden haben, die Bereitung der Purpurfarbe und das Färben

mit demselben zuerst in Phönizien
ausgeübt worden ist."⁸²

George Tryon had the right instinct when he wrote:

"It is probably that all ancient peoples inhabiting sea-shores have become accidentally acquainted with this property common to so many molluscs at a very early date."⁸³

The natives exercising purple-dyeing with *Purpura patula* and *Purpura lapillus* on many coasts of Central America are hardly the debtors of the Phoenician still less of the Spanish conquerors, for, as E. von Martens rightly observes,⁸⁴ purple-dyeing had long died on the Mediterranean coasts by the time of the discovery of America. The tradition crediting Phoenicia with the invention of purple-dyeing is probably true only in the limited sense that it was on the coasts of that country that the art was brought to its technical perfection. Of this we have evidence in the high esteem in which Phoenician purple was universally held. Strabo states that the Tyrian purple was prized above all others. Laconian purple also enjoyed great fame, but not on a level with the Phoenician. It should, however, also be noted that the excellence of the purple of that provenance was partly ascribed to the intrinsic qualities of the purple snails living in the Phoenician waters.⁸⁵

With this should be compared an homily by R. Levi in Midrash Rabbah Genesis, 90, which reckons חלזון, or the purple mollusc among the characteristically Palestinian articles sent by Jacob as a gift to Joseph. In thus singling out the purple mollusc the Agadah reflects, I think, the belief, current in its time, in the exceptional qualities of the Palestinian, or more properly Phoenician murices and *Purpurae*.

When once we have considered the unlikelihood of the Phoenicians having been the only discoverers, it may, perhaps, not be venturing too far to ask whether the Phoenicians were

⁸² Pietschmann, Richard, Geschichte der Phönizien, Berlin (1885), p. 239.

⁸³ Tryon, G. *ibid.*, p. 43.

⁸⁴ Martens, E. von, "Purpurfarbereien in Central America," Verhandlungen der Berliner Anthropologischen Gesellschaft, 22. Oktober 1898, p. 482-486.

⁸⁵ Pausanias, Periegesis of Greece. Book III, ch. 2. para. 6.

discoverers at all, or, in other words, whether they had not themselves borrowed from some other nation the secret of purple-dyeing. Pietschmann has very nearly said as much:

"The terms that are common in Hebrew for the purple colors are hardly of the Canaana origin."

"Die Benennungen welche in Hebräischen für die Purpurfarben üblich sind, sind schwerlich Kanaanaischen Ursprung."⁸⁶

The historian of the Phoenicians, however, has omitted to state his reasons for this assertion. The names to which he refers are of course *Tekhelet* and *Argaman*. Aramaic תכלת and ארמנא, Assyrian, takiltu and *Argamannu*. Why may not תכלת in particular be purely Semitic? The most plausible etymology of ארגמן or ארגון is that connecting it with the Sanscrit *ragamen* and *ragavan*, both adjectives derived from *raga* = red ⁸⁷(Bernay's in Gesenius' Thesauriis Addit.I.). The etymology of *Tekhelet* has been less satisfactorily explained. If, however, ארגמן comes from India, may not תכלת, its regular companion, trace its origin to the Sanskrit *kala*, dark blue, indigo blue? The Indians ranked high as dyers.⁸⁸ Whether they exercised purple-dyeing I have not yet investigated. Ctesias states that the Indians exhibited wonderful skill in imitating the colour of purple by means of vegetable dye-stuff.⁸⁹

If both *Tekhelet* and *Argaman* are of Indian origin, then it would certainly not be an improbable supposition that the Phoenicians obtained the thing exactly from the same source from which they got the name. This they may have done when still living on the Persian Gulf, prior to their immigration into Syria. The Indians may have meantime abandoned the use of marine animal dye-stuff for some reasons no longer ascertainable. On the other hand, it is equally possible that the Phoenicians only borrowed the name but not the thing, simply adapting to the colours produced with the purple seasnail terms used in India, in their native forms, of course, for

⁸⁶ Pietschmann, R., *ibid.*, p. 239.

⁸⁷ תרגם may perhaps be the תפעל of רגם, red, bright, hence to enlighten, to illumine, to explain, to interpret. Cf. קידושין ל"א ע"ב, לא צהריתו.

⁸⁸ Lassen Christian, *Indische Altertumskunde*, Leipzig (1858), V.I, p. 277.

⁸⁹ Ctesias Cnidius, *Ex Ctesia ... excerptae historia*, book XXL

designating the corresponding colours obtained with vegetable dye-stuff; but even on this alternative supposition Phoenician dependence upon India in the dyeing craft will have to be conceded to some extent. The derivation proposed here for *Tekhelet*, however, is hardly of a nature to furnish a firm base for such far-reaching deductions; that of ארגמן, though plausible enough, is not entirely free from doubt. A Phoenician literature, of course, hardly exists. I have not made a search for *Tekhelet* or *Argaman* in Plautus, but it is very unlikely to occur there. In Sanchriathon and in Philo Byllus I have found no mention of purple. Closely as we have learnt to associate Phoenicia with purple I felt keenly disappointed on failing to find a single mention of either תכלת or ארגמן in the Phoenician inscriptions published in the *Corpus Inscriptionum Semiticarum*. Perhaps someone else will be more successful. I state this fact simply with the object of inciting others to a harder search, without in the least wishing to imply that the silence of the inscriptions affords a handle for casting doubt upon the reputed supremacy of the Phoenicians as purple producers.

A real difficulty is offered by Ezekiel 27, 7b: "of *Tekhelet* and *Argaman* from the isles (or coast lands) of Elishah was thy cover." And this stands in an elegy on Tyre! Surely it is like bringing coals to Newcastle?⁹⁰ Ezekiel, be it distinctly emphasized, does not in the slightest degree warrant the inference that the "isles of Elishah" were the only centres of purple production, or that Tyre manufactured no purple at all. What the prophet does imply is that the "isles of Elishah" were the producers of purple par excellence and that their wares when imported into Tyre threw the native fabrics into the shade.

Similarly, in the first half of this verse Egypt is said to have furnished "fine linen" with embroidery. Now, we know that Egypt was preeminent in the production of fine linen. This analogy alone would sufficiently establish the inference drawn from the second half of the verse with regard to the "Isles of Elishah."

Where are those isles or coast lands? Various identifications have been proposed the Peloponnesian coasts,⁹¹ Carthage, Sicily, etc. Recently it has been identified with Alsa or Alasia of the Egyptian texts. The latter, according to Professor Maspero, designates the northern part of

⁹⁰ Curiously enough Professor Besnier in his really admirable article on "Purpura" in the *Dictionnaire des Antiquités Grecques et Romaines* refers to Ezekiel 27 as one of the sources speaking of Phoenicia as mistress of the art of purple-dyeing.

⁹¹ Halevi, Joseph, *Recherches Bibliques*, Paris (1895), pp. 260-264. Also Saglio, Edmond; Daremberg, Victor Charles, "Purpura," *Dictionnaire des Antiquités*, Paris (1907), pp. 415-6.

Coilosyria. Professor Sayce draws attention to an hieratic papyrus, now in the Hermitage at St. Petersburg, showing clearly that, unlike Professor Maspero's hypothesis, Alsa must have adjoined the Mediterranean coastland. In giving an account of an embassy sent by sea to the King of Gebal in the time of the high priest Ur-Hal the text states: "the Egyptian envoys were wrecked on the coast of Alsa where they were afterwards hospitably entertained by the queen of the country."

The theory now most generally accepted is that Alasia is identical with Cyprus.⁹² It would thus follow that Cyprus held at one time the palm of purple manufacture. This would not at all conflict with what we otherwise know of Cypriot art and civilisation. I know of no researches into the subject of Cyprus as a purple producer, but the following passage in Dedekind may, I think, be appositely quoted:

About variable purple substances . . . see my Parisian paper on Oxyblatta in the 3 series, 4 vol. of the 'Archiven de Zoologie expérimentale et gén.,' where I first drew attention to a variable purple on an Artemis statue from Larnakei (Cyprus), etc.	"Über changeanten Purpurstoffe . . . siehe meinen Pariser Aufsatz über Oxyblatta in der 3 Serie, 4 Bd. der 'Archiven de Zoologie expérimentale et gén.,' wo ich zum ersten Male auf ein Purpur-changeant-Himation an einer Artemisstatur von Larnakei (Cypern) aufmerksam gemacht habe, etc." ⁹³
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Whether *עִלְיִשָּׁה* is to be equated with Cyprus or not, Ezekiel 27, 7b. admits, at least to my mind, of no other solution but that the universally renowned Phoenician preeminence in purple production is younger than Ezekiel (died. c. 571 BX).

An error shared by many a noted authority is that Homer refers to the Phoenicians as famed for their purple fabrics. In so up-to-date a medium of information as the article "Phoenicia" in the latest edition of the British Encyclopaedia a statement is made to this effect, the source indicated being Iliad, VI. 289. In view of the excellence of the article as a whole, this, I believe, a single

⁹² Driver, Samuel Rolles, *Modern Research as Illustrating the Bible*, London (1909), p. 32.

⁹³ Dedekind, *ibid.*, v.I, p. 89.

slip may well be pardoned, but a misleading statement in what may be termed a national work, constituting a glorious monument to British science and learning, ought not to be allowed to go unrectified. I have not found in Homer the slightest reference to Phoenicians as purple manufacturers, to say nothing of their supremacy as such. Iliad VI. 289 speaks of Sidonian women as exceptionally skilled at embroidery work ("Embroidered garments, the work of Sidonian women"). There is no allusion here to purple-dyeing or indeed of any sort, but simply to artistic needlework, a peculiarly feminine craft, especially in antiquity. Note this passage in Perrot et Chipiez:

"It is most often embroidered with a needle, it is that the Latins called *acu pingere*; we do not understand how with the work of the ancients we could have executed in the fabric itself. All these figures which we have seen cover the Assyrian fabrics, in the bas-reliefs where the sculptors have copied them with such meticulous accuracy; with the needle, on the contrary, as the Latin phrase was so well expressed, one can easily achieve the same effects as with brushes; all it takes is skill and time. "

"C'est le plus souvent broder à l'aiguille, c'est que les Latins appelaient *acu pingere*; on ne comprend pas comment avec le métier des anciens on aurait pu exécuter dans le tissu même toutes ces figures qui nous avons vu couvrir les étoffes assyriennes, dans les bas-reliefs où les sculpteurs les ont copiées avec une si minutieuse exactitude; avec l'aiguille, au contraire, comme s'exprimait si bien la locution latine, on peut aisément obtenir les mêmes effets qu'avec les pinceaux; il n'y faut que de l'adresse et du temps."⁹⁴

Compare Hebrew רוקם and comp. רוקם וכו' יומא ע"ב ע"ב.

Incidentally we learn from Homer that in his time Sidon was the home of the highest skill of embroidery. That the coloured threads used in Phoenician embroidery work were of native dyeing does not at all necessarily follow. These may have been, in Homer's time, imported from abroad

⁹⁴ Perrot, Geoges, Chipiez, Charles, *Histoire de l'Art, dans l'Antiquité*, Paris (1890), p. 877.

Cyprus or elsewhere, just as at a much later time Phoenician purple wool would be worked into textiles in Assyria.⁹⁵

The absence in Homer of all association of purple production with the Phoenicians tends, I think, to strengthen my contention that Phoenician supremacy under that aspect dates from a period later than Ezekiel.

Solomon orders from Hiram, King of Tyre, cedar wood to be used in the construction of the Sanctuary, but not תכלת, *Tekhelet*, or ארגמן, *Argaman*.⁹⁶ On the other hand, he asks him to send him a "skilful man to work in *Argaman* and karmil and *Tekhelet*, etc."⁹⁷ "And he made the veil of *Tekhelet*, and *Argaman* and karmil and fine linen and wrought thereon Kerubim."⁹⁸ This is in consonance with the Phoenician excellence at embroidery alluded to in Homer.

In the corresponding account in Kings⁹⁹ there is nothing answering to this, simply because Kings only deals with wood and mineral materials.

C. Egypt and Purple Dyeing

Whether purple-dyeing was practised in Pharaonic Egypt is a deeply interesting question, easy to ask but hard, very hard, to answer. Facilities for purple-dyeing would be offered by both the Mediterranean and the Red Sea. Future research by specialists may, let us hope, succeed in throwing light in this direction. It is, however, I surmise, not very likely that the answer will be discovered in the Egyptian texts themselves either affirmatively or negatively. At best we shall have to be contented with a more or less high degree of probability. Should this, however, point in the negative direction, the general belief in the hoary antiquity of the Phoenician pre-eminence in purple-dyeing will have thereby received at least a mild shaking. From very early times Phoenicia is known to have been under Egyptian influence, and it is only reasonable to suppose that she must have in some way reciprocated. From 1600 to 1350 Egypt exercised dominion over Phoenicia. An inscription on the tomb of Rekhmara, governor of Thebes, under Thothmes III (18th dynasty) represents the former as receiving the homage of Phoenician princes in the name of the Pharaoh.¹⁰⁰ Phoenician art from the earliest times exhibits traces of Egyptian influence. An

⁹⁵ Pausanias, *ibid.*, Book V. ch. 12, para. 4.

⁹⁶ I Chronicles, ch. II, vs. 1, 2.

⁹⁷ *Idem*, Ch... II, v. 6.

⁹⁸ *Idem*, Ch. III, v. 14.

⁹⁹ I Kings, Ch. V, v. 16; Ch. 7, v. 51.

¹⁰⁰ Vires, Ph., "Le tombeau de Rekhmara," *Mémoires publiés par les membres de l'Institut Français*

old Egyptian text (about 1400) refers to Sidon, Sarepta and Tyre (Dar); of the latter it says that she is "richer in fish than in sands."

Dr. Alexander Dedekind, the well-known Egyptologist and porphyrologist appears to advocate the view that purple dyeing was practised in ancient Egypt. The hieratic papyrus No. 3933 at the Vienna Imperial Museum contains a list of various precious articles with their respective prices. One line reads: "*qema nofrzay*, "etc. *Zay* is a word which occurs a number of times in the Egyptian texts. Dr. Dedekind tries to show that it denotes purple, i.e. cloth dyed with (marine) animal secretion. He thus translates the above line: "beautiful cloth of purple," etc. The learned Egyptologist further points to Papyrus Sallier, No. 2, British Museum, containing a poem in which are discussed the disadvantages of the various crafts and occupations. Of the dyer the poet says: "His hands stink; they have the stench of rotten fish; the dyers sully all garments." This, Dr. Dedekind holds, distinctly applies to purple dyeing, for, as implied in Pliny and Strabo, and as corroborated by a series of experiments extending from William Cole to Professors Dubois and Friedlaender the purpurgenic matter emits an offensive garlic like smell in the course of its photographic development.¹⁰¹

Dr. Dedekind, moreover, draws attention to a number of Egyptian articles at the Vienna Museum which, according to him, are dyed or painted with purple pigment. Thus the garment of a certain Zaher or Zehir, priest of Amon at Thebes, has been identified as purple by Dr. Dedekind aided by Herr Ernest Berger of Munich, an eminent painter known for his researches into colour in antiquity. But this and similar facts really do not go to the root of the essential point. Given the correctness of the identification, there is nothing to indicate that the garment in question was dyed in Egypt. Purple garments might well be worn in Egypt without there being a single purple factory in existence in the country. Should it even be absolutely proved that at this or that period purple dyeing was not practised anywhere in the land of the Pharaohs, it would not in the least follow that purple cloth was not then to be found within the Egyptian frontiers. Zaher or Zehir, though a priest of Amon, might wear without prejudice to his sacred office a garment made and dyed abroad. It is possible that during their ministration in the temple, Egyptian priests would

d'Archeologie Orientale, Cairo, (1902-), v. V, p. 33; Also, Müller, Wilhelm Max, Asien und Europa, Leipzig (1893), pp. 208-212.

¹⁰¹ Dedekind, "Recherches sur la Pourpre 'Oxyblatta' chez Assyriens et les Egyptiens," *Archives de Zoologie Experimentale et Générale*, Serie III, v.IV (1896), 481-516.

take care to exclude from their attire articles of dress of foreign make, though I cannot recall anything giving the palest colour to an assumption of this kind. But then there is no indication that the garment in question formed part of the priest's sacerdotal wardrobe. Very probably it did not; in early Egypt fine white linen to the exclusion of colour of any sort was the rule for the priestly dress during officiation in the sanctuary.¹⁰²

Apart from all this, the evidence adduced in favour of the garment being genuine purple, or, to use the technical expression, "*Purpura blatta* or *oxyblatta*," is not very clear to me. This, if I have rightly understood Dr. Dedekind, is based upon identity of nuance with a certain textile at the Naples Museum dyed with the flower of *Murex trunculus*. But identity of nuance is no proof of identity of dyestuff. Again, there is another difficulty which baffles me. Dr. Dedekind defines the colour as "*rosa*." But with the dyestuff furnished by *Murex trunculus* we have learned to associate rather dark violet shades.

The *rosa* garment of the priest of Amon, it may be added, is not, according to Dr. Dedekind, the only specimen of purple at the Egyptian Museum in Vienna. The learned Egyptologist speaks also of red purple dating from the XXIst dynasty of "planches de bois peintes avec *Argaman* dans la collection des antiquités égyptiennes de la cour impériale (wooden planks painted with argaman in the collection of Egyptian antiquities of the imperial court)," of a number of Egyptian paintings "en pourpre rouge foncé," exhibited in Room VI, and of decoration "avec la couleur de sang figé (with the color of frozen blood)."¹⁰³ These paintings and decorations, carrying within them, I expect, evidence of native art, have, I think, a greater bearing than the purple fabrics upon the main question with which we are concerned, but then painting and dyeing are two separate departments. After all, it is only chemistry that can ascertain by an analytical process whether these fabrics and paintings are genuine purple.

To return now to the hieratic papyrus No. 3933 of the Vienna Museum. If *zay* means purple in the proper sense of the word, it still fails to afford us a clue to the solution of our problem. What it does then show is that purple fabrics were to be found in pharaonic Egypt. That such was the case in the latter country at a time when purple factories existed somewhere in Asia or in Africa is exactly what we should have divined, though the light from the papyrus is most welcome. Dr.

¹⁰² Herodotos, *Apuleius*, XI; also: Leviticus Ch. 16, v. 4; Talmud Yerushalmi, *Yoma*, ch. VII, hal. 2. ולמה בבגדי לבן

¹⁰³ "Laus ei summa in colore sanguinis concreti nigricans aspectu idemque suspectu refulgens, unde et Homero purpureus dicitur sanguis." Pliny, *ibid.*, v.II, book IX, ch. 38, p. 115.

Dedekind, in that exceedingly instructive article, brings to our notice the interesting fact, revealed by Papyrus Harris No. 1, that the vast treasures of Ramses III also included purple. I may add that the earliest known mention of תכלת *takiltu* occurs in a list of precious articles sent to Egypt by Dusratta, King of the Mittani, as dowry to the Egyptian prince who was about to marry his daughter. This shows at any rate that *Tekhelet* was highly prized in Egypt in the age of Amenhophis III.

In support of Dr. Dedekind's explanation of *zay*, the idea once occurred to me that it might be connected with *zahi* or *dahi*, a word designating the Phoenician in the oldest Egyptian inscription; *zay* would therefore mean the Phoenician stuff, somewhat as a well-known vegetable dyestuff, was called *indikos* by the Greeks and *indicum* by the Latins on account of its Indian provenance. No inference, however, could thence be drawn, either that purple dyeing was practised in Egypt or that it was not, in the period coeval with the papyrus in question. A principal variety of ancient purple was termed *p. Tyria*, whether dyed on the Tyrian coast or on the shores of the Adriatic. What the hypothesis would indeed warrant is that already at that early age Phoenicia was looked upon in the land of the highest contemporary civilisation and culture as the principal, if not the only, producer of purple a result which would, of course, clash with my solution of the difficulty presented by Ezekiel 27, 7b. In view, however, of the entire repudiation of it by Professor Maspero, I feel disinclined to base anything upon my proposed derivation for *zay*. The learned professor, replying to a query I had addressed him on the point, writes:

"It is not certain that the word transcribed *zai* by Dedekind means purple, but it seems certain to me that it has no kinship with *Zahi*, the Phoenicia: the proper name contains a soft aspirated that the common name does not contain."

"Il n'est pas certain que le mot transcrit *zai* par Dedekind signifie pourpre, mais il me paraît certain qu'il n'a pas de parenté avec *Zahi*, la Phoenicia: le nom propre renferme une aspirée douce que le nom commun ne renferme pas."

If, as Professor Maspero says, it is not certain that *zay* signifies purple, it is, however, absolutely certain that it denotes a very expensive stuff of some sort. May it not, I venture to suggest, with

the greatest possible reserve, simply mean silk, zay being the sharpened Chinese sei; si compare the variants "sze", "szu", "sz" Korean sa, sil, sir? Compare the Teutonic say silk, German Seide.

The ancients obtained their silk from China. Serikon (silk) is connected with Eyfes, which probably means the Chinese, the people of silk, the root being Chinese "sei."

If this be correct, it would furnish us with the highly interesting information that already in the earliest times silk was imported into Egypt, but how far this would go to indicate direct commercial intercourse between the celestial empire and the magic land of the Nile it would be hard to determine. A direct result of the acceptance of this meaning for zay would be the disarming of opposition to the rendering of משי in Ezekiel by "silk." It is not impossible that משי is the Chinese si with preformaticum.

Recognizing, as I have said before, the important part which chemistry with its processes of analysis never dreamt of by Egyptian wisdom and magic must play in the solution of the question whether purple dyeing was anciently exercised in the land where stood the cradle of science, I applied to Professor Friedlaender, now professor of chemistry at Darmstadt University, who is known to have studied the relics of ancient purple under the chemical aspect. In his kind reply the eminent chemist says:

"Egyptian ... I have not yet been able to find evidence in the large European collections, perhaps because the extraordinarily numerous remains from pre-Christian Egypt consist exclusively of dyed linen and cotton, but purple was apparently only dyed on wool and silk."

"Aegyptische ... habe ich in den grossen europäischen Sammlungen bis jetzt nicht nachweisen können, vielleicht deshalb, weil die ausserordentlich zahlreichen Ueberreste aus dem vorchristlichen Aegypten ausschliesslich aus gefärbtem Leinen und Baumwolle bestehen, Purpur aber anscheinend nur auf Wolle und Seide gefärbt wurde."

It would be interesting to learn of what stuff the garment is made which has been identified by Dr. Dedekind as purple fabric.

With regard to Egyptian paintings. Professor Friedlaender is silent, nor, as it appears, has he yet studied the coloured textile extant in the Asiatic and African collections. A hard search in the museums in Egypt itself and in Constantinople might perhaps be worth the trouble.

Professor Friedlaender's attempted explanation of his failure to find specimens of purple among the relics of ancient Egypt is worthy of very serious consideration. Pliny speaks of attempts at dyeing linen with purple pigment, but in terms hardly implying brilliant results."¹⁰⁴

Byssus, the finest sort of linen in the production of which Egypt excelled, also seems but rarely to have been dyed with purple.¹⁰⁵

The dyeing of linen with even vegetable pigment seems to have been comparatively rare in antiquity. Down to as late a date as the Lex Valentina the choice of material lay between wool and silk.

No private citizen shall have the right to dye either silk or wool with the colors purple," etc.	"Fucandae atque distrahendae <i>Purpurae</i> vel in serico vel in lana quai blatta," etc.
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That cotton was anciently dyed with purple dye-stuff does not seem very likely.

Linen, as is well known, was the material generally used for clothing in ancient Egypt. Now since that stuff was anciently regarded as not adapted for dyeing with purple pigment, the manufacture of purple one might feel disposed to argue would hardly gain a footing there. But the tables might easily be turned. Would Egyptian genius be powerless to discover some means for successfully dyeing linen with purple secretion? Linen being the national material of dress, such a discovery would almost be a necessity, if there really existed the same enthusiasm for purple as elsewhere,

¹⁰⁴ "Tentatum est tingui linum quoque, et vestium insaniam acciperi, in Alexandri magni primum classibus Indo amin narigantis Velo purpureo ad Actium cum M. Antonio Cleopatra venit, eudemque effugit. Hoc fuit imperatoriae nauta insignet." Pliny, *ibid.*, v.II, book XI; ch. 39, p. 202.

¹⁰⁵ Schmidt, *ibid.*, P. 46.

and we know full well what wonders the mother of invention can perform. These doubts of mine were strengthened on finding, in the course of my researches, the mention of linen *Tekhelet* in connection with the gifts sent by Hezekiya to Sanherib:

30 talents of gold ... garments of many colours, linen cloth of blue purple (<i>kitu</i> <i>takiltu</i>), cloth of red purple	"30 biltu huraso lu-val-ti bir-mi ku <i>kitu sabatu ta-kil-tu sabatu arga-man-nu.</i> "
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B.T. Eydts, to whom the transcription is due, translates "30 talents of gold ... garments of many colours, linen cloth of blue purple (*kitu takiltu*), cloth of red purple (*sabatu Argamannu*);".¹⁰⁶

It would be futile to object that perhaps the linen *Tekhelet* thus mentioned was the product of some unsuccessful experiment made in or about Hezekiya's time, and which was but rarely repeated afterwards (cf. Pliny cited above "Tentatum est", etc.). The *Tekhelet* in question must really have been of the best of its kind since it was forwarded as tribute to the "great King." One might even go further and argue that linen *Tekhelet* in particular must have ranked higher, at least in Palestine in Hezekiya's days, than all other purple fabrics. Why is there no specification of the material in the case of *Argamannu*? Was it merely a matter of chance that Hezekiya sent to Sanherib linen instead of woollen *Tekhelet*, and the Assyrian scribe simply records the fact? But, so far as I know, *sipatu* (wool) regularly goes with *takiltu* in the Assyrian inscriptions, a phenomenon which warrants the inference that linen *Tekhelet* was not the rule. Why should Hezekiya have departed from the rule in the choice of material intended to quench the fire of the tyrant's greed, if not for the reason that the exception was the more precious sort just because its production was peculiarly difficult?

Casting about for an alternative explanation to that proposed by Professor Friedlaender, I hit upon the following hypothesis: In Phoenicia the purple murices were held sacred to Astarte¹⁰⁷ a fact which, by the way, throws a side light upon the classical legend which tells that the first purple garment was presented by Hercules (the Phoenician Melkart) to his Consort. May not a similar belief have prevailed in Egypt, producing, however, a result exactly the reverse of that which it

¹⁰⁶ Eydts, B.T., *Zeitschrift für Assyrologie*, III (1888), Leipzig.

¹⁰⁷ Gruppe, Paulus Otto, *Griechische Mythologie*, Leipzig (1892), p. 1349

brought about in Phoenicia? Fully conscious of the boldness of the idea, I wrote to Professor Maspero, asking the eminent Egyptologist and historian of antiquity what he thought of it. Here is the Professor's reply:

"I don't think it was the religious question that prevented the Egyptians from using purple. Iron was the bone of Typhon and in honor of religion, which does not prevent the Egyptian priests themselves from using it in everyday life: they limited themselves only to excluding ritual cults: I believe that there was above all a matter of personal taste and fashion until the saite period: it seems that then, under Asian and Greek influences, the taste changed and the colorful fabrics became fashionable purple with them. However, this is only a conjecture."

"Je ne crois pas que ce soit la question religieuse qui ait empêché les égyptiens d'employer la pourpre. Le fer était l'os de Typhon et en honneur à la religion, ce qui n'empêche pas les prêtres égyptiens eux-mêmes de s'en servir dans la vie courante: ils se bornèrent seulement à exclure des cultes rituels: je crois qu'il y eut là avant tout une affaire de goût personnel et de mode jusqu'à l'époque saïte: il semble qu'alors, sous les influences asiatiques et grecques, le goût se modifia et que les étoffes bariolées deviennent à la mode la pourpre avec elles. Ce n'est là toutefois qu'une conjecture."

In the same letter Professor Maspero states:

"I don't know of any example of purple-dyed cloth in Pharaonic Egypt: the only specimens of red dye or something like that I know of are cathame fabrics, but they are very rare. The leathers are more frequently colored red, but I don't

"Je ne connais pas d'exemple d'étoffe teinte en pourpre dans l'Egypte pharaonique: les seuls spécimens de teinture rouge ou à peu près que je connaisse sont des étoffes au cathame, encore sont-elles fort rares. Les cuirs sont

see anything resembling the hues of the various purples used in antiquity. The Pharaonic Egyptians dressed in white: with very rare exceptions, they used the blue, pink, red, green, yellow thread only for the bedding of fabrics for embroidery, for borders, pure fringes. It is only in Roman and Byzantine times that we see the appearance of fabrics, woollens especially of purple, blue, and red tones that recall purple and that are perhaps".

plus fréquemment colorés en rouge, mais je n'y vois rien qui ressemble aux teintes des différentes pourpres usitées dans l'antiquité. Les Egyptiens pharaoniques s'habillaient en blanc: à de très rares exceptions près, ils n'employaient le fil de couleur bleu, rose rouge, vert, jaune que pour les linceuls d'étoffes pour des broderies, pour des liserés, pur des franges. C'est seulement à l'époque romaine et byzantine qu'on voit paraître des étoffes, des lainages surtout de tons violets, bleus et rouges qui rappellent la pourpre et qui le sont peut-être".

The statement of Professor Maspero that the Pharaonic Egyptians clothed themselves in white is probably not meant to be absolute. In very early times things were different.

However, such influences could only have affected the detail, because the general character of the Egyptian costume is entirely opposite to that which we meet at the same time in northern Syria ... with the Egyptians, wide, wrinkled robes of white, translucent linen without any jewelry, clothes, where apparently only flawless purity and the finest fabric are thought of. From the beginning, that was not the case in Egypt

"Indes könnten solche Einwirkungen nur das Detail betroffen haben, denn der allgemeine Charakter der ägyptischen Tracht ist dem, den wir gleichzeitig in Nordsyrien treffen, durchaus entgegengesetzt ... bei den Ägyptern weite, faltige Gewänder von weissem, durchscheinendem Linnen ohne jeden Schmuck, Kleider, bei denen augenscheinlich nur auf tadellose Reinheit und feinstes Gewebe gedacht wird. Von

either. The clothes of the old empire sometimes seem to be made of a heavy material; women's clothes are more often colored than white, and even in the middle kingdom they are sometimes green or colored. Much earlier, the color disappeared from the men's clothes, and although the inscriptions still indicate the red, blue and green stuff as a need of the gods and the deceased, these substances have long since been replaced by the fine white ones in the living."

Anbeginn an war das freilich auch in Aegypten nicht gewesen. Die Kleider des alten Reiches scheinen zuweilen aus einem schweren Stoff zu bestehen; die Frauenkleider sind häufiger bunt als weiss und noch im mittleren Reiche sind sie zuweilen grün oder bunt. Ungleich früher ist die Farbe aus den Männerkleidern verschwunden, und wenn auch die Inschriften nach wie vor das rote, blaue und grüne Zeug als Bedürfnis der Götter und der Verstorbenen angeben, so sind doch diese Stoffe bei den Lebenden längst durch die feinen weissen verdrängt."¹⁰⁸

Speaking again of Egyptian dress, Ermann states:

Speaking again of Egyptian dress, Ermann states: "This love for colored patterns, however, was limited exclusively to the coarse fabrics; for the finer ones, which were intended for clothing, color and pattern were almost completely frowned upon. In this case, all art was given the one task of producing the finest, white linen possible and brought it to incredible perfection; I only remember those white robes of the nobles, which

"Diese Liebe zu farbigen Mustern blieb indes ausschliesslich auf die groben Gewebe beschränkt; bei den feineren, die zur Kleidung bestimmt waren, waren Farbe und Muster fast ganz verpönt. Man setzte in diesem Falle alle Kunst an die eine Aufgabe, möglichst feines, weisses Leinen herzustellen und brachte hierin es allerdings zu unglaublicher Vollkommenheit; ich erinnere nur an jene weissen Gewänder der Vornehmen, die so

¹⁰⁸ Erman, Adolf, Aegypten, Tübingen (1885), p. 299-300.

were so fine that limbs shimmered
through them."

fein waren, dass die Glieder durch sie
durchschimmerten." ¹⁰⁹

A new line has thus been opened up for our inquiry. It need not exactly have been the Egyptians' affection for linen which may have prevented purple dyeing from establishing itself in their midst. Their very marked preference for transparent white would be just as potent, if not a more potent cause in that direction. But then, for what reason would purple be excluded from the tombs, seeing that in death the Egyptian did not spurn colour? Professor Maspero's refutation of my hypothesis does not so forcibly apply here. The sepulchre was a sanctuary with the Egyptian.

Last, but not least, I may quote a communication from the celebrated British Egyptologist Professor Flinders Petrie of London University. I regret that it only has a partial bearing upon the point under discussion. In answer to a question I had addressed him, whether he could recall any reference to the symbolism of colour in the Egyptian texts, the learned professor wrote to me in 1910 (July 2nd.): "I regret that there has been no research as to the symbolic use of colour in Egypt. Nor do I remember any allusions to the meaning of colour in the literature. As to תכלת I see Cesenius takes it to be the H. *janthina*. But I doubt if that dye has been found in ancient Egypt. Indigo is the usual blue there anciently. If you wish to see an example of the woven work of blue, red, and yellow as old as the Exodus, please refer to the frontispiece of "The Tomb of Thoutmosis IV" by Carter & Newberry (Constable) 1904. Wilkinson¹¹⁰ already states that the chemical examination of certain specimens of Egyptian blue fabrics proved the dye to be indigo."

Professor Maspero sets up the commencement of the Saitic period as the conjectural terminus from which coloured fabrics, including purple, began to come in fashion in Egypt. Ezekiel speaks of embroidered Egyptian Fine linen, but there is nothing to indicate that the embroidery was also of Egyptian manufacture.¹¹¹

Pliny cannot sufficiently admire the skill of the Egyptian dyers of his time. It is clear from his account that, as Wilkinson points out, they "possessed a knowledge of the effects of acids on

¹⁰⁹ Idem., p. 594.

¹¹⁰ Wilkinson, John Gardner, *Manners and Customs of the Ancient Egyptians*, 3 vols. London (1878), v.II, p. 163.

¹¹¹ "ברקמה ממצרים"; "שש ברקמה ממצרים" may only refer back to שש not to ברקמה.

colour and submitted the cloth they dyed to one of the same processes adopted in our modern manufacture."¹¹² This wonderful degree of perfection in Pliny's days could not have been but of yesterday. The royal dress of the Pharaohs consisted of fine white linen. Joseph, while in Canaan, receives from Jacob a coat of many colours as a mark of high distinction, but when he is raised by Pharaoh to the Egyptian viceroyship he puts on vestures of fine linen.¹¹³ Josephus, with his usual liberality, allows him also a suit of purple clothes at Pharaoh's expense, of course. In Josephus' time purple had long conquered Egyptian taste and fashion. That the later Egyptian kings clothed themselves in purple is plainly stated by Livy¹¹⁴ and Pliny.¹¹⁵ Tertullian even states that such was the case from the earliest times.

“Therefore, the purple and the ornaments of the neck in the same manner were the insignia of dignity among the Egyptians and Babylonians”

"Igitur, *Purpura* ilia, et cerucis ornamentum eodem modo apud Aegyptos et Babylonios insignia erant dignitatis,"¹¹⁶ etc.

This is probably mere projection into the past; but, in spite of all that has been said, it is, I think, quite possible that many a Pharaoh would, under the influence of his close intercourse with Asiatic princes, adopt purple as his dress, if not on the most solemn State functions, inseparably bound up with religion in ancient Egypt, at least on certain less official occasions, especially in receiving Asiatic deputations, when it would be of psychological importance that the Pharaoh should appear in the most gorgeous uniform devisable in order to impose upon the colour-loving Barbarians. Egyptian kings in particular, who had formed matrimonial alliances with Asiatics, would contract a taste for coloured dress, especially for purple. One such alliance has already been referred to, and there a fact which may not be devoid of significance we have seen *Tekhelet* figuring in the list of the wedding gifts.

¹¹² Wilkinson, *ibid.*, p. 168.

¹¹³ Genesis, Ch. 37. v. 3; Ch. 41, v. 42.

¹¹⁴ Livy, *Annals*, book XXVII, Ch. 4.

¹¹⁵ Pliny, *ibid.*, book XIX, ch. 1, v.III, p. 174.

¹¹⁶ Tertullian, *De Idolatre*, ch. XVIII.

In Manetho's time, purple has already captured that impregnable fortress of ancient customs the Egyptian priesthood.¹¹⁷

Sepulchres dating from the fourth to the fifth century C.E. have revealed a wealth of purple woollen clothes embroidered with gold.¹¹⁸ Whether these are really purple, chemistry is now able to ascertain, but it can hardly determine whether they are of native or foreign dyeing. On the supposed existence of a purple dyehouse about the beginning of the seventh century C.E. in this (Upper Egypt), see Dr. Dedekind's refutation of W. Adolf Schmidt's arguments.¹¹⁹

It will not, I hope, be entirely out of place to quote in connection with our subject the following passage from the Midrash Rabbah, Gen. 90).

קחו מזמרת הארץ בכליכם ר' יהושע דסכנין בשם ר' לוי דברים שהן מזמרים בעולם חלזון חמר קטף וכו'

"Take of the best products (zimrath) of the land in your vessels" (Gen. 43). R. Joshua of Sakhnin said in the name of R. Levi: "things which are celebrated (mesamrin, lit. "sing praises") in the world; *hillazon*," etc. *hillazon* in this context stands for the purple mollusc, either that productive of *Tekhelet* or of *Argaman*, or for both. R. Levi himself scarcely claimed for this interpretation the authority of Mosaic tradition; it simply reflects the author's age. It is not *Tekhelet* or *Argaman* that R. Levi represents as one of the most valuable Palestinian or Phoenician products but rather the *hillazon*. May not this be taken as some indication that in R. Levi's time (floruit 230 CE (*floruit*: Latin for "flourished." A period when the person was known to be alive.)) Egypt produced good purple which was only inferior to the Phoenician fabrics. that inferiority being attributed to the innate superiority of the Phoenician purple molluscs. This is just the sort of explanation one would expect the greatly admired Egyptian dyers to offer for their inability to rival, or even outdo the Phoenicians.

We may now sum up the evidence in as far as it bears upon the solution of our problem.

Dr. Dedekind's identification of certain Pharaonic Egyptian articles as purple fabrics and paintings respectively is based upon the fact that these exhibit shades of colour identical with those presented by other objects known to have been dyed or painted, as the case may be, with purple pigment. One can only express the hope that the identifications will one day be verified by

¹¹⁷ Apotelesmatica, I, v.101, II, v.234, III, v.37.

¹¹⁸ Bock, Franz, Katalog für christliche Textilfunde des Jahres 1886.

¹¹⁹ Dedekind, Beitrag, v.IV, pp. 400-403; 708-713 ;.

Professor Friedlaender's chemical examinations. A distinction must be drawn between textiles and artistic paintings. The evidence of the former only goes to show that purple fabrics might here and there be met with in Pharaonic Egypt. The latter, on the other hand, if they proclaim themselves as of native origin prove at least that painting, if not dyeing, with purple was practised, provided, of course, that their paint is shown by Professor Friedlaender's method to be of molluscan origin. This would be already a great gain. The derivation proposed by the eminent Austrian Egyptologist for zay connecting it with purple would, if correct, prove that at a certain time purple formed a very highly prized article of luxury in Egypt, though one would be at a loss to tell for what particular use it was then employed, whether for clothing or for tapestry, or for both. Of incomparably greater significance is the Papyrus Sallier No. 2 (British Museum). Does it necessarily follow that the text refers to purple dyeing? Indigo, which, as we know, was anciently employed in Egypt, likewise emits an ammonia-like smell at a certain stage in its manufacture. But perhaps this is less than what the language of the text warrants. Again, may not the stench have been due to the employment of urine, which, as we know from Pliny, entered into the manufacture of even certain purple varieties? But this also perhaps fails to satisfy the poet's sweeping condemnation of the dyeing craft.¹²⁰ Lastly, may not the old Egyptian poet have in mind certain acids used in dyeing? We know that at least about Pliny's time, acids were so employed in Egypt. But all such doubts and murmurings must be hushed into silence on hearing the great dyer and chemist, Professor P. Friedlaender, speak thus:

"According to Dedekind, it does not seem unlikely that the old Egyptians were no strangers to purple robes. In an interesting poem from the time of Ramses II, the author discusses the dark sides of the various professions; all are laborious and arduous ... 'The blacksmith gets hands like a crocodile and is dirty like fish spawn, the barber shaves until late into the night,	"Nicht unwahrscheinlich erscheint es, nach Dedekind, dass auch den alten Aegyptern purpurne Gewänder nicht fremd waren. In einem interessanten aus der Zeit Ramses II. stammenden Gedicht diskutiert der Verfasser die Schattenseiten der verschiedenen Berufe; alle sind mühevoll und beschwerlich ... 'Der Schmied bekommt Hände wie ein
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¹²⁰ In the Talmud urine is not classed among stuffs emitting strong stench. See שבת 180:., "מי רגלים וכו'." and ib.98: המוציא ריח רע כל הוא.

he rushes from house to house and lives from his hands to fill his chariot, like the bees that eat the fruit of their work', etc. Finally, about dyeing, he says: 'His hands stink, they have the smell of rotten fish, he scares away all cloth.' If the conviction is not entirely flawless, nor is the other hieratic papyrus, in which the prices of various treasures are indicated, among other things, according to a reading of purple fabrics,* then the highlighting of the very unpleasant smell characteristic only of purple dyeing is so striking that one will hardly be able to think of another branch of dyeing."

Krokodil und ist schmutzig wie Fischlaich, der Barbier rasiert bis tief in die Nacht, er eilt von Haus zu Haus und lebt von seinen Händen, um seinen Wagen zu füllen, gleich den Bienen, welche die Frucht ihrer Arbeit verzehren' usw. Vom Färben endlich heisst es: 'Seine Hände stinken, sie haben den Geruch fauler Fische, er verscheut alles Tuch.' Ist die Überzeugung nicht ganz einwandfrei, ebensowenig, wie die einen anderen hieratischen Papyrus, in welchem die Preise verschiedener Kostbarkeiten u.a. nach einer Lesart auch von Purpurstoffen angegeben werden,* so ist doch das Hervorheben des nur für die Purpurfärberei charakteristischen, sehr unangenehmen Geruchs so auffallend, dass man kaum an einen anderen Zweig der Färberei wird denken können."¹²¹

If then, as Professor Friedlaender thinks highly probable, the reference is to purple dyeing, then the papyrus really proves more than Dr. Dedekind seems to be conscious of. The test, of this interpretation, implies not only that molluscan secretion was a dyestuff but also that it was the dyestuff employed in Egypt in the days of Ramses II. A moment's reflection on the part of the reader will at once make this clear.

Professor P. Friedlaender's statement that he has not been able to discover Egyptian purple fabrics of a pre-Christian date in the great European collections is of the utmost significance, but we

¹²¹ Friedlaender, Paul, Zur Kenntnis des Farbstoffs des antiken Purpurs aus *Murex brandaris*, Wien (1909), p. 4.

might wish for greater precision, indicating the extent to which the learned professor has carried his investigations, for it is scarcely imaginable that he has submitted every coloured piece of that description to a chemical test. As it is, the professor's assertion tends to uphold the view that purple was not much in fashion in ancient Egypt. But there may have been now and again persons of more or less eccentric or original tastes who would precisely, for that reason, adopt purple as their dress. But such departure from the general rule would not easily give rise to the establishment of purple dyeing.

The effect of Professor Maspero's statement is about the same. It is, however, worth

The italics are my own, remarking that he assigns no reason for the assumption that the coloured ribands, laces and fringes, which, as he admits, were not rare, were not dyed with purple. The application to the solution of our question of the "renseignements" furnished by the great French Egyptologists, anyhow, decidedly points in the negative direction. Since colour was only employed to a very limited extent, purple dyeing, which entailed great enterprise and labour and demanded very high returns, would not find Egypt a congenial soil.

D. Takiltu and Argamannu in the Cuneiform Texts.

In the Assyrian inscriptions we often meet with sipatu takiltu, *Tekhelet* wool, and sipatur *Argamannu*, *Argaman* wool. Takiltu already occurs in the Tell-el-Amarna Letters circa 1500-1300 B.C. This, as Professor Stephen Langdon, Shillito Professor of Assyriology at Oxford University, has kindly informed me, is the earliest known mention of takiltu. In Assyrian, according to Professor Langdon, takiltu does not occur before the 8th century B.C. "The word appears in Mitanni," so Professor Langdon states in a private communication to me, "about the same time as in Babylonia, hence we might infer that they borrowed it either from the Mitanni or the Aramaic peoples. It may, like *Argamannu*, eventually be a loan-word from India."¹²² Takiltu appears to have been brought to Babylonia by the Cassites. It occurs in the business documents of the Cassite Kings, and became current in Babylonia after the 16th century, *Argamannu*, or bright purple, occurs first in Assyria about the eighth century. So far as I know, it does not occur at all in Babylonia."

In the Assyrian texts both takiltu and *Argamannu* only appear as objects of tribute. "There is nothing," Professor Sayce states in reply to my query, "in the cuneiform lexicons so far as I know

¹²² Towards the end of this letter, however, the learned professor says with reference to my suggestion that Tekhelet may be connected with the Sanscrit Kola "The word looks Semitic and not Indian".

which throws light on their meaning, nor is there anything relating to their use in a temple." "Neither of these words," Professor Langdon informs me in the above-mentioned reply, "is used apart from wool." The learned Assyriologist means, I think, that they do not occur as colour designations of any other stuffs. There are, however, two or more instances where they are preceded by another word than sipatu (wool): "Kito... subatu takiltu subatu *Argamannu* -... cloth of takiltu, cloth of *Argamannu*",¹²³ "a-na mu-ti i ta-kil-tav-ar-ga-man-nu."¹²⁴ Does then the occurrence of sipatu with takiltu or *Argamannu* imply that these fabrics were also made of other stuff than wool, for otherwise there would have been no need to indicate the nature of the material? Not at all! The force of sipatu in these connections is simply to describe the stuff as raw wool in contradiction to cloth or textile (subatu or some such word). Quite to the contrary, the fact that subatu carries with it no indication of the stuff warrants the inference that it was in all cases the same, that is, wool. But how are we to explain kitu, which means linen? The difficulty has already been discussed under other aspects in connection with Egypt. It will interest the reader to learn the view of Professor Langdon. Replying to the objection I had raised from kitu takiltu as against his assertion that "neither word occurs apart from wool," the learned professor, writing under date of February 8th, 1914, says: "On a faussement transcrit ce passage. Il n'y a pas kitu takiltu nulle part." There is thus, according to Professor Langdon, an end to the matter once and for all. I may add, however, that Professor Sayce, in his reply to me with regard to kitu takiltu, says nothing against the correctness of the transcription, but simply explains the grounds for the rendering of kitu by linen, suggesting, however, that perhaps it may mean cotton, for, as King has shown, cotton was anciently used in Babylonia.

A purple mantle streaked with white stripes formed part of the royal insignia in Assyria.¹²⁵ Purple was also worn by Babylonian Kings.¹²⁶ It does not, however, appear to have been confined to the royalty at least, not *Tekhelet* in Assyria. Ezekiel speaks of Assyrian governors and rulers, "attractive youths all of them, horsemen riding upon horses, clad in *Tekhelet*."¹²⁷ There is no mention of *Argaman*. Is it because that sort of purple was the peculiar privilege of the King? Daniel¹²⁸ would seem to give this inference some support, at least as far as Babylonia is

¹²³ Sn. Rass. line 56.

¹²⁴ Oppert, Jules, Grande inscription du palais de Khorsabad. Paris (1863).

¹²⁵ Steger, Adrian, "De Purpura Sacrae Dignitatis Insigni," in Dedekind, Beitrag, I, p. 295.

¹²⁶ Tertullian, *ibid.* I.C.; Xenophon, *Phaideaia*, p. VII.

¹²⁷ Ezekiel, Ch. XXXIII, v.6.

¹²⁸ Daniel, Ch. V, v.7.

concerned, but I should hesitate to emphasize the point. What light, if any, is thrown upon the matter by Professor Langdon's statement that *Argamannu* does not occur in Babylonia at all?

Of Sardanapal (Assur-bani-pal, 668-626 B.C) it is related, in illustration of his effeminacy, that he wasted some of his valuable time in spinning purple wool.¹²⁹

Was purple dyeing exercised in Assyria? From Ezekiel we learn that Assyrian traders supplied the Tyrian merchants with *Tekhelet*. "Charan and Canneh, and Eden, the merchants of Sheba, Asshur, (and) Kilmad, were the merchants. These were the merchants in ornamental wares, in cloaks of *Tekhelet*¹³⁰ etc. The difficulty treated of in this chapter in connection with the isles of Elishah also applies here and the solution there proposed might be adopted in the present case too. But really the two instances are not exactly parallel. The *Tekhelet* and *Argaman* furnished by the Isles of Elishah are obviously described as imported for home use,¹³¹ for the embellishment of life in Tyre; whereas verses 23-24 speak of the supplying of wares to the Tyrian merchant princes for their cosmopolitan commerce. However excellent its purple might be, Tyria could not possibly supply the whole world, and there would be a number of extra-Phoenician purple factories sending their wares to Tyre, the mistress of the seas, for shipment and transport by her merchants and sailors to various trading centres. Great Britain supplies many a parallel. The same remarks apply to Aran, which is also mentioned,¹³² as having been in the habit of supplying *Argaman* among other kinds of merchandise.

If, however, purple dyeing was, as seems probable, confined, at least in Biblical times, to coast lands, Assyria proper would be out of place in connection with purple production, but it is possible to think of Assyrian merchants transmitting to the Tyrian firms purple dyed on the Persian gulf. The inland sea of Nejef (Bahr Nedjefk a sweet water lake, hardly furnishes purple-giving molluscs; the genera *Murex* and *Purpura* cannot live in sweet water. I have no information with regard to *Janthina* and *Aplysia*. In view, however, of the fact that lakes and rivers also harbour certain species of dye-yielding molluscs, we cannot confirm with absolute

¹²⁹ Justin, I, 32.

¹³⁰ Ezekiel, Ch. XXVII, v.23-24.

¹³¹ תכלת וארגמן מאיי אלישה היה מכסף

¹³² Idem, v.16.

certainty that purple dyeing with mollusc pigment was never practised on the shores of the Nejef.

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Rabbi Huna, a Palestinian Agadist, renders Joshua VII, 21, כֹּתְרָא בְּבִלְיָא by אֶדְרַת שְׁנֵעַר, "Babylonian purple cloak,"¹³⁴ not, however, necessarily implying that Babylonia contained a purple dye house in his time. Purple wool from anywhere might, of course, be worked into cloth in Babylonia, which was famed for its textile works.¹³⁵

Dr. Dedekind¹³⁶ interprets the frequently occurring metaphor in the Assyrian texts of the battlefield being dyed with the enemies' blood like wool as alluding to the special purple fabric termed Tyria dibapha in Pliny which resembled the colour of coagulated blood. If this be correct, then from the frequency with which the similitude occurs in such association we might perhaps infer that *Argaman* purple, if not actually dyed in Assyria, was at least in very common use in that country, for how else would that particular colour have so impressed the popular mind as to have given rise to a standing phrase? From Ezekiel,¹³⁷ however, it seems somewhat that *Tekhelet* which, whatever its colour, did not resemble blood, was the more fashionable or more common purple variety in Assyria. There is, however, I think, no need to examine these arguments, as the inference drawn by the distinguished porphyrologist appears to the dyeing of wool with dyestuff, whether vegetable or animal not necessarily red either. When the Hebrew Psalmist laments: "O God! nations have entered into thy heritage ... They have given the dead bodies of thy servants as food ... They have shed their blood like water all round about Jerusalem," he certainly makes no allusion to the colour of either blood nor water.

¹³³ It might be of some interest to recall the tradition associating the Phoenicians with Lake Nejef. "The Syrian nation was founded by the Phoenicians, who, being troubled with earthquake, left their native country and settled first on the banks of the Assyrian lake, and afterwards on the coast of the Mediterranean, where they built a city which they called Sidon, on account of the abundance of fish, for the Phoenicians call fish 'sidon.'" (Justinus XVIII, III, 2). The Assyrian lake is probably the Bahr Nedjef.

¹³⁴ *Yalkut Shimoni*.

¹³⁵ In the Midrash Rabbah the question is advanced "What has Babylonia to do here?" R. Simeon ben Johai reported a tradition: every king and every ruler who had no dominion in Palestine would say "I am nothing worth!" As for the King of Babylonia, his viceroy had his abode in Jericho, forwarding dates to his superior and receiving from him gifts in return." We now know, of course, that Babylonian influence prevailed in Palestine down to shortly before the Israelite conquest.

¹³⁶ Dedekind, *Recherches*, 109.

¹³⁷ Ezekiel, Ch. XXIII, v.6.

E. Tekhelet and Argaman in the Tabernacle

The first mention of *Tekhelet* and *Argaman* appears in Exodus.¹³⁸ In the first year after the Exodus from Egypt the Israelites are ordered by divine command through Moses to furnish materials for the construction of a sanctuary. "And the Lord spoke unto Moses saying, Speak unto the children of Israel, that they may bring me an offering;... And this is the offering which ye shall take from them: gold and silver and copper. And *Tekhelet* and *Argaman*, etc." *Argaman* is generally explained as red purple. With regard to *Tekhelet* there is less consensus among translators and interpreters. While formerly it would be rendered by "blue purple," since Hartman¹³⁹ the more prevailing tendency has been to explain it as denoting both violet and blue purple but chiefly the former. But whatever difference of opinion there may be about the respective shades, the tacit assumption is generally made that both *Tekhelet* and *Argaman* are varieties of purple, or, in other words, of stuff dyed with sea-snail pigment. That this great assumption is not questionable will be shown later.

The account of the construction of the Tabernacle of which the opening verses have just been quoted certainly presupposes as thorough an acquaintance on the part of the Israelites with *Tekhelet* and *Argaman* as with "gold" and "silver," and as high an appreciation of these clothing stuffs as of the precious minerals. How is the phenomenon to be viewed in the light of what has previously been said with regard to purple in Egypt? No definite conclusion has been reached simply because in the present state of our knowledge the problem scarcely admits of a solution in the proper sense of the word. The critical theory of the composition of the Pentateuch would hardly countenance the bringing of the P's account as evidence in this connection; it would simply return it with the usual remark: P is projecting into the past. The utmost that Higher Criticism might grant would probably be that at least contemporaneously with P purple had the same currency and high value in Egypt as in Babylonia or in Palestine, but even such a concession, meagre as it is, would be little short of an act of grace depending on the subjectivity of the critic. The general tendency in critical circles would perhaps be to answer first in the negative the question with regard to purple in Pharaonic Egypt and then to take the regular occurrence of *Tekhelet* and *Argaman* in Exodus XXV as one more illustration of P's projectional practices.

¹³⁸ Exodus, Ch. XXV, v.3.

¹³⁹ Gesenius, Thesaurus, תכלת = caerulea sive violacea Purpura.

From the strictly scientific standpoint, however, no such procedure could be allowed. If the present instance offers nothing against the critical view, neither does it go to strengthen it. Granting that Egyptian taste and fashion about the time of the Exodus absolutely tabooed, as it were, purple in all its various shades, we would still scarcely be entitled to assume, in the absence of evidence, that such was the case among the foreign Semitic colonists; or, to speak more to the point, among the Hebrews, who probably from the remotest antiquity cherished a love for colour.

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That the Hebrews, during their sojourn in Egypt, lived in comparative seclusion out of close touch with the religion and inner life of the dominant race, we have first the direct evidence of the Torah and, next, indirect evidence from the fact of the Exodus itself; for if the Hebrews with their admittedly high capacity for adaptability had developed, on settling in Egypt as a small clan, a strong tendency towards assimilation with the natives, and had met with a reciprocating inclination on the part of the latter, then, I say, the sons of Israel would have become so completely merged in the sons of Ham in the course of over two centuries that an Exodus would have hardly taken place at all. Sane critics, of however radical a direction, will hardly venture to question the historicity of the sojourn and the Exodus.

Apart from these considerations, there is a certain document which makes it appear not unlikely that at least under Ramses II purple dyeing was practised in Egypt on a very large scale. I refer to papyrus Sallier No. 1 (Brit. Mus.) which has already been discussed under this aspect. Now it is

¹⁴⁰ Cf. Erman, *ibid.*, II, p. 299. "... denn der allgemeine Charakter der aegyptischen Tracht ist dem, den wir gleichzeitig in Nordsyrien treffen, durchaus entgegengesetzt. Bei den Syrern ... Kleider in denen dunkelblaue Lagen mit dunkelroten abwechseln, durchweg mit reicher Stickerei bedeckt etc."

Cf. Genesis XXXVII, 3c "and he made him a coat of many colours." Judges V, 30, implies that coloured and embroidered garments were much in vogue among the Israelites of Deborah's age. The Kings of the Midianites, near kinsmen of the Hebrews, wore mantles of *Argaman* as royal insignia: Judges VIII, 26c, Saul's reaction against Kanaanitism left the fancy for colour altogether untouched at least, as far as concerned female dress "O daughters of Israel, weep for Saul, who clothed you in scarlet with beautiful dresses, who put on ornaments of gold upon your apparel" (II Samuel, I, 24).

Cf. Proverbs XXXI, 21-22. Isaiah III, 1825- makes no special allusion to colour and is too far removed from the age of the Exodus to be quoted in this connection. Cf. also Genesis XXVII, "And Rebekah took the goodly garments of her eldest son Esau which were with her in the house, and clothed therewith Jacob her youngest son." The reference here is not to colour alone, for Isaac being blind (*ib.* 1) Jacob could not, of course, be detected through his not wearing Esau's rich coloured garments. The "goodly garments" were overlaid with artistic (probably coloured) knit-work, and perhaps also embroidered with gold (cf. Erman l.c.) which the blind patriarch might easily feel.‡

generally agreed that Ramses II was the Pharaoh of the oppression and that his son and successor, Meremptah, was the Pharaoh of the Exodus.¹⁴¹

If the papyrus in question furnishes evidence of the flourishing of purple dyeing in Egypt in the days of Ramses II, that state of things did not probably go back to many centuries before, nor survive centuries after.

¹⁴¹ The famous inscription of Merenptah found by Professor Flinders Petrie in 1896 in the King's funeral temple at Thebes, containing, as the late Professor Driver says (*Modern Research*, etc., p. 38), the earliest mention of Israel known at present to occur on any monument, raises, as that distinguished Biblical scholar rightly remarks, "more questions than it solves." I may be permitted to observe that a Jewish tradition which, though recorded in the Aggadah, may represent a reminiscence from the earliest days, tells of an abortive partial exodus thirty years before the great universal Exodus. See: Sanhedrin 92b: Who were the dead that Ezekiel called back into life? Rab said they were the Ephraimites who had wrongly calculated the era of the redemption," etc. Cf., Rashi *ad locum*. Pirke d'Rabbi Eliezer: "R. Eliezer said all through the sojourn of the Israelites in Egypt the Ephraimites lived in the greatest security and prosperity, until there arose Nun, a descendant of Ephraim, and said, God has revealed Himself unto me, bidding me take you out from Egypt. His tribesmen, buoyed up by their royal descent (seilicet, from Joseph, the viceroy of Egypt) and their great warlike abilities then rose up, and, taking their sons and daughters with them went out from Egypt. Hereupon the Egyptians arose and killed all their mighty men of valour." Mekhilta, Exodus XIII, i: *Aliter* "... this refers to the Ephraimite war ... because they observed not God's covenant and refused to walk in His law and they trespassed the appointed end and the oath: (*it was therefore to be feared*) that the Israelites, seeing the bones of their brothers strewn in Philistia, might return back to Egypt."

The inscription in Professor Lehmann-Haupt's translation reads as follows: "... The princes are prostrate, saying 'Salam'. Not one among the Barbarians raises his head. Laid waste is Lybia ... Canaan is seized with every evil. Ashkelon is led captive. Gezer is taken. Jenom is annihilated. The Israelite tribe its men are few, its seed exists no more. Palestine (Charu, land of the Charités) has become a widow for Egypt (i.e. helpless before her). All lands are united and at peace. Everyone who was a marauder is held in check by King Merenptah," etc.

It has been argued from certain indications in the inscription that the abode of the tribe of Israel to which the text refers is to be sought in the Mountains of Ephraim. (See Lehmann-Haupt, *Die Geschichte Judas und Israels im Rahmen der Weltgeschichte*. I, Tiibingen (1911), p. 2930-). This affords a curious point of contact with the Aggadah insofar as the latter connects members of the Ephraimite stock with a pre-Exodian partial excursion from the land of oppression. Professor Lehmann-Haupt, it may be added, in an original discussion, tries to show that the Israelites are spoken of in the inscription as a people not yet fixedly settled in Palestine, (*ib.*, p. 30 in *fine*). May not the pride of Ephraim have had something to do with reminiscences of that bold venture, with the fact that their ancestors had preceded all the other tribes in Palestine?

Exodus 44 .5-: "And the King of Egypt said unto them, Wherefore do ye, Moses and Aaron, hinder the people from their work? Get you unto your own affairs." 5: "And Pharaoh said, Behold the people of the land now are many, and ye disturb them in the pursuit of their labours." Verse 5 implies, I feel, a rejoinder to Pharaoh's question in verse 4, suppressed in the text.

A distinction is also apparently made between "now" and a past occasion. May not an allusion be contained here to a previous time when a Pharaoh *had* granted a favour similar to that prayed for by Moses and Aaron in verse 3. I do not wish to suggest that this has any relation with the problem raised by the inscription of Merenptah. With reference to the same subject, it may be remarked that the escape of a portion of the Hebrew race from Goshen might be favoured by the invasion of the Delta by the Lybians, which took place in the fifth year of Merenptah's reign.

The name of Amenhophis IV is connected with a tremendous revolution in the religious life of Egypt. That pharaoh who has been called the heretic king established the worship of the Sun as the religion of his land to the exclusion of all other cults. Khu-naten, the official title assumed by Amenhophis IV, is generally explained as meaning "Glory of the Solar Disk." His enthusiasm for the Sun-god was boundless.¹⁴² Egyptian art and luxury could hardly remain unaffected. May not this ardent devotion to the Sun have brought about the introduction of purple which owes its colour to the action of the sunrays, and which, as we know, was anciently regarded as the special favourite of the great source of light?¹⁴³ "The purple dye delights in close contact with the Sun. His rays blazen it up, making its splendour greater and more brilliant," etc. The ancients with their small knowledge of nature could not help attributing the photographic property of the purple liquid to the direct favour of the Sun. It is worth comparing, in this connection, the Phoenician belief associating purple with Astarte, the consort of Baal the Sun-god. The Phoenician priests of Baal were clothed in sumptuous purple garments. It was perhaps under Asiatico-Semitic influence that Amenhophis acted in setting up the Sun-god as the deity of his nation. If I remember aright, his mother was an Asiatic princess of Semitic origin. Asiatic influence would certainly promote the introduction of purple. But perhaps Amenhophis IV's religious resolution was simply a determined return to the original Egyptian cult. The sun is the most ancient object of worship to be met with on the Egyptian monuments. Ra was venerated from the earliest times in the land of the Pyramids. In that case colour in general would come back to favour, if, as Ermann states, in the very early ages dyed garments were worn to a great extent. Purple would have a two-fold claim as "Queen of Colours" and as the favourite of the Sun.

Merenptah, the Pharaoh of the Exodus, is separated from Amenhophis IV by only an interval of some 130 years.

Perhaps this train of thought might help us to the understanding of the reference to dyeing in Papyrus Sillier No. 2, which, as we have seen, not improbably implies that purple dye was the dye par excellence in the days of Ramses II, the father of Merenptah.

The reaction against colour and the return to white linen need not have gone together with the undoing of Amenhophis IV's work in the domain of religion which followed his death. This may have taken place later than Merenptah.

¹⁴² Petrie, Flinders, *History of Egypt*, London (1895), p. 11211 ff.

¹⁴³ Pollux, I, 6.

III. THE SOURCES OF THE DYESTUFFS PRODUCTIVE OF *Tekhelet* AND *Argaman*

A. "Iakinthos" and "Porphyra" in the Greek Version of the Old Testament.

That *Argaman* was blatta purple¹⁴⁴ (i.e., dyed with marine snail pigment) is attested by the Septuagint, the oldest translation of the Pentateuch. Wherever *Argaman* occurs in the Torah it is rendered by *Porphyra* or one of its derivatives, and this rendering is indeed adhered to throughout the rest of the Bible. *Tekhelet*, whether occurring by itself or in close association with *Argaman*, is represented by *Iakinthos*. The impression thus created is that *Tekhelet* does not fall under the appellation *Porphyra*. I do not wish to imply that *Porphyra* was not elastic enough to be used sometimes as a term embracing all kinds of purple, including *Iakinthos*, but that in its ordinary sense it denoted fabrics distinctly differing in colour from *Iakinthos*, so that its conjunction with the latter term involved no clashing or overlapping.

Iakinthos as the name of the coloured fabric, curiously enough, very rarely occurs in Greek literature outside the version of the Bible. So far as I know, there are only two solitary instances: Athenaeum lib. XII and Arrian lib. VI. In each of these passages *Porphyra* and *Iakinthos* occur together, presenting the same phenomenon as in the Septuagint and the other Greek translations. I cannot recall a parallel collocation in Latin literature. The nearest approach is Juvenal ... "*Purpura* vendit causicum, ventum amethystina."¹⁴⁵

That *Tekhelet* (*Iakinthos* of the Greek versions) was also of (marine) molluscan origin has not been questioned, so far as I know, by any standard author. De Pierre¹⁴⁶ quotes a certain writer. Birwood, to the effect that *Tekhelet* was indigo-blue. As he gives no reference, I have not been able to verify the source. Professor Flinders Petrie, in the letter referred to, seems to hold the same view at least, as far as the *Tekhelet* of the Tabernacle is concerned, but there is no need to go over again the ground already covered. If it were shown that the *Tekhelet* dye in the earliest time was of vegetable origin, it would follow that a later age made the change to a marine animal dyestuff, for, as will soon be made clear, we have indisputable evidence that at least in the last decades of the Second Temple *Tekhelet* was certainly of the latter origin. But so far there is no serious ground for assuming any such break in the *Tekhelet* tradition.

¹⁴⁴ Schmidt, W.A., *ibid.*, passim.

¹⁴⁵ Juvenal, 7, 134.

¹⁴⁶ DePierre, "Historique de l'Indigo," *Teinture*. v.III, Paris (1893).

B. Marine Shell-Snail Origin of Tekhelet and Argaman; the Greek Versions, Philo and Josephus Collated with the Talmud and the Tosephta.

The molluscan origin of the *Argaman* dye, apart from the rendering of *Argaman* by Porphyra is also expressly stated by Philo¹⁴⁷ and Josephus,¹⁴⁸ both contemporaries of the Second Temple. These authors, in giving an hermeneutic interpretation of the Tabernacle, explain Porphyra (= *Argaman*) as symbolizing water, because its dye is derived from a shell-snail living in the sea. Of *Iakinthos* (= *Tekhelet*), they say that it represents the air. being black or dark. Their silence with regard to the shell-snail origin of *Iakinthos* proves absolutely nothing.

In their scheme of symbolic interpretation there is really no occasion for an express mention of the conchylian origin of the *Tekhelet* dyestuff. It would, moreover, have broken the point of their Midrash, for since *Tekhelet* is also derived from the sea, the intelligent reader might be prompted to ask, what need is there for *Argaman* to symbolise water? Could not *Iakinthos* signify at the same time both air and water?

In the Babylonian Talmud¹⁴⁹ the sea-snail origin of the *Tekhelet* dye is expressly stated. Some account is given of the dyeing of that fabric with the blood of the hillazon in the time of the great Amora Abaye. A description is also given of the *Tekhelet hillazon*: tests are prescribed for detecting fraudulent imitations with a certain vegetable dyestuff (*kala-ilan*). Though the Talmudic passages in question deal mainly with *Tekhelet* used for the ritual fringes on the garments¹⁵⁰ or *tzitzit*, there is not, I think, the flimsiest ground for drawing a distinction between this and the sacerdotal and cultural *Tekhelet* (תכלת של מקדש תכלת של בגדי כהונה). I cannot think of any plausible reason for a distinction of this kind. In the Sifre¹⁵¹ a *gezerah shavah* (גזירה שוה) is in fact instituted with reference to quite another point between *Tekhelet* in Numbers XV, 37, and *Tekhelet* in Exodus XXV, 4 in connection with the Tabernacle. The reader who has the elementary knowledge of the Talmud knows that, according to most authorities, in a case like this the two members of the *gezerah shavah* have absolutely the same signification (אין גזירה שוה למחצה). In the course of a discussion in the Talmud (ib.) relating to *Tekhelet* S (*Tekhelet* S throughout this chapter will stand for *Tekhelet* of the *tzitzit*; *Tekhelet* T for *Tekhelet* of the Temple (sacerdotal and cultural *Tekhelet*).

¹⁴⁷ Philo, *de Vita Mosis* ... Prag (1838).

¹⁴⁸ Josephus, *Antiquitatum Iudaicarum*, III, 8.; *De Bello Judaico*, VI, 6.

¹⁴⁹ *Menahot*, 43-44.

¹⁵⁰ Numbers, ch. XV, v.37.

¹⁵¹ Sifre, Numbers, XV, 37.

). a baraita is adduced referring expressly to *Tekhelet* T, thus showing the identity of the two. Similarly in Yevamot 4b an halakhah based upon the interpretation of a verse relating to *Tekhelet* T is readily applied to *Tekhelet* S.

A statement in an extra-Talmudic¹⁵² baraita expressly declares: "*Tekhelet* is dyed with no other pigment but that obtained from the *hillazon*," (אין צובעין תכלת אלא בחלזון; Baraita d'tzitzit). Though standing in a tractate dealing especially with *tzitzit* it is practically meant to have universal application. But perhaps it might be objected that the baraita dating presumably from a time posterior to the destruction of the Temple has in view only *Tekhelet* S. The Tosephta Menahot Ch. X, however, contains a baraita expressly referring to *Tekhelet* T: "*Tekhelet* is not ritually fit, unless it is from the dyestuff of the *hillazon*; if it is not from the *hillazon* it is not fit." (תכלת אין) (כשירה אלא מן החלזון שלא מן החלזון פסולה). This baraita in all probability goes back to Temple times, as indeed a greater part of Mishnaioth and baraitoth relating to the Temple and the sacrificial cult.¹⁵³

It is interesting to note that while the Judaeo-Hellenic sources (Philo, Josephus and the LXX) attest the sea-snail origin of the *Argaman* dyestuff and are silent with regard to *Tekhelet*, the traditional sources on the other hand furnish evidence to that effect as far as concerns *Tekhelet*, and say nothing with regard to *Argaman*. Even the Tosephta Menahot, so explicit on *Tekhelet* under this aspect, says not a word about *Argaman*. This is the more remarkable seeing that next to the above halakah relating to *Tekhelet* there appears in the Tosephta an halakah laying down a certain restriction with regard to the provenance of *tola'ath shani* or scarlet, the regular pendant of

¹⁵² The non-Talmudic reader should consult, for an explanation of this and similar terms, some introduction to the Talmud or articles.s.v. Talmud in the standard Encyclopaedias.

¹⁵³ This is also true in the case of, indeed, a very great proportion of the Mishnah as a whole. There is neither occasion nor room in the present work for developing the point. I would, however, avail myself of this opportunity to point out an inaccuracy in the Jewish Encyclopaedia. In the article "Talmud" it asserts that already the first Mishnah proves that some Mishnaioth date from Temple times, for the Mishnah states: "When begins the time for the reading of Shema in the evening. When the priests go in for eating their *terumah*." This is a mistake hardly worthy of the writer: *terumah* is independent of the existence of the Temple, and continued to be eaten by descendants of the Aaronic stock after the destruction of the Temple as much as before, so long as Levitical purity was maintained. Cf. eg., Pesahim 72b. See משנה למלך רמב"ם פרק ג, מהלכות אכל

The Midrash Tanhuma Section Terumah, 5, Lublin (1896) might be misinterpreted as implying that *Argaman* was not of shell-snail origin.

וזאת התרומה אשר תקחו מאתם אמר להם הקב"ה אין אתם מביאין משלכם אלא מביזת הים שנתתי לכם שנאמר כנפי יונה נחפה וכסף ותכלת וארגמן שצובעין אותו דבר זכר לאות שכבר התקינו ארות העולם. תולעת שנאמר אל תראי תולעת יעקב וכו'.

Tekhelet and *Argaman* in the Pentateuch. Disagreement between the LXX, Philo and Josephus on the one hand and the Tosephta on the other is not to be thought of. My explanation is simply this: There was no necessity for formulating a law in rejection of nonconchylian dyestuffs for *Argaman*, simply because the word *Argaman* itself denoted nothing but purple dye or purple stuff, being the equivalent of the Greek or the Latin *Purpura*: *Argaman* also designated the species of sea-snail productive of the dye which, when applied to clothing stuff gave to the latter the name of *Argaman*. To have said that stuff dyed with vegetable pigment is not *Argaman*, however close its colour to the latter might be, would have been like saying, for instance, that counterfeit gold might not do when Law required gold (zahab).

Even if we had no distinct testimony that *Tekhelet* was of conchylian origin, we might be led to infer this from the never varying order in which the two words *Tekhelet* and *Argaman* occur in the Bible, and in the Assyrian inscriptions. *Tekhelet* always precedes *Argaman* just as zahab (harsu) (gold) ever precedes keseph (kaspu) (silver). "Gold and silver ... and *Tekhelet* and *Argaman*," etc., in the Pentateuch; "gold, silver ... *takiltu*, *Argamannu*," etc., in the cuneiform texts. This phenomenon makes it evident that *Tekhelet* was the more precious stuff. Now we know that in antiquity purple was infinitely more expensive than fabrics dyed with vegetable pigment. Since, therefore, *Argaman* was purple it follows of necessity that *Tekhelet* was also of the same origin but the most highly prized of its kind.¹⁵⁴

As already remarked, the Tosephta Menahot X in all goes back to Temple times, and what it says of *Tekhelet* must therefore be true for *Iakinthos* of the Septuagint and of Philo and Josephus. It is otherwise also clear that תכלת was of sea-snail origin for if the Greek word denoted a fabric dyed with some vegetable dyestuff then Aquilas, who, in his translation closely adhered to Tanaitic tradition, would have replaced *Iakinthos* of the LXX by some other term, or, if even did not exist, would have simply transcribed the Hebrew.

The Lex Valentina¹⁵⁵ includes hyacinthina in the category of *Purpura blatta* or pure genuine sea-snail purple. Though the document is far removed from Aquilas, from Philo and Josephus,

¹⁵⁴ דם occurs here only in association with תכלת. The passage is indeed a crux, the commentators not knowing how to deal with it. אותו (masculine) cannot of course go with תכלת: read אותן (plur.) referring to both תכלת and ארגמן which are dyed with לאות דם refers to the miracle of דם in Egypt (Exodus VII, 19). Read next תולעת שנאמר לא תראי תולעת יעקב מה תולעה אין כזה אלא בפה כך ישראל שכבר התקינו אבות עולם וישראל בני ישראל תפשו אומנת אבותיהם אברהם וזר

Compare Tanhuma בשלח p. 9.

¹⁵⁵ *Lex Valentina*. c. 3, 4, 20, 20.

and still more from the LXX, its evidence could not have been summarily dismissed, even if there had been no express statements in Talmudic tradition.

C. Professor Riedel's Theory of Argaman.

In a recent contribution to the etymology of *Tekhelet* and *Argaman*, the writer, Dr. Riedel, reaches the novel conclusion that *Tekhelet* should be rendered by purple and *Argaman* by Indian-red (Indisch rot).¹⁵⁶ Thus *Argaman* according to him is not purple at all but a vegetable dyestuff. He refers, of course, at the very beginning of his essay to the Greek versions, but *Iakinthos* he misunderstands and *Porphyra* for *Argaman* he simply rejects.¹⁵⁷ For the present suffice it to remark that Riedel has reckoned without the host. It is all very well arguing the incorrectness of this or that rendering in the old versions, but in a case like the present one, any amount of argument and dialectic is so much empty talk. The authors of the LXX, Philo and Josephus, all lived in times when both *Tekhelet* and *Argaman* were used in the temple. Josephus indeed officiated himself in the Sanctuary. Their renderings are not merely renderings; they are unimpeachable testimonies that *Tekhelet* and *Argaman* in the days of the Second Temple were known as, and designated by, *Iakinthos* and *Porphyra* respectively. The worst that the most sceptical mind could do would be to doubt whether the priestly authorities of the Second Temple rightly interpreted these terms, and whether they had not been better advised had they consulted some Biblical scholar who might have taught them to adopt "Indisch rot" instead of purple for the *Argaman* of the sacerdotal vestments and of the temple curtains.

IV. HILLAZON (SHELL-SNAIL) IN THE TALMUDIM, THE MIDRASHIM AND THE TARGUMIM

A. חלזון Hillazon.

חלזון *hillazon* of the Talmudim, the Midrashim, and Targum Jonathan is the Syriac *Helzūnā*¹⁵⁸ and the Arabic *Halazūn*. In these languages the word denotes: (1) the land shell-snail, French *limaçon* (as distinct from *limace*, naked snail); (2) the sea shell-snail (*limaçon de mer*). It doubtless has the

¹⁵⁶ A vegetable dye obtained from *Rubia* and *Morinda citrifolia*. Cf. *Alttestamentliche Untersuchungen*. Heft I (1902), p. 63899.

¹⁵⁷ "Die alten Übersetzer verstehen unter ארגמן ... unter *Tekhelet* den roten Hysginpurpur der Hyacinthuspflanze." The arguments by which Riedel tries to show that *Tekhelet* denotes red purple resembling the colour of blood are indeed too futile to need refutation. A mere glance at the chapters dealing with *Tekhelet* and *hi/lazon* in the present work will, I am sure, convince the reader of the justice of this condemnatory remark.

¹⁵⁸ Smith, Payne, *Lexicon Syriacum*.

same meaning in the Jewish sources. The shell of the *hillazon* is called נרתיק nartik, case; מלבוש garment, cloak.¹⁵⁹ The verb פצע (pasa) employed of the crushing of the *hillazon*¹⁶⁰ has reference in Tanaitic to some hard crustaceous substance. An allusion to the shell seems to be contained in Megillah 7a:

שפוני הוא דבר: Rashi annotates: שפוני זה חלזון שמוני זו טרית חול זו זכוכית לבנה. חשוב דלשו' ברייתא. More probably, I think, שפוני is interpreted in its Biblical significance of something hidden from view, concealed¹⁶¹ treasured; the shell-snail or rather the particular species yielding the precious purple dye.

חלזונא in Targum Yerushalmi for צלצל¹⁶² should be read with Kohut on Ms. authority helonas, corn-worm (Completem s.v. חלזון). הזה in Yalkut Shimoni,¹⁶³ cannot be correct. Kohut amends כפליקון - Peleku after Tanhuma b. As an alternative solution he suggests to connect the word with Halaza-hailstone. Whatever the correct reading may be חלזון in this passage cannot, I feel sure, stand for: הזה היה יורד כקצץ את האלנות שנאמר יהרג בברד גפנם

Would it not be sheer nonsense to say "How did the hailstone fall? Like yon hailstone it fell hewing down the trees?"

חלזון in the Mishna¹⁶⁴ is explained by Maimonides:

שיצא עין בשר מותר וימשך עד שחופה קצת משחור העין וישמו מפורסם אצל הרופאים (בלשון ערבי טפרה) (פרוש המשנה).

It is hard to see the connection of this with חלזון. Perhaps that sight obstructing formation was so named from its crusty nail-like matter (זפרה). Cf. שחלת = Onyx = צפורן).

It is at least doubtful whether Halaz (Arabic, to peel skin, to remove a shell) has any relationship with חלזון. May not חלזון be a derivative from זחל? חלז, חלזון, חלזון. Cf. טרם, רצפ, etc. Cf. חפז, פחז, צרפ (etc. Cf. שחל, שחלת. Snails would thus be divided into two great classes: זחלים, naked snails, and

¹⁵⁹ דברים פ"ח, מדרש תהלים פסיקתא רוייהי בשלה

¹⁶⁰ שבת דף ע"ה מעוד א

¹⁶¹ צפון. cf. כ' שם חלקת מחוקק ספון

¹⁶² Deuteronomy ch. 24, v.42.

¹⁶³ וראא Yalkut Shimoni, section 185,

¹⁶⁴ Bekhorot II, 8.

חלזנות, shell snails: the transposition of the consonants merely serving to mark the distinction. (Cf. French limaçon for naked snails and limaçon for shell snails).

The following passage in the Yerushalmi has given commentators an untold amount of trouble:

חזקיה אמר ההורג כינה בשבת כהורג גמל וכו' אמר ר' שמעון בן חלפתא ולא מחילזון שמענו וחלזון יש. לו גידין עצמות¹⁶⁵ ולא כן תני כל דבר שאין גידין ועצמות אינו חי יותר משישה חדשים

is construed by the commentators as a negative interrogation. The passage thus asserts that the *hillazon* belongs to those lower forms of life which being deprived of bones and gidim (veins, sinews, blood-vessels) cannot, according to the Talmud, live longer than six months.¹⁶⁶

Kohut, while rightly expressing dissatisfaction with the explanations given by the commentators, advances his own view that חלזון in this passage stands for the Arabic Halaz, a species of louse, thus agreeing with the context which begins with the halakhah 'ההורג כינה וכו'. I cannot accept this all too easy solution of the difficulty. That one and the same word should have served to designate both the molluscs and the louse is as much an insult to the former as to the intelligence of the people who could thus think of the two so indiscriminately.

Again, as *hillazon* at all events also denotes shell-snail, the interrogator on the Yerushalmi should have added some qualifying epithet to חלזון in declaring that having neither asamot nor gidim it cannot live longer than 6 months. Some such emendation as חלז for חלזון would be indispensable upon Kohut's hypothesis. Besides, Kohut's solution really fails on being applied to the interpretation of the sugya as a whole.

Sanhedrin 91a (עלה להר) applies, according to Lewysohn.¹⁶⁷

B. Distinctive Names of Species.

Distinctive names for species of molluscs are seldom met with in the Talmud. Avoda Zara 28b משקדי חלזונה is an instance. What particular species is referred to would be hard to determine. The only clue afforded by the text is the indication of its being used for the cure of hemorrhoids. Our copies have משקדי with ד. The Aruch reads משקרי with ר. Lewysohn¹⁶⁸ equates the word with nisuka (double shelled). This is at least dubious. Kohut accepting the reading of the Aruch and

¹⁶⁵ Yerushalmi, *Shabat* I, 3.

¹⁶⁶ Or 12 months, Hullin 58a.

¹⁶⁷ Lewysohn, Ludwig, *Zoologie des Talmuds*, Frankfurt (1858), p. 364 to *Helix pomatia*.

¹⁶⁸ Idem, p. 368, p. 283.

connecting משקרי with the Arabic שקר shaker (intense red) identifies the species with the Porphyra-*Purpura* of Aristotle and Pliny: חלזונא משקרי would thus mean "of the intensely red molluscs," that is of the molluscs yielding a red dye. It is rather doubtful whether this is the true identification.

have not been able to trace in ancient medicine the employment of *Purpura* in the treatment of hemorrhoids. But as I have not carried my investigations far enough I should lay no emphasis on the negative result of my researches in this direction. In modern pharmaceutics nothing is known of such a use of any species of the mollusca. I make this assertion on the authority of an eminent specialist:

"Faculty of Medicine, University of Paris
Laboratory of Pharmacology and Medical
Matters.

Sir,

It is, to my great regret, impossible for me to provide you with useful information on the points on which you have done the honour of consulting me. Products of which you tell me are no longer used for a long time in current therapy and they have no value ...

"Faculté de Medicine, Université de Paris
Laboratoire de Pharmacologie et de
Matière Medicale.

Monsieur,

Il m'est, a mon grand regret, impossible de vous fournir d'utiles renseignements sur les points relativement auxquels vous m'avez fait l'honneur de me consulter. Les produits dont vous me parlez ne sont plus usités depuis longtemps dans la thérapeutique courante et ils n'ont aucune valeur ...

Dr. G. Tourbed."

A more potent objection is offered by the circumstance that, at least so far as I know, שֶׁקֶר with ש is never used for red in the Talmudim and the Midrashim: שֶׁקֶר, סִיקְרָא, סְקֵרְתָּא do occur as denoting red paint or ink. It would follow that either:

- the particular designation is a loan-word from Arabic; or that
- the whole prescription is derived from an Arabic source

is not very probable, there being little ground for supposing that the Palestinian Jews about the end of the 3rd Century were dependent upon the Arabs in matters of marine zoology.

Of (b) something might be said. There are a few allusions in the Talmud to remedies due to Arab travellers.¹⁶⁹

I have not found any particular designation of species of molluscs in the Arabic lexicons which I have consulted. Professor Bartholemy, Arabic Professor at the Ecole des Hautes Etudes, informs me that neither has he.

Kohut further suggests that his explanation of מִשְׁקֵרֵי חִלְזוֹן might throw light upon Midrash Rabbah Genesis 91

קחו מזמרת הארץ ... דברים שהם מזמרים בעולם חלזון חמר קטיף וכר.

חמר is none too easy. (See the commentaries.) Kohut proposes to connect חמר with the preceding word, taking the two as a composite expression חמר חלזון the red *hillazon* (Arab: Ilamia = red), the *Purpura* of the ancients. The Phoenician purple is known to have been famous beyond all others.

This is not at all bad, but חמר is not the usual word for red in Talmudic and Midrashic literature. The passage, moreover, being in Hebrew, we should expect חלזון אדום rather than חלזון חמר. Is the appellation due to an Arabic source?

The doubt expressed in connection with מִשְׁקֵרֵי also applies here. Or are we to suppose that חלזון חמר goes back to an early Semitic period when Hebrew usage still retained very close affinities with the Arabic, thus indicating that the Hebrews had become acquainted with the dyeing of red purple already in pre-Biblical times?

¹⁶⁹ E.g. 82 בשבת 110b.

It is, however, possible to think of חלזון חמר in this instance as being connected with the Biblical חמר deep-red wine, wine of the best quality.¹⁷⁰ *Argaman* of the best quality was conceived as a reproduction of the colour of black-red wine:¹⁷¹

בבס ביין לבושו ודם ענבים סותה יהא ארגון טב לבושו' וכו'

The *Purpura haemastoma* which gives a dark-red purple was probably employed in the manufacture of the Tyrian dark-red purple. חלזון חמר would then be the Hebrew name for the species now called *Purpura haemastoma*. A very welcome light would thus be thrown upon the Midrashic passage mentioning חלזון חמר as first among the products for which Canaan was anciently famed. The modern Arabs living about the Haifa coast call the purple snail¹⁷² אלהלזון. They do not however term it חלזון חמר as they should have done, if Kohut's explanation of חלזון חמר were correct. The *Purpura haemastoma* is largely represented among the purple-giving molluscs inhabiting that region. Professor Friedlaender has informed me that he is about to go to Haifa for the purpose of conducting researches into the chemical constitution of the dye furnished by that species. All lovers of science will wish him the greatest success. The appellation אחרמר, by the way, may, I think, be due not to the colour of the pigment secreted by the *Purpura haemastoma* but rather to the bright orange red colour of the animal's mouth. (Cf. *Purpura haemastoma*: blood mouthed *Pourpre bouche à sang*).

C. Special Designations for the Species Furnishing Tekhelet and Argaman Respectively.

Were there special names in use for the different species furnishing *Tekhelet* on the one hand and *Argaman* on the other? If חלזון חמר designates the *Purpura haemastoma* the question will of course have been answered in part. Would these be distinguished as חלזון של תכלת and חלזון של ארגמן respectively?

A baraita quoted Menahot 44a and the ברייתא בציצית gives a description of the *hillazon* producing the *Tekhelet* dye.

As the object of that baraita is evidently to furnish a clue to the identification of the *hillazon*, would it not have been sufficient to have simply indicated its special name? Are we to infer then

¹⁷⁰ Deut. XXXII, 14; Is. XXVIII, 2.

¹⁷¹ *Targum Onkelos*, Gen. XLIX, 11.; Cf. Ovid, *Faest.* II, 316; Cf. Bluemner, Hugo, *Die Farbenrechnungen bei den römischen Dichtern*, Berlin (1892), p. 192.

¹⁷² 1. Schwartz. Yehoseph, *A descriptive geography . . . of Palestine*, Philadelphia (1850), p. 197.

that no such particular designation existed? Or was its special name "*hillazon* shel *Tekhelet*" חלזון של תכלת which of course would not by itself afford the key to the identification of the species?

Generally speaking the majority of references to the *hillazon* have in view of the species furnishing *Tekhelet* and *Argaman*, but no one, let us hope, will repeat the initial error committed by G.E. Leiner of huddling up all references to the *hillazon* as applying exclusively to the *Tekhelet-hillazon* (חלזון של תכלת).

A baraita is quoted (75a, שבת.) relating to the number of transgressions committed in fishing and crushing a *hillazon* on a Sabbath day. The Gemara (ib.), in answering a certain question raised with regard to that baraita, makes a certain statement which can only apply to purple-giving molluscs without supplying the apparently necessary premise that the baraita must be understood as having reference to those species only. This might be taken as an indication that when nothing is said to the contrary, *hillazon* in the Talmud should be understood as applying to the purple-giving molluscs. On a closer examination, however, it becomes clear that no such inference is warranted by the passage in question. The tacit assumption underlying the Gemara is simply based upon the self evident consideration that a Jew would have no business to fish any but purple-giving molluscs; for the mollusca belong to the division of impure animals which may not be eaten by Jews: The law also forbids the direct engaging in the commerce of impure edibles.¹⁷³ To meet the possible objection that a Jew fishing on Sabbath might as well eat forbidden food, I should add that the baraita deals with transgression due to ignorance (שוגג). Fishing of mollusca for medical purposes would be too rare to necessitate and express negation on the part of the Gemara. Apart from this consideration it is probably that Jews would not themselves fish the species they needed for pharamaceutic uses but would procure them from gentile dealers.

V. THE TEKHELET-HILLAZON

A. Samuel Bochart as a Pioneer in the Study of Tekhelet and Argaman, His Treatment of the Zoological Aspects of the Subject of J. Braunius' "*De Vest. Sacerdotum hebraeorum*."

Long after Rondelet had furnished the starting point for the scientific study of ancient purple dyeing in general, the investigation of Semitic purple in particular was allowed to remain an

¹⁷³ See: פסחים 23a and שביעית 7.4: צידי דגים שנודמנו להם מינים טמאים וכו';

uncultivated field anxiously awaiting some energetic labourer to pass his plough over the desert-land overgrown with briars and brambles.

Such a one finally arose in the person of Samuel Bochart. In his *Hierozoicon*,¹⁷⁴ a monument of vast learning and industry, Bochart devotes considerable space to the discussion of תכלת and ארגמן, paying special attention, in conformity with the plan of his work, to the zoological aspect of the subject. He makes no attempt, it is true, to identify the species furnishing *Tekhelet* and *Argaman* respectively with actual species inhabiting the mighty deep, but he does try to rediscover them in Pliny's feeble and shallow descriptions of the purple molluscs:

It is proven that תכלת Tekhelet, and ארגמן Argaman, are two kinds of sea purple, of which the former is blue of shellfish, the latter is properly purple, and is made of the so-called purpura	"Probatur תכלת Tekhelet, et ארגמן Argaman, esse marinae <i>Purpurae</i> duo genera, quorum ille caeruleum ex conchyliis, hoc proprie purpureum fuit, ex <i>Purpurae</i> proprie dictae sanie factum."
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Bochart maintaining that the *Purpura conchyliata* was produced from a particular species distinct from those used in the dyeing of *Purpura* properly so called, identifies *Tekhelet* with the dye obtained from the former and *Argaman* with that extracted from the species yielding *Purpura* in the strict sense.

His identification of *Tekhelet* is grounded upon the following reasoning: *Tekhelet* according to Jewish tradition was a blue colour produced with the dye of a certain species of marine-shell-snail. A certain variety of conchylum purple was of a blue colour: ergo *Tekhelet* is to be identified with that particular variety. It goes without saying that the argument ultimately rests upon the assumption that *Iakinthos* of the LXX is identical with the *Tekhelet* of the Talmud and of Maimonides. Bochart's grounds will be examined later.

¹⁷⁴ Bochart. Samuel, *Hierozoicon*, London (1663), part II, chs. 9-11.

¹⁷⁵ Idem, p. 736.

The next worker in the field of Semitic purple was J. Braunius.¹⁷⁶ His contribution to the investigation of the subject exhibits little that might be characterised as a distinct advance upon Bochart.

B. Michaelis' Attempted Identification of the Tekhelet-hillazon with *Sepia loligo*.

The first attempt at an identification of the *hillazon* shel *Tekhelet* seems to have been made by Michaelis. Following Maimonides' description of the *Tekhelet hillazon*, Michaelis identifies the species with sepia or more precisely *Sepia loligo*. So sure is he of the identity that he ventures in fact to explain on that basis the etymology of *Tekhelet*, the sepia on being pursued ejects its ink-like secretion. This derivation for *Tekhelet*, needless to say, has little plausibility even on the assumption of the correctness of the identification. Whatever may be thought of the value of Michaelis' hypothesis it must be owned that it marks an appreciable progress in the scientific study of the question, attempting as it does to rediscover the *Tekhelet-hillazon* in living nature as distinct from the dead book.

Gesenius following the direction pointed to by his distinguished predecessor in the study of Hebrew philology, likewise tries to identify the "*hillazon-shel-Tekhelet*" with a known species, but not content with interpreting Jewish tradition alone, he attempts to combine the data supplied by the latter with the statements of Pliny regarding the purple mollusca.

“The "buccini" species found in the open Mediterranean Sea, clinging to rocks, with its shell of a violet hue, a dark violet color, as described by Forskalius.”	"שחלת = תכלת" buccini species in mari mediterraneo uperta, petris adherens, circa scopulosque lecta, testa violacio, color obscure violaceus ut ait Forskalius." ¹⁷⁷
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C. Identification of the Species with *Helix Janthina* by Gesenius.

He thus identifies the species with *Helix Janthina*. In the light of all that has been said in connection with Pliny's *Buccinum* it will be sufficiently clear that the great Hebraist betrays

¹⁷⁶ Braun, Johannes, בגדי כהנים *id est Vestibus sacerdotum*.

¹⁷⁷ Pliny, *ibid.*, IX, p. 127. *Hebraeorum*, Amsterdam (1680), v.L chs. XIII-XIV.

muddled zoology in confounding the Buccinum of the Roman naturalist with the Janthina genus. The indication "color obscure violaceus," however, if detached from the context, might fairly describe the coloration of a species of the genus Buccinum (= *Purpura* of the moderns) but of such a one which being a non-Mediterranean mollusc, could hardly have been envisaged by Pliny. Gesenius, in any case, has nothing of the kind in view.

D. Imperfect Application of the Results Obtained by Lacaze-Duthiers to the Study of Tekhelet and Argaman.

Lacaze-Duthiers omitted all mention of *Tekhelet* and *Argaman* in his epoch making *Memoire sur la pourpre* ("Memory on the Purple").¹⁷⁸ Though his researches had enabled him to distinguish the purple molluscs according to variation in the final tone of their pigment, he nevertheless made no direct attempt at assigning the principal purple colours occurring in Pliny let alone Semitic literature to corresponding species of Murices and *Purpurae*. Writers on *Tekhelet* and *Argaman* were thus hardly placed in a position of readily suggesting the probable identifications of *Tekhelet* and *Argaman* species respectively upon the authority of Lacaze-Duthiers' results. The articles on the subject in the best Bibli-cal lexicons, though posterior to the publication of the *Memoire sur la Pourpre* ("Memory on the Purple"), limit themselves to informing the reader that the ancients obtained the purple dye from *Murex brandaris*, *Murex trunculus* and *Purpura haemastoma*, without in the least attempting to indicate which furnished *Tekhelet* and which *Argaman*. Even "Article on Colours in the Bible" from the able pen of Franz Delitzsch forms no exception in this respect.¹⁷⁹ Bizio, however, had he been consulted, might have pointed out the way. The Italian porphyrologist repeatedly expresses the view that *Murex trunculus* was the species anciently employed in the dyeing of the *Purpura amethystina* and *Murex brandaris* in that of the *Purpura tyria*.

Pietschmann in his *History of the Phoenicians* made the nearest approach towards an attempted identification of the *Argaman* species:

"The juice of the *Purpura haemastoma*,
the buccinum mussel as Pliny calls it,

"Eine sehr ins Rothe spielende Farbe giebt
der Saft der *Purpura haemastoma*, der

¹⁷⁸ Lacaze-Duthiers, *Memoire*, Ch. 1, passim.

¹⁷⁹ Herzog, Johann, Jakob, *Realencyclopädie*, Gotha (1860), v. VIII, "Farben."

gives a very red colour; he supplied the lighter purple of Taranto, which argaman of the islands of Elisha mentions Ezekiel as a trade item of Tire."

Buccinummuschel wie sie Plinius nennt; er lieferte den helleren Purpur von Tarent, das *Argaman* der Inseln Elischa das Ezechiel als Handelsartikel von Tyros erwähnt."¹⁸⁰

The reference to Ezekiel, as Pietschmann explains in a foot-note, is based upon the identification of Elischa with Halaesa on the north coast of Sicily. *Purpura* haemastoma, however, furnishes sombre tones rather than 'helleren Purpur' ('lighter purple')."¹⁸¹ For *Tekhelet* Pietschmann offers no suggestion.

E. Dr. A. Dedekind's Contribution to the Study of the Identification of the Species Productive of Tekhelet and Argaman Respectively.

It has fallen to Dr. Dedekind to press Lacaze-Duthiers' far-reaching results into the service of Semitic porphyrology.

In one of his letters, M. Dedekind says to me: "I was sent, a few weeks ago, volume II (Hierozoicon) of Samuel Bochart, where one finds curious remarks on the purple. The work is from 1663. Bochart talks a lot about two kinds of purple, one crimson, the other blue or violet. 'It is proven that תכלת Tekhelet and ארגמן Argamman are...' These colors only became clear to me and for the first time

"Dans l'une de ses lettres, M. Dedekind me dit: On m'a envoyé, il y a quelques semaines, le volume II (Hierozoicon) de Samuel Bochart, où l'on trouve de curieuses remarques sur la pourpre. L'ouvrage est de 1663. Bochart y parle beaucoup de deux espèces de la pourpre, l'une cramoisie, l'autre bleue ou violette. Probatur תכלת thecheleth, et ארגמן esse ... Ces couleurs ne sont devenues claires

¹⁸⁰ Pietschmann, *ibid.*, p. 242.

¹⁸¹ As the amethyst purple colour was really the result of a mixture in certain proportions of the pigments of both "*Purpura*" (or pelagia) and buccinum, and the *Purpura* Tyria owed its tone to a double dyeing with the secretions of species of both these genera, Bizio has not articulated his view with the necessary distinctness at least in as far as it applies to the data supplied by Pliny.

the day I was able to observe your
drawings," Mr. Dedekind adds."

pour moi et pour la première fois que le
jour où j'ai pu observer vos dessins,"
ajoute M. Dedekind.¹⁸²

Dr. Dedekind has since maintained that Lacaze-Duthiers' researches have once for all furnished the clue to the identification of the species used for *Tekhelet* and *Argaman* respectively. In the fourth volume of his *Beitrag*¹⁸³ in the course of a criticism of George Tryon's references to ancient purple, Dr. Dedekind gives the following classification:

Purpura lapillus, *Murex erinaceus*, *Murex trunculus* = gehören zur Purpursorte *Tekhelet* (d.i. violetter oder blauer Purpur) (belongs to the purple variety *Tekhelet* (i.e. purple or blue purple))

Murex brandaris, *Purpura haemastoma* = gehören zur Purpursorte *Argaman* (d.i. roter oder karminer Purpur) (belongs to the purple variety *Argaman* (i.e. red or carmine purple))

In a private communication to me last summer, the learned author, while commenting on a series of notes on תכלת I had forwarded to him, insisted with as much emphasis as ever upon the identification of the *Tekhelet*-species with *Murex trunculus* and of the *Argaman* species with *Murex brandaris* and *Purpura haemastoma*. He also mentioned *Murex erinaceus* as a possible identification with the *Tekhelet* species, adding, however, that in view of the minuteness of the dye-secretion of the species its employment for dyeing was unlikely. Was Dr. Dedekind's omission of *Purpura lapillus* in the above communication due to the fact of that species being non-Mediterranean?

The identification adopted by Dr. Dedekind, be it carefully noted, is based solely upon the tradition of the *Tekhelet*-nuance: It takes no note of the description of the *Tekhelet-hillazon* as given in the Talmud and as reproduced by Maimonides. *Tekhelet* according to some was blue, according to others dark violet playing into bluish; *Murex trunculus*, Dr. Dedekind affirms, is capable of producing both blue¹⁸⁴ and dark violet playing into blue, but the latter is the usual result of the development of the pigment of that species. The species known to have been employed in Phoenician purple dyeing are *Murex trunculus*, *Murex brandaris* and *Purpura haemastoma*.

¹⁸² Lacaze-Duthiers, *Archives de Zoologie*, p. XVIII.

¹⁸³ Dedekind, *Beitrag*, v.IV, p. 886.

¹⁸⁴ Herzog, *ibid.*, "Purpur," v.XII, pp. 398-400.

There can be no question about the identification of the *Tekhelet* species. Whether *Tekhelet* denotes the former or the latter colour or covers both, *Murex trunculus* is the only possible solution out of the three species just named. There is of course the possibility that *Tekhelet* was produced from a fourth species not yet identified. Gaillardot¹⁸⁵ on whose authority it is asserted that remains of shells of *Murex brandaris* and *Purpura haemastoma* have been found about Saida bearing internal evidence of their employment in dyeing really never asserted that no others had been discovered. From the fact, however, that the one mass consists exclusively of *Murex trunculus* shells while in the other *Murex brandaris* and *Purpura haemastoma* are found together it may be inferred that the latter is composed entirely of shells of species furnishing colours homogeneous with that obtained from *Murex brandaris* and *Purpura haemastoma* that is *Argaman* rather than *Tekhelet*.

The possibility of identifying the *Tekhelet*-mollusc with some indeterminate species other than *M. trunculus* is thus reduced to a minimum, though it is not entirely excluded, for it is possible that the remains of the *Tekhelet* shells on the Phoenician coast have somehow disappeared, or that the shells being utilized for some purpose were not allowed to accumulate in the manner of those of *Murex trunculus*, etc....

There is of course a distinct relationship between the determination of the exact *Tekhelet* colour and the identification of the species furnishing the *Tekhelet*-dye.

If, as Baehr¹⁸⁶ contends, *Tekhelet* was a pure dark blue to the exclusion of violet, then the claims of *Murex trunculus* will require some propping before they can be urged with unmixed confidence. The chemical constitution of the purpurigenic matter secreted by that species also includes an element of red, necessitating a violet shade in the final development. The question will be dealt with elsewhere; here it can only be touched upon. Dr. Dedekind in one of his letters to me says with reference to certain statements made by me in connection with the subject:

"The purple drawings by Lacazes using purple from <i>Murex trunculus</i> (Volume I of my "Contribution ") show sky-blue purple	"Die Purpurzeichnungen des Lacazes' mittels Purpurs von <i>Murex trunculus</i> (I. Band von meinem "Beitrag") zeigen
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¹⁸⁵ Gaillardot, *ibid.*, p. 17.

¹⁸⁶ Baehr, Karl, *Symbolik des mosaischen Cultus*. Heidelberg, 183739, "תכלת."

in the assimilated areas."

himmelblauen Purpur an den imbibierten Stellen."

In another communication the learned porphyrologist points to those designs as illustrating the Talmudic statement that *Tekhelet* is like unto the sky. The colour, however, of those "imbibierte Stellen" ("imbibed places") is light sky blue (helles Himmelblau), not dark sky blue which is the colour of the cloudless Palestinian sky in bright sunshine but this is an objection of very little force. The phenomenon presented by those sky blue spots is, however, hardly comprehensive enough to satisfy the view advocating a pure blue for *Tekhelet*, that the *Murex trunculus* may be accepted without further ado as the *Tekhelet*-species. The sky-blue colouring in question is due to infiltration and the instability of the matter.¹⁸⁷ Cf. Lacaze-Duthier's statement with reference to the designs with pigment of *Purpura lapillus*.

F. Description of the Tekhelet-Hillazon in the Talmud.

Lacaze-Duthiers, indeed, states that in the course of his experiments one subspecies of *Murex trunculus* yielded a blue, but he adds that the same variety gave at another time a violet. He was unable to determine the cause of the variation. Should what I might call "the pure-blue theory" fix upon that subspecies as the *Tekhelet*-mollusc or as we would say in Hebrew the *hillazon-shel-Tekhelet*, (חלזון של תכלת), the identification would carry with it the corollary that, the ancients being aware, unlike Lacaze-Duthiers, of the cause of the deviation, knew how to make the pigment of the variety of *M. trunculus* produce a pure blue when they wanted to fabricate *Tekhelet* with it. Or, again, it might be possible for the pure-blue theory to admit *Murex trunculus* in general as the *Tekhelet* species but with the necessary limitation that the dye received certain treatment. This may have consisted in the arresting of the photographic development at the deep-blue stage, or in the admixture of certain drugs having the effect of deadening the red factor.

Professor Friedlaender, however, in one of his letters to me, asserts that with the species with the chemical constitution of whose dye he is acquainted, it is impossible to produce a pure blue. The statement covers *Murex trunculus*. Professor Raphael Dubois, on the contrary, states in a private communication to me, that it is possible by a certain artifice to produce a pure blue out of the

¹⁸⁷ Dr. Dedekind, however, also speaks of "wahres tropisches Himmelblau" from *M. trunculus* in his possession. See Beitrag I, p. 93. *Archives de Zoologie*, Paris (1896).

pigment of *Murex trunculus*. Whether this is possible or not, it is certainly impossible for a non-chemist like me to come to a definite conclusion where authorities differ.

At all events, the *Murex trunculus* has a strong claim upon our attention in this connection. As the principal centre of *Tekhelet* production as far as Jews are concerned is located by tradition in the territory of Zebulun which adjoined Sidon, the evidence in favour of *Murex trunculus* applies as much to the solution of the question with regard to Jewish as to Phoenician *Tekhelet* though I know of no distinct mention of *Tekhelet* in particular in connection with Phoenician industry.

The inquirer equipped with a knowledge of the experiments of Lacaze-Duthiers, of the discoveries of Wilde, deSaulcy, and Gaillardot and of the conclusions arrived at by Dr. Dedekind will go to the Talmud only for a confirmation of the identification of the *Tekhelet*-species with *Murex trunculus*. But there is a surprise in store for him.

ת"ר חלזון זהו גופו רוצה לים וברייטו¹⁸⁸ רוצה לדג עולה אחד¹⁸⁹ לשבעים שנה ובדמו צובעין

¹⁹⁰ תכלת לפיכך דמיו יקרין

"... This is the description of the *hillazon*:

- (1) its body (i.e. the colour of its body or shell) is like unto the sea;
- (2) its shape (or form) is like unto a fish, and
- (3) it comes up once in seventy years; and with its blood *Tekhelet* is dyed, wherefore it is very dear."¹⁹¹

The baraita is quoted with very slight variations in the Yalkut Shimoni:

תנו רבנו חלזון זו גופו דומה לים וכו' עולה אחת לשבעים שנה

The reading זו would seem to treat חלזון as of feminine gender though it is masculine throughout the rest of the passage as well as in all other texts when חלזון occurs.

It would seem that the original reading of the Yalkut was זהו. A copyist wishing to correct it after the reading of the Talmud placed a ו over the ה. Another scribe taking the ו as a correction of the ה

¹⁸⁸ Lewysohn wrongly renders "seine Entstehung" (op. cit., 1 c). In רש"י and רבנו גרשום and cf. נדה כ"ד ע"ב.

¹⁸⁹ Bochart wrongly renders: "unus solum in terram ascendit singulis sept. anni." אחד often stands for אחת ("one") in Tanaitic usage. Cf. *Yalkut* אחת.

¹⁹⁰ Riedel (l.c.) erroneously translates "deshalb ist sein Blut theur."

¹⁹¹ Menahot, 44a.

wrote זֶה. In any case the reading would bear its justification within itself; the noun *hillazon* comprising all kinds of shell snails. זֶה (zeh) (this species of *hillazon*) would be the proper word rather than זֶהוּ (zehu) (this *hillazon* this is its description) which might lead to the misunderstanding of the passage as applying to *hillazon* in general, and so turn the Talmudic description into a source of error for the ignorant and of amazement for the better informed. Yet the reading זֶהוּ may be original. The passage is doubtless an extract from a context dealing with *Tekhelet* and *hillazon-shel-Tekhelet* where of course there would be no room for mistake. In the Talmud also the description appears in close proximity to passages dealing with the *hillazon-shel-Tekhelet*. I would add, however, that the reading זֶה (zeh) has the support of no less an authority than Samuel b. Hofni (See my edition of the 9th chapter of his כתאב אחכאם שרע אל כחאב אחכאם שרע אל in the July number of the Jewish Quarterly Review 1914).

I entertain a strong suspicion that the original text of the description had neither זֶה nor זֶהוּ, but simply read חלזון גופו רוצה ובו' in the immediately preceding passage (in the original context) dealing with the dyeing of *Tekhelet* with the pigment of *hillazon*; there could have been no occasion for either of these particles. Thus in the Baraitha d'tzitzit (בריתא דציצית) where the description stands after the statement חלזון תכלת אלא בחלזון צובעין there is neither זֶה nor זֶהוּ.

דמיון דמיון לקריה in the masculine refers to the *hillazon*. Here Samuel B. Hofni may have preserved the original reading דמיה in the feminine, referring to *Tekhelet*.

The description is due of course to a Tanaitic source but it is difficult to fix the date of its formulation.

G. Speculations about the Cause Which Prompted the Formal Declaration of the Characteristics of the Tekhelet-hillazon.

What may have been the occasion of this formal declaration of the *hillazon*-tradition? Was it an attempt made in certain quarters to replace the traditional *hillazon-shel-Tekhelet* by some other species? Or does the baraita owe its origin to a desire on the part of the Jewish authorities to enlighten the general public with regard to the true nature of the *Tekhelet* dye in view of a widely prevalent error that kala-ilan (vegetable dyestuff producing a *Tekhelet*-like colour) might do for *Tekhelet* shel tzitzit? Or again, does the description simply represent an halakhah pure and simple taught in the academies as explanatory of the halakhah dating from hoary antiquity: תכלת אלא: "Tekhelet is not kasher (ritually fit), except if dyed with the blood of the *hillazon*"

There is, I think, some ground for supposing that the baraita represents an epistle sent to the diaspora (גולה) either for the purpose of enlightening extra-Palestinian Jewry, or in direct answer to the inquiry about the identity of the *hillazon-shel-Tekhelet*. The final statement לפיכך דמיו יקרים "Therefore (i.e., because of the rarity of the species) it (*Tekhelet*) is very dear" would have been a superfluity in an halakhah taught at a Palestinian academy. The hearers of the lecture would be as cognisant of the cause of the expensiveness of *Tekhelet* as the lecturer himself. In an ordinary discourse the point might well be mentioned but in a formal concise halakhah it would be rather out of place. If, on the other hand, the baraita was primarily intended for the information of the exiled communities, the case would be different. People buying at an exorbitant price *Tekhelet sheltzitzit* sent from the Holy Land might be eager to learn the reason of the high expensiveness of the article.

H. Description of the Tekhelet-hillazon in the Baraita d'Tzitzit.

The Baraita d'Tzitzit contains substantially the same description:

שאיין צובעין תכלת אלא בחלזון חלזון למה הוא.

בריייתו דומה לדג וגופו דומה לרקיע ואין עולה אלא שבע שנים

"... What is the *hillazon* like unto? Its shape is like unto that of a fish and its body (i.e., colour of body or shell) is like unto the sky, and it only 'comes up' once in seven years therefore is it very dear?"

The differences to be noted are:

- (1) characteristic (b) precedes (a);
- (2) the colour is likened to the sky not to the sea as in the Talmud;
- (3) the shorter number seven for seventy of the Talmud.

I. Detailed Study of the Talmudic Description of the Tekhelet-hillazon.

Which species of marine shell-snail is meant by the description thus recorded in the Talmud and the Baraita d'Tzitzit?

Before we attempt answering the question, it is of course absolutely essential to ascertain the exact import of each of the three elements which constitute the description.

(a) presents no serious difficulties: it refers to a dark blue or dark violet-blue resembling the colour of the Mediterranean or of the clear cloudless Palestinian sky in bright sunshine

(b) offers considerable difficulty. What is the exact delimiting force of this likening of the form of the *Tekhelet-hillazon* to a fish? In other words which species or genera of marine shell-snails are meant to be excluded by (b)?

It is clearly of vital importance to determine first of all the scope of application of the term *dag* (fish) in the Talmud. With reference to the concept "fish" in ancient classical literature Dr. L. Germain in reply to a question addressed by me says:

"Among the ancients, all animals that live in the sea were designed under the name of Pisces. Thus Pliny, after saying *Piscium quidam sanguine carent*¹⁹² which is an assertion at least bizarre, adds that there are 3 categories of Pisces: peas, soft (Mollia); Crustaceans (Crustacea); and testaces (testacea).

Aristotle is the only ancient author who clearly separated molluscs from fish. Among the Moderns, the term fish is restrictive and applies as you only know to marine or freshwater vertebrae whose type is, for example, salmon by eliminating all Crustaceans, Molluscs, Cephalopeds and others that are Invertebrates. "

"Chez les anciens on designait sous ce nom de Poissons tous les animaux qui vivent dans la mer. Ainsi Pline, après avoir dit *Piscium quidam sanguine carent*¹⁹² ce qui est une assertion au moins bizarre, ajoute qu'il y a 3 categories de Poissons: les Pois, mous (Mollia); les Crustaces (Crustacea); et les Testaces (testacea).

Aristote est le seul auteur ancien ayant nettement separé les mollusques des poissons. Chez les Modernes, le terme poisson est restrictif et ne s'applique comme vous savez qu'aux vertèbres marins ou d'eau douce dont le type est, par exemple, le saumon en éliminant tous les Crustacés, Mollusques, Céphalopodes et autres qui sont des Invertébrés."

¹⁹² Pliny, *ibid.*, book IX, ch. 44.

The Tanaites, as is clear from their likening of the figure of the *hillazon* to that of fishes, were not in this instance behind Aristotle. The Mishna (Kelim X, 1) distinguishes "fishes" (*dagim*) and "beasts of the sea" (*hayyot hayam*)¹⁹³ עצמות הדג... עצמות חיה שבים

R. Elijah Wilna (ib. אליהו רבה) strikes out חיה שבים on the ground that all marine creatures whatever their form are comprised in the appellation *dag*:

ול"ג עצמות חיה שבים כל שבים מין דג הוא כל דמות שתהיה לו

There is, however, no real ground for questioning the correctness of the text; characteristic (b) in the description of the *hillazon* shows clearly the inexactness of R. Elijah Wilna's sweeping generalisation. I doubt if the assertion really emanates from the celebrated "gaon of Wilna."

From the sporadic allusion to the nature and characteristics of fishes it is difficult to evolve a more or less clear idea of the type *dag* (fish) according to the Talmudic conception.¹⁹⁴

Maimonides distinguishes two classes of aquatic creatures:

1. *dagim* (fishes)

2. *sheretz hamayim* (שרץ המים), i.e., "creatures not of the shape of *dagim*."

איזהו שרץ המים אלו הבריות הקטנות כמו התולעים והעלוקה שבמים והבריות הגדולות ביתר שהן חיות הים כצמות של¹⁹⁵ בבל כל שאינו בצורת דג לא דג המא ולא דג טהור כגון כלב המים והדלפון והצפרדע וכיוצא בהן

This is not very helpful. It would appear, however, that in his conception the Gasteropoda and Cephalopoda, at least are comprised in the term *dag*. It is significant that in his description of the *Tekhelet-hillazon* Maimonides does not reproduce the Talmudic statement that the *hillazon* is like unto a fish, but says plainly that it is a species of fish. Nachmanides¹⁹⁶ seems to hold that all marine creatures furnished with legs in the manner of terrestrial animals are excluded from the category of *dag*.

¹⁹³ מצורע; שמיני, Sifra

¹⁹⁴ Cf. ירושלמי: כלאים, פרק א, הלכה ו'; בכורות ח ע"א; עבודה זרה מ ע"א. מררש רבא, בראשית, פרשה א; כלים פרק י; משנה א'; חולין קי"ב ע"ב; גדה מ ע"א רמב"ם כ"ב הלכות, מלאכות אסורות.

¹⁹⁵ שמיני. Nachmanides, *Comm, on the Pentateuch*, sect.

Would it follow according to Nachmanides that (b) should be understood as excluding the Gasteropoda to which belong the genera *Murex Purpura* and also *Janthina*? Is then the *hillazon-shel-Tekhelet* to be sought, according to Nachmanides, exclusively among the Cephalopoda? I very much doubt whether such is the import of (b). It should also be noted that דומה (*domeh*, "is like") is a relative term. It is scarcely possible to determine the degree of similarity demanded by (b).

Our search for the *hillazon shel Tekhelet* is thus hampered by an obscurity which is hard to dispel.

The last element also offers certain difficulties. ועולה אחד לשבעים שנה "it comes up once in seventy years." "oleh" (עולה) has been taken by some as meaning that the *hillazon-shel-Tekhelet* is not fished but is caught on the cliffs and rocks when it creeps up from the sea. This is, however, not warranted by the verb *alah* עלה. *Oleh* may well mean "is fished." Sabbath 74b refers to the manipulation of nets in fishing the *hillazon* in connection with the preparatory work for the construction of the Tabernacle.

Rashi explains the reference as applying to the *Tekhelet-hillazon*. But the Talmud has in view the *Argaman-hillazon*, of both species. Rashi reflects his interpretation of *Argaman* as only a colour designation with no restriction as to the origin of the dyestuff producing the particular colour.

Sabbath 26a referring to fishermen engaged in the catching of *hillazon* may likewise apply either to both species or to *Argaman* alone. It might be argued that since in the time of Raba or R. Ilai (to either of whom is ascribed the reference to the fishing of the *hillazon* quoted Sab. 74b) *Argaman* had long disappeared from religious use,¹⁹⁷ the *Tekhelet* rather than the *Argaman* species would be uppermost in the minds of students of the Torah when speaking of *hillazon* in connection with the Tabernacle or Temple; if therefore the *Tekhelet*-species were not secured by means of fishing, Raba or R. Ilai would have thought it necessary to add some such qualification as *shel Argaman* to *hillazon*. The argument, however, hardly possesses sufficient cogency to serve as a basis for our inquiry.

(c) "... once in seventy years". This appears very baffling on the face of it but in reality the statement should present no insurmountable difficulty. When in 1887 a certain R. Gershon Enoch

¹⁹⁷ Since the destruction of the Temple

Leiner embarked upon a hard search after the *Tekhelet-hillazon* he found his way blocked by (c). Science knows nothing of such a septuagenarian "appearance" of any of the denizens of the sea.

Apart from that it is not stated what date is taken as a starting point from which the periodicity is to be counted nor is there a record of the "appearance" of that rare species at a definite point of time which might serve us a base of calculation. Leiner¹⁹⁸ contends that though its "appearance" *en masse* would occur only once in seventy years it could be found in small quantities at any time.

In reality, however, the expression is simply an arithmetic hyperbole of the kind which is pretty common in the Talmudim and Midrashim. "Once in seventy years" amounts to saying that the species is caught at long intervals of time. The value of (b) is rightly estimated in his edition of the Baraitha d'Tzitzit.¹⁹⁹

(בגמרא שם הגירסא) שבעים שנה והוא אגדה. ובשבת אמרו לחרמים וליוגבים ומזה מוכח ר"ע שנה לאו דוקא.

His argument, however, from Sabbath 26a is pointless because the reference in that passage may be to the *Argaman*-species. Nebuzzadan would be as much interested in the fishing of the *Argaman-hillazon* as in that of the *Tekhelet* species. Perhaps his interest would be centred in the former rather than in the latter species.

Owing to the absence of a distinct mention in Talmudic literature of *hillazon* in connection with *Argaman*, Jewish writers, generally speaking, laboured under the misconception that *Argaman* was not of *hillazon* origin.

The Baraitha d'Tzitzit has "once in seventy years" which being the more sober number is probably the original one. "Seven years" is likewise a round number; strict periodicity is hardly to be thought of.

It should be carefully noted that the Talmud does not attribute the expensiveness of *Tekhelet* to the fewness of the individuals constituting the *Tekhelet*-species but to the rare "appearance" of individuals belonging to that variety of sea-snail. When the "appearance" does take place it may be a very numerous one.

¹⁹⁸ לינר גרשון חנוך, שפוני סמני חול. וארשא תרמ"ז (1887) ע"א¹⁹⁸.

¹⁹⁹ (שבע מסכתות קטנות ירושלמיות ... (עורך) רפאל בן קיר כה"ם פרנקפורט א"מ תר"א (1851).

J. Identification of the Tekhelet-hillazon according to the Talmud;
Correspondence between the Present Writer and Dr. L. Germain of the
Department of Malacology, Museum National d'Histoire Naturelle (Paris).

It is, as already explained, very difficult to determine the exact value of (b); but whatever genera or orders of marine forms of life may be meant to be excluded, it is not unlikely that, to say the least, the exclusion does not comprise all the species belonging to the Gasteropoda and the Cephalopoda. In making our search among these classes of Mollusca we are limited by the consideration that the species sought must be a Mediterranean one. This somewhat narrows the area of research and so, to some extent lightens our task. The first species to occur to the mind is of course *Murex trunculus* which, if we had no traditional description of the *Tekhelet-hillazon*, we should not have hesitated for a moment to suggest as the most probable identification. But *Murex trunculus* fails, in the first place, to satisfy characteristic (a). The shell of *M. trunculus* is brownish white; the colour of the animal is dirty whitish speckled with brown and yellow; the operculum is reddish brown.²⁰⁰

It does not satisfy (c) either, even after the indication has been stripped of its hyperbolic clothing. That it satisfies (b) is also not entirely free from doubt.

The shell of a certain variety of *Murex brandaris* is of a blue colour not unlike the colour of the Mediterranean sea.²⁰¹ *Murex brandaris*, however, gives rather red purple, or *Argaman*.

The colour of the shell, by the way, is hardly what (a) requires. גופו "gupho" means the colour of the animal rather than that of the shell.

In most mollusca the colour of the body is rather whitish or yellowish.

The *Purpura patula* very nearly satisfies (a) and enjoys the additional distinction of belonging to a genus one species of which, at least, is known to have been anciently used for purple-dyeing.

It is also said to be rarely met with.

²⁰⁰ Pali, *Testacea utriusque Sicilidae* (1795), Pl. XLIX, fig. 7.

²⁰¹ Martini, Friedrich, *Neues Systematisches Conchyliencabinet*, Nürnberg (1769-1829), v.III, Table 115, fig. 1064.

"The animal (i.e., *Purpura patula*) differs from the previous ones in that its color is darker and pulls on purple ..

This coquillage is quite rare; we see it on the rocks of Cape Manuel... When the operculum of this animal is pressed a little after it has entered its shell, it renders a fairly large amount of liquor that is initially greenish and becomes dark purple as it dries out. It is known that this property is common to most species of this genus."

"L'animal (i.e., *Purpura patula*) diffères des précédents en ce que sa couleur est plus foncée et tire sur le violet ..

Ce coquillage est assez rare; on le voit sur les rochers du cap Manuel... Lorsqu'on presse un peu l'opercule de cet animal après qu'il est rentré dans sa coquille, il rend une assez grande quantité de liqueur qui est d'abord verdâtre et qui devient pourpre foncé en se dessechant. On sait que cette propriété est commune à la plupart des espèces de ce genre."²⁰²

May not (c) mean that the species usually very sparsely represented is at some rare occasions found in greater abundance?

Another point to be noticed is that there is nothing in the Talmud indicating the minuteness of the purpurigenic liquor secreted by the *Tekhelet* species. It is to the paucity of the dye-secretion in the purple snails that the expensiveness of purple is attributed in ancient authors.²⁰³ In the Talmud on the other hand, the preciousness of *Tekhelet* is ascribed solely to the rare "appearance" of the animal. This would seem to imply that the colouring matter in the *Tekhelet* species was not so very small. In *Purpura patula* this is indeed the case. (Cf. above "une assez grande quantité de liqueur (a fairly large amount of liquor).") Does the colour of the final development of its pigment also go to support the suggestion of *P. patula* as the *hillazon-shel-Tekhelet*?

An almost fatal objection against *Purpura patula* is offered by the fact that the species is a non-Mediterranean one. But may not *P. patula* though no longer known to live in the Mediterranean have lived in that sea along the Syrian coast until some 13 centuries ago or so?

²⁰² Adamson, Michel, *Histoire Naturelle du Senegal, Coquillages*, Paris (1757), p. 106.

²⁰³ Pliny, *ibid.* Bk. IX, ch. 46: "liquoris hic minimi..."

May not the final disappearance of the species from that region have been the real cause of the extinction of *Tekhelet*? This is extremely improbable if not utterly impossible.

A passage in the Sifre almost seems to indicate that the *hillazon* finally disappeared altogether, the fact being ascribed to the desire on the part of the Almighty to reserve the precious species for the use of the righteous in the Messianic age. "R. Jose said, Once in walking from Kezib to Tyre I met a certain old man. I greeted him and asked him 'What are you gaining your living from?' He said to me: 'From the *hillazon*.' I said to him: 'Is it often found?' He said to me: 'By Heaven, there is a certain place in the sea where it (scilicet: the *hillazon*) is cast on mountains and lizards strike it and it dies and melts (or rots) away on the spot.' I thereupon said to him: 'By Heaven it is a souvenir which has been stored away for the righteous in the World to Come.'"

A variant reading which I prefer has: "it is shown (*by this fact*) that it (the *hillazon*) has been stored away for the righteous in the future time" (the Messianic age). That the passage refers to the *Tekhelet-hillazon* is clear from the context.

When the old man says that he makes his living from the *hillazon* without any limiting epithet he has only the *Tekhelet-hillazon* in view; for the *Argaman-hillazon* had little interest for Jews in R. Jose's time. Imagination pictures the righteous (צדיקים) in the Messianic age clad wholly in *Tekhelet*, the colour recalling the sky and the Throne of Glory. Compare Baba Batra 74a דעתירה דשריא תכילתא לאריקאי לעלמא ראתי.

Does the expression "it is hidden" or "has been hidden" imply that the *hillazon-shel-Tekhelet* was not to be had in R. Jose's days? But R. Jose lived centuries before the disappearance of *Tekhelet shel Tzitzit*! The passage perhaps admits of a satisfactory explanation. The rareness of the appearance of the *hillazon* would be generally ascribed to the fact that the species rarely visited the Palestinian waters. On being told by the "old man" that the *hillazon* was often cast ashore upon a certain out-of-the-way island, R. Jose inferred that the rareness in question was a special dispensation of providence. In the Messianic age the *hillazon* would appear in abundance in order to enable the just to clothe themselves wholly in *Tekhelet*.

If for the present all hope is to be abandoned of rediscovering the *hillazon-shel-Tekhelet* in some species of the genera *Murex* and *Purpura* we could do worse than suggest the *Janthina* as a not improbable identification. The identification readily occurred to me on beginning the study of the subject. I was glad to find afterwards that I had been anticipated by Gesenius. On further

investigation I came across²⁰⁴ certain objections against the identification with *Helix janthina* in particular. In order that I might be able to walk on firmer ground I forwarded a copy of notes prepared by me on the identification of the *Tekhelet-hillazon* to Professor Joubin, Professor of Malacology at the Museum National d'Histoire Naturelle. The learned professor handed over my manuscript to Dr. L. Germain, Dr. des Sciences, *preparateur* at the Museum. The following is the text of Dr. Germain's reply with reference to the identification of the species employed according to the Talmud for the dyeing of *Tekhelet*:

"HYACINTH"

The only molluscs in the Mediterranean that can provide a blue dye are the Janthines. These animals are few in number in species. The type is Lamarck's *Janthina communis*... which is Linne's *Helix janthina*. But this species does not live in the Mediterranean. The Janthines that inhabit this sea belong mainly to the following two species: *Janthina pallida* de Harvey and *Janthina prolongata* de Blainville.

As you have seen from the texts quoted by you (p. 6 of your manuscript), these animals abundantly provide a bright and brilliant purplish blue coloring liquor.

The peculiarities attributed to the hillazon

"HYACINTHE"

Les seuls Mollusques de la Méditerranée qui puissent fournir une teinture bleue sont les Janthines. Ces animaux sont peu nombreux en espèces. Le type est le *Janthina communis* de Lamarck²⁰⁵... qui est l'*Helix janthina* de Linne.²⁰⁶ Mais cette espèce ne vit pas dans la Méditerranée. Les Janthines qui habitent cette mer appartiennent surtout aux deux espèces suivantes: *Janthina pallida* de Harvey²⁰⁷ et *Janthina prolongata* de Blainville.²⁰⁸

Ainsi que vous l'avez vu par les textes cités par vous (p. 6 de votre manuscrit) ces animaux fournissent abondamment une liqueur colorante bleue violacée vive et brillante.

²⁰⁴ Lewysohn, *ibid*.

²⁰⁵ Lamarck, Jean Baptiste, *Histoire Naturelle des Animaux sans vertèbres*, Paris (1822), v.VI, part II, p. 206.

²⁰⁶ Linné, Carl von. *Systema Naturae*. 13th ed. Wien (1767-70), p. 1246.

²⁰⁷ Thompson, *Ann. Natur. History* (1846), II, fig. 6.

²⁰⁸ *Dictionn. hist, natur* (1822), XXIV, p. 156.

by the Talmudic tradition are, I believe, at least largely due to the *modus vivendi* of the Janthines. These animals are pelagic that is to say that they inhabit almost continuously the high seas on the surface and that, in any case, they never live fixed to the shore like the Purples, the Murex, etc ... They stand on the surface of the waters, despite their light shell but nevertheless of an appreciable weight thanks to a float where they stick their eggs. Their coloration is a beautiful purplish blue, which can be easily confused with the color of the sea.

Finally, you will immediately see the importance of this last remark as a large number of pelagic animals, Janthines for some years are extraordinarily abundant, while in previous years they were rare or even very rare. When they are very abundant, the blows of the sea, even if not very violent, throw them back in large quantities on the shore where they are very easily collected, if still alive. It is undoubtedly to this peculiarity, which must not have escaped the inhabitants, that we must attribute the septuagenarian periodicity of the appearance of the *hillazon* of which the Talmud speaks. But this periodicity is not in regular reality: the truth is that, starting from a year when

Les particularités attribuées au *hillazon* par la tradition Talmudique tiennent, je le crois, du moins, en grande partie au *modus vivendi* des Janthines. Ces animaux sont *pélagiques* c'est-à-dire qu'ils habitent presque continuellement la haute mer à la surface et que, dans *tous les cas*, ils ne vivent jamais fixés au rivage comme les Pourpres, les Murex, etc... Ils se tiennent à la surface des eaux, malgré leur coquille légère mais cependant d'un poids appréciable grâce à un flotteur où ils collent leurs oeufs. Leur coloration est d'un beau bleu violacé, qui se confond assez facilement avec la couleur de la mer.

Enfin et vous verrez de suite l'importance de cette dernière remarque comme un grand nombre d'animaux pélagiques, les Janthines sont certaines années extraordinairement abondantes, alors que les années précédentes elles étaient rares ou même très rares. Quand elles sont très abondantes, les coups de mers, même peu violents, les rejettent en grande quantité sur le rivage où elles sont très facilement recueillies, même encore vivantes. C'est sans doute à cette particularité qui n'avait pas dû échapper aux habitants qu'il faut attribuer la périodicité septuagénnaire de l'apparence du *hillazon* dont parle le Talmud. Mais cette périodicité n'est pas en

the Janthines are very abundant, we see for several years (3, 4 or 5 years, sometimes even more) these animals become much rarer, to be again extraordinarily common during a new season and so on.

I forgot to tell you that the 2 Janthines mentioned above living on the coast of Syria, including *J. prolongata* Blainville which provides the most abundant dye, The objections drawn from the authors cited by you (pp. 6 and 7 of your work) against this identification of the hillazon do not stand up to scrutiny since they are based on the Linnaeus *Helix janthina*, which is Lamarck's *Janthina communis*, a species that does not live in the Mediterranean."

réalité régulière: la vérité est que, en partant d'une année où les Janthines sont très abondantes, on voit pendant plusieurs années (3,4 ou 5 ans, parfois même davantage) ces animaux devenir beaucoup plus rares, pour être à nouveau extraordinairement communs pendant une nouvelle saison et ainsi de suite.

J'oubliais de vous dire que les 2 Janthines citées précédemment vivant sur les côtes de Syrie, notamment *J. prolongata* Blainville qui fournit le plus abondamment la teinture. Les objections tirées des auteurs cités par vous (p. 6 et 7 de votre travail) contre cette identification du *hillazon* ne résistent pas à l'examen puisqu'elles sont basées sur *l'Helix janthina* Linné, qui est la *Janthina communis* de Lamarck, espèce qui ne vit pas dans la Méditerranée."

In the manuscript referred to by Dr. Germain I based the claims of *Janthina* upon four grounds.

1. it satisfies (a);
2. it gives a violet-blue dye;
3. it is rare in the Mediterranean;
4. its dye-secretion is fairly abundant in quantity. In *Janthina prolongata* the secretion in fact amounts to an ounce.

Dr. Germain's initial assertion: "Les seuls Mollusques de la Méditerranée qui puissent fournir une teinture bleue sont les Janthines (The only molluscs in the Mediterranean that can provide a blue dye are the Janthines)" makes the case for *Janthina* exceedingly strong. Thus according to Dr. Germain even if we had not the traditional description of the *Tekhelet-hillazon* we should have

had no other choice but *Janthina*. The element of blue in the pigment of *Murex trunculus* does not, it would seem, appear to my learned correspondent sufficiently pronounced to establish the claim of the species to the identification in question. Here, of course, comes in the question of the determination of the *Tekhelet*-colour. The subject will be treated later, but I may say here that Dr. Germain's conception of the *Tekhelet*-nuance is in harmony with the trend of Jewish tradition. The pure-bluish will be very nearly satisfied. As Dr. Germain describes the dye as "teinture bleue (blue dye)" at the outset of his instructive reply, his later definition of the colour as "bleu violacé (purplish blue)" need not trouble much the pure-blue theory. The colour according to him would seem to be distinguishable from blue only with a certain amount of difficulty. It can also easily be turned into a pure blue.

"By ammonia oxolate it gives a precipitate ... of a dark blue color and by silver nitrate a very pleasant blue ash color."

"Par l'oxolate d'ammoniaque elle donne un précipité ... d'un bleu foncé et par le nitrate d'argent une couleur de cendre bleue très agréable."²⁰⁹

(c) is admirably explained by Dr. Germain. We should read with Baraita d'Tzitzit *seven* instead of *seventy*. As the interval varies between 3 to 5 or 6 years, "seven" roundly describes it.

No evidence has hitherto been found of the employment of the *Janthina* in ancient dyeing, but too great stress need not be laid upon the point. In view of the rarity of the occasions on which the species could be secured, no serious objection should be drawn from the absence of remains of *Janthina* shells on the sites of former dyeing establishments on the Phoenician coasts. Of the species *known* to have been used by the Phoenicians in purple-dyeing, the one which furnishes a dye answering at least to some extent to the tradition of the *Tekhelet* nuance is none other than the *Murex trunculus*. Did the Jews then, employ for the dyeing of *Tekhelet* a species of mollusc different from the one used by the Phoenicians for the manufacture of their *Tekhelet*? Granting

²⁰⁹ Lesson, René, "Voyage autour du Monde," *ZoologieU*, Paris (1826), p. 367 "Janthina prolongata."

that such was the case what explanation could we offer for this deviation? Was the Jewish *Tekhelet* different in nuance from that of the Phoenicians?

But the rendering of *Tekhelet* by *Iakinthos* in the LXX, in Philo, in Josephus, etc.... certainly disproves any such assumption. This Hellenic designation of the fabric most certainly was not confined to *Tekhelet* of Jewish provenance. Or was the difference between the Jewish and the Phoenician practice due to a change on the part of the latter? *Tekhelet* dyeing on the earliest times had been confined to the *Janthina* pigment; while the Phoenicians at a certain point of time abandoned the *Janthina* in favour of the *Murex trunculus*, the Jews continued to adhere exclusively to the former. For ritual *Tekhelet* the Law required cloth dyed with the *Janthina* pigment because the dyeing with it was believed to go back to Mosaic times, while the *Tekhelet* from *Murex trunculus* was looked upon as post-Mosaic. The hypothesis is, I think, hardly tenable. In the Talmud mention is made only of *kala-ilan*, a certain colour produced from a vegetable stuff, as an inadmissible substitute for ritual *Tekhelet*. Again, the tests prescribed for ascertaining the genuine character of a given sample of *Tekhelet* would have little meaning on that hypothesis. How could it be ascertained by means of the tests that the *Tekhelet*, though not *kala-ilan*, was dyed with the pigment of the *hillazon-shel-Tekhelet*, and not with that of *Murex trunculus*? Here, however, there is a loophole of escape for the hypothesis in question, should the dye of the *Janthina* prove to be faster than that of *Murex trunculus*; for then the tests might well distinguish *Tekhelet* dyed with *Janthina* from that dyed with *M. trunculus*. It may also be worth remarking that as the pigment of *Murex trunculus* is *not* fast to washing while the *Tekhelet*-dye, according to the Talmud, appears to possess greater fastness than indigo which is fast to washing, it follows that the *Tekhelet* secretion is faster than that of *Murex trunculus*. As, however, we do not know the exact nature of the drugs with which the *hillazon* secretion was mixed in the manufacture of *Tekhelet*, we cannot confidently assert that the *Tekhelet* pigment, whatever it may be, is faster than that of *Murex trunculus*.

An alternative hypothesis suggests itself: under the stress of the imperial legislation ever narrowing the use of purple, and monopolising its manufacture for the government, the production of *Tekhelet* with *Murex trunculus* became increasingly difficult and even dangerous for the Jewish dyers. Under these circumstances the Jews adopted *Janthina*, a species not envisaged by the imperial legislation, as a substitute for *Murex trunculus*.

This suggestion, too, cannot stand anything like a close examination. If such were the case the Talmud would have recorded descriptions of both *M. trunculus* and *Janthina*, or it would have indicated somehow that *Tekhelet* might be produced from another species than the one described. Besides, there is no trace whatever of a break in the *hillazon* tradition, nor is it at all likely that such a change would take place at so late a period as that which is required by the exigencies of the hypothesis.

The only alternative left is the supposition that all *Tekhelet* (*Iakinthos*) whether Jewish or Phoenician was dyed with the pigment of a species not used in purple dyeing in the stricter sense: This species, according to indications supplied by Jewish tradition may perhaps be the *Janthina* (i.e., *Janthina prolongata* Blainville and *Janthina pallida* Harvey. Cf. Dr. Germain).

Some explanation should be given of Dr. Germain's statement:

"The objections drawn from the authors cited by you (pp. 6 and 7 of your work) against this identification of the hillazon do not stand up to scrutiny since they are based on the Helix Janthina Linnaeus which is Lamarck's Janthina communis, a species that does not live in the Mediterranean."

"Les objections tirées des auteurs cités par vous (p. 6 et 7 de votre travail) contre cette identification du *hillazon* ne résistent pas à l'examen puisqu'elles sont basées sur l'*Hélix Janthina* Linné qui est la *Janthina communis* de Lamarck, espèce qui ne vit pas dans la Méditerranée."

In the manuscript to which Dr. Germain refers, I said: "Lewysohn²¹⁰ raises two objections against the identification of the *hillazon-shel-Tekhelet* with the *Helix Janthina*:

"About the extraction of the juice, Sabbath 75a reported that the snails were

"Über die Gewinnung des Saftes wird Sabbat 75a berichtet dass man den

²¹⁰ Lewysohn, *ibid.*, p. 281, Par. 365.

squeezed out of the juice, noting that the juice of a vividly crushed snail is clearer and more valuable. - From this goes here that the talm. snail not the *Helix* *Janthina*... because on the one hand you only get the purple of this snail when you put it on glowing coals and on the other hand the juice of this animal, as long as it lives, is green or white; only when it dies does it get a beautiful purple-like color

Schnecken den Saft ausquetschte, wobei bemerkt wird, dass der Saft einer lebendig zerquetschten Schnecke klarer und werthvoller ist. - Hieraus geht hier dass das talm. חלזון (*hilazon*) nicht die *Helix* *Janthina*... sein kann, denn einerseits gewinnt man den Purpur dieser Schnecke erst, wenn man sie auf glühende Kohlen legt andreseits ist der Saft diese Tieres, so lange es lebt, grün oder weiss; erst wenn es stirbt bekommt es eine schöne Purpur ähnliche Farbe."

The passage referred to by Lewysohn really requires elucidation.

ת"ר הצד חלזון וכו' וליחייב נמי משום נתילת נשמה נשמה...

כל כמה ראית ביה נשמה טפי נחש ציה כי היכי דליצל צבעיה

"... the longer the *hillazon* retains its life, the better pleased is he who tries to extract its dye for then its pigment will produce a brighter hue."²¹¹ The readings vary between דליצל "in order that it be bright" (or splendid), and דליצלה ... "that it be successful."

Dr. L. Germain to whom I forwarded a translation of the above Talmudic statement says in his reply with reference to this point:

Pliny and Aristotle are absolutely right; living Purples and Murex give a much higher coloring lique than that provided by dead animals. "

"Pline et Aristote ont parfaitement raison; les Pourpres et Murex *vivants* donnent une liquer colorante bien supérieure à celle fournie par les animaux morts."

²¹¹ Shabbat 75a.

This of course applied to the Talmud as well. The matter, however, is not quite clear to me. Aristotle, who is blindly followed by Pliny, informs us that "those who collect the flower (i.e, dye-secretion) of the *hillazon* endeavour to bruise them while they are alive, for if they should die before they are bruised they cast out the flower together with their life."²¹² Aristotle, it is thus seen, does *not* really say that the quality of the dye varies according to whether the dye was extracted before or after the animal's death.

The Talmud, on the other hand, states a fact of which apparently no mention is made by Aristotle.

Does the *Janthina* satisfy Sabbath 75a? Or does the passage in question refer only to the *Argaman*-species? The first question I must leave for the present unanswered. With regard to the second, I should say that *prime facie* (based on the first impression) one would be inclined to say that the text has in view both species, but it is really difficult to decide the point.

With regard to the fastness of the dye of *Janthina*, Dr. Germain states in one of his replies to me:

"We do not know anything at present about the inalterability of the colouring liquor of *Janthina*. However, it is extremely likely that its dye has the same properties as that derived from *Murex* and *Buccina*."

"Nous ne savons rien, actuellement, d'absolument précis en ce qui concerne l'inaltérabilité de la liqueur colorante de la *Janthina*. Il est cependant extrêmement probable que se colorant possède les mêmes propriétés que celui tiré des *Murex* et des *Buccina*."

K. Description of the Tekhelet-Hillazon in Maimonides' Code.

Maimonides' description of the *hillazon* is noteworthy in itself and also because of its association with a movement for the restoration of *Tekhelet-shel-sisit* after centuries of desuetude.

²¹⁴והוא דג שדומה עינו לעין התכלת ודמו שחור כדיו ובים מלח²¹³ הוא מצוי

²¹² Aristotle, *Historia Animalium*, Bk. V, ch. 15.

²¹³ The Arabic designation for the sea in general: ים המלח; אל בחר;

²¹⁴ Maimonides, *ibid.*, *hillazon*, *tzitzit*, II, 1.

"It is a species of fish the colour of which resembles that of *Tekhelet* and its blood is black like ink and it is found in the salt-sea" (i.e., not in sweet water). By the "blood which is like ink," Maimonides doubtless understands the dye-secretion of the species. Maimonides, it will have been observed, makes no mention of the septuagenarian or septennial "appearance" or "coming up" of the *hillazon*. His severe critic R. Abraham b. David whose wont it is to challenge the slightest deviation of Maimonides from the Talmud here maintains complete silence. Again the indication concerning the inklike blackness of the "blood" is not traceable, so far as I know, to any traditional source. Here too R. Abraham b. David's silence is significant. It would seem that in scientific matters Maimonides' critic fully recognised his (Maimonides') superiority.

L. Identification of the Tekhelet-hillazon as Described by Maimonides.

Michaelis identifies Maimonides' *hillazon* with *Sepia loligo*.²¹⁵ Lewysohn apparently unaware of Michaelis' attempt explains the description as applying to *Sepia officinalis*, commenting at the same time very adversely upon Maimonides' view: the colour obtained with the *Sepia* secretion is brown or black-brown whereas *Tekhelet* according to the Talmud was sky-blue; the colour of the shell of *Sepia officinalis* is white throughout, that of the body is whitish punctuated red.

Thus, says Lewysohn, neither the colour of the dye of *Sepia officinalis* nor that of its body or shell answers to the identifications given in the Talmud.

"Auch die weitere Angabe Maimunis', (Also the further indication of Maimonides)', " Lewysohn declares,

²¹⁵ Michaelis, *Lexicon*, "תכלת".

"that the blood of the squid is black is inaccurate, because its blood is white, and only in the abdomen is the bladder filled with black liquid. - Finally, this fish, although most common in the Mediterranean seas, but also in all lakes 'he is much less precious; then Zebulun would not have possessed such a valuable sea treasure as is shown in the possession of the חלזון."	"dass das Blut des Tintenfisches schwarz sei, ist ungenau, denn sein Blut ist weiss, und nur im Unterleib befindet sich die mit schwarzer Flüssigkeit angefüllte Blase. - Endlich ist dieser Fisch, obwohl am häufigsten im mittelländischen Meere, doch auch in allen Meeren vorhanden; er ist viel weniger kostbar; es hätte dann Sebulon keinen so werthvollen Meerschatz, wie er im Besitze des חלזון dargestellt wird, besessen."
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Anent (concerning) the colour of *Sepia*, I should mention that the identification with *Sepia loligo*, adopted by Michaelis, enjoys the advantage of being able to point to Voigt (Mollusken) as the authority for the statement that the animal is "blau rot punktiert (blue red dotted)." In charging Maimonides with exactness for saying דמו שחור וכו' "its blood is ink-black" shows clearly that he has misunderstood the codifier's meaning. In the Talmud as in Maimonides' code the dye secretion is termed דם "blood."²¹⁶

Having identified Maimondes' *Tekhelet-hillazon* with *Sepia officinalis* Lewysohn was fully within his rights when he tried to point out the untenability of what he thought to be the Maimunistic theory, but when, however, he ventured to suggest the source of Maimonides' "error" he must have forgotten that he was dealing with one of the deepest and most careful thinkers that ever lived.

"Then, as Landau rightly pointed out, a reading place in LXX hivizu would have given permission. These translate namely	"Alsdann möchte, wie Landau richtig bemerkt eine Lesort in LXX hivizu Veranlassung gegeben haben. Diese
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²¹⁶ Cf. Aristotle, Pliny and Vitruvius.

B.M. 4: 7 blue by oloporhyron d.i. very purple; another reading but loud oloporphyron, and allerdings means the juice".	übersetzen nämlich B.M. 4:7 תכלת durch oloporhyron d.i. ganz purpurn; eine andere Lesart aber lautete oloporphyron, und allerdings heisst der Saft des Tintenfisches olos."
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One feels almost amused. In the first place it is extremely doubtful whether Maimonides had a first hand acquaintance with the LXX. Granting that he read the LXX in Greek, would he have allowed himself to be guided by a single exception? Would it not occur to him that the Greek text might be corrupt?

M. G.E. Leiner's Supposed Rediscovery of the Tekhelet-hillazon in *Sepia officinalis*.

In 1887 R.G.E. Leiner, of whom much will be said afterwards, fired by the ambition of becoming the restorer of *Tekhelet* published a pamphlet entitled שפוני טמוני חול in which he gave an exposition of the data relating to the identification, suggesting at last that the *Sepia officinalis* seemed to be the *Tekhelet*-species. In a booklet פתיל תכלת published shortly afterwards he tried to fortify his position, adducing arguments which he thought were strong enough to disarm all opposition.

I forbear examining his thesis in detail. Suffice it to say that Leiner started with the wrong assumption that all references to *hillazon* apply exclusively to the *Tekhelet*-species.

One argument in particular which Leiner regarded as irrefutable has not indeed a grain of cogency: (a) R. Nachshon Gaon²¹⁷ in a responsum gives למאסמא (*l'masma*) as the Arabic equivalent of *Tekhelet*; (b) in the Hebrew translation of Ibn Sina's compendium of medicine it is stated that the bone of the *hillazon* called in Latin למאסיא (*l'masia*) is used for medicinal purposes; (c) the species so employed is none other than the *Sepia officinalis* and since *l'masia* = *l'masma* = *Tekhelet* - ergo, the *Sepia officinalis* is the *Tekhelet*-species.²¹⁸

²¹⁷ עיתור הלי ציצית

²¹⁸ לינר פתיל תכלת ע' 27

Needles to say למאסיה is not to be transcribed by *l'masia* but by *limacia*, plural of limax, snail. למאסמא denotes the colour of the sky, sky-blue.²¹⁹

Lewysohn states that the *Sepia officinalis* does not satisfy the condition of similarity of the colour to the sea. Leiner maintains that it does, or in other words, that the colour of the body of *Sepia officinalis* is essentially *blue*.²²⁰

Dr. Germain may be allowed to decide the question:

It is impossible to accept that the color of <i>Sepia officinalis</i> L. satisfies the condition of similarity with the color of the sea. Although, thanks to special organs, called chromatophores and spread throughout almost the entire extent of the skin, <i>Sepia officinalis</i> can vary, at its will, the color of its body, it can not obtain a general color similar to that of the sea; it is above all possible for him to mimic the appearance of the bottom on which he swims or to simulate with more or less accuracy the rocks or algae on which he stands in ambush."	"Il est impossible d'admettre que la couleur de <i>Sepia officinalis</i> L. satisfasse à la condition de similarité avec la couleur de la mer. Bien que, grace à des organes speciaux, appelés chromatophores et répandu dans presque toute l'étendue de la peau, le <i>Sepia officinalis</i> puisse faire varier, à sa volonté, la couleur de son corps, il ne peut obtenir une couleur générale semblable à celle de la mer; il lui est surtout possible de mimer l'aspect du fond sur lequel il nage ou de simuler avec plus ou moins d'exactitude les rochers ou les algues sur lesquels il se tient en embuscade."
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The only serious ground for identifying the Maimunistic *hillazon* with *Sepia officinalis* is the indication about the ink-like blackness of the dye-secretion. It seems to me, however, highly improbable that Maimonides interpreted the Talmudic description of the *hillazon* as applying to *Sepia*. Nor can it be supposed that the great codifier simply followed a tradition recorded in an

²¹⁹ Jepheth the Karaite's commentary on the Pentateuch, section מ"מ. Ms. copy, Bibliothèque Nationale, Paris: כי תפסיר תכלת קאלקוס אנה איסלון מן מזומן אלצבע והו אלאסממוני

²²⁰ לינר, שם, מבוא.

old source no longer extant. In view of all that has been said, it is clear that *Sepia officinalis* cannot be the species anciently used for *Tekhelet* dyeing. Maimondes' description represents, I think, a combination of the Talmud with Aristotle.

The great codifier would seem to have had no first hand knowledge of the purple-giving species. The indication about the blackness of the dye would seem to be derived from Aristotle.²²¹

N. The Possibility of Textual Corruption in the Talmudic Description of the Tekhelet-hillazon.

It is sorely disappointing to be told that the striking researches and discoveries which have thrown so much light on the subject of ancient purple dyeing fail to afford us the key to the solution of the problem presented by the Talmudic description of the *hillazon-shel-Tekhelet*. The only escape from the difficulty, however, is recourse to textual emendation. Lewysohn identifying the *Tekhelet*-species with Pliny's *Purpura*, which, by the way, he wrongly equates with the *Purpura* of modern zoology emends גופו i.e. the colouring matter, for גופו, "the body" in characterisation (a). The correction, besides lacking the support of any authority, is really inadmissible; גופו does not mean colouring matter but colour, appearance.²²² If in the text גופו would have the same significance as מופו, that is, the colour of its body. Kohut²²³ entirely misinterprets גופו.

Raphael Rabinowicz²²⁴ mentions the omission of גופו in a single manuscript. Working on the basis of the variant reading we might suggest that (1) the original text read: חלזון רמו דומה לים i.e. its blood is like unto the sea, (2) the omission of דמו was occasioned by the graphic similarity of the two words; (3) גופו was afterwards inserted to complete the sense.

Once we have substituted "damo domeh l'yam" דמו דומה לים "its blood (dye secretion) is like unto the sea" for gupho, etc. ... "its body is like unto the sea," we have thrown the door wide open for the admission of the old favourite *Murex trunculus*, though (c) at any rate may still occasion some difficulty. Compare Professor Friedlaender²²⁵

²²¹ Aristotle, *ibid.* Bk. V, ch. 15.

²²² e.g., ע"ב, ע"ב.

²²³ *Aruch*, Completum, s.v. חלזון.

²²⁴ ארביניביץ, רפאל נתן, דקדוקי סופרים. מינכן, תרכ"ח-ע תרנ"ז. (1868—1897) מנחות מ"ד, א.

²²⁵ Friedlaender, *ibid.*, p. 7.

"... and a look at the illuminated glands of the Murex trunculus also shows us that the 'purple sea' means a poetic hyperbola."	"... und ein Blick auf die belichteten Drüsen von Murex trunculus zeigt uns man auch, dass das 'purpurne Meer' eine dichterische Hyperboi bedeutet."
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But to build a scientific identification on an hypothetical reading based upon the very doubtful authority of a single manuscript is like "trusting on yon cracked reed-staff, which if a man lean on it, will enter into his hand and pierce it."²²⁶

VI. TEKHELET AS A COLOUR DESIGNATION

A. The Greek Equivalent of Tekhelet and Argaman Respectively in the LXX.

In the LXX, the oldest Greek translation of the Bible, *Tekhelet* is rendered by *Iakinthos*, *Argaman* by *Porphyra*. A single exception has been pointed out:²²⁷ Numbers 4, 7 where *Iakinthos* represents beged *Tekhelet* (a garment of *Tekhelet*) of the Hebrew. On closer examination, however, the discrepancy vanishes altogether. The Greek version obviously reflects a Hebrew original differing from the Masoretic text: *olo* has nothing corresponding to it in our Hebrew copies. Is it not highly probable that the original lying before the translation had here beged kelil *Argaman* בגד כלייל ארגמן? This is otherwise apparent; for it is scarcely imaginable that the translator engaged upon rendering the highest literary treasure of his nation would work so arbitrarily as to put *Porphyros* a word used by him several times in this chapter as the Greek equivalent of *Argaman* for *Tekhelet*, an expression rendered by *Iakinthos* throughout the rest of this very chapter. In our Hebrew text, it may be passingly noticed, כלייל never occurs in association with ארגמן. In verse 13, where the Septuagint otherwise exhibits traces of a variant original, Imagys oloporphyron stand for our בגד ארגמן.

²²⁶ Isaiah, Ch. XXVI, v.6.

²²⁷ Bochart, Brunius, Gesenius. Wetstein on Pollux VII, XII, Schmidt, Lewysohn Riedel *et alia*.

Note the symmetry maintained by the Masoretic text: vv. 5-12 *Tekhelet* is ordered throughout for the furniture belonging to the Inner-Sanctuary (כלים שבפנים) *Kelil Tekhelet* (כלייל תכלית) being assigned to the Holy Ark as the object of the highest veneration: vv. 13-14 *Argaman* is prescribed for the appurtenance of the Outer-Sanctuary (כלים שבחוץ).

B. The Greek Equivalents of Tekhelet and Argaman Respectively in Aquilas, Symmachus and Theodotion.

Aquila, Symmachus and Theodotion follow the LXX

Aquila: Exodus, 35, 23, 25; Ezekiel, 27, 24.

Symmachus: Ex. 35, 23 (Ezek. 23, 6 תכלית = תכלית)

Theodotion: Ex. 28,6; 35,23; Jer. 10,9 (Ezek. 23,6 תכלית for תכלית as Symmachus).

The Aruch s.v. חור quotes Midrash Rabbah Esther I, 6

חור כרפס ותכלית תרגם עקילם איירינן קרפסיגון טיגון

Benjamin Musaphia (ib.) observes that טיגון *tinon* must be a corruption of יקיגטיגון = Iakinthinon.

Sachs²²⁸ next suggests that the correct reading is ינטיגון Ianthinon. The corruption of ינטיגון Ianthinon into טיגון being more likely than that of יקיגטיגון Iakinthinon into טיגון. Were we to admit the correctness of Sachs' emendation we would have to cast about for an explanation why in Esther I, 6 Aquilas rendered *Tekhelet* by Ianthina. Were Iakinthina and Ianthina synonymous in contemporary usage?²²⁹

The Midrashic passage is, however, not quoted in full in the Aruch. The complete text reads:

חור כרפס תכלית תרגם עקילם איירינן קרפסיגון ר' ביבי אמר טיגון וכו'

R. Bibi evidently does not intend טיגון (*tinon*) as a rendering of *Tekhelet*, nowhere in Talmudic, Midrashic or Targumic literature is *Tekhelet* represented otherwise than by *tekelta*, or תכלא \tikla; תכלתא; there could have been no occasion for citing Aquilas in explanation of so ordinary a word: if indeed recourse to Aquilas were necessary, it would hardly have been deferred in the Midrash until Esther I, 6 was reached. Again *Tekhelet*-shel-tzitzit being still in vogue, the meaning of the word must have been clear to everybody in R. Bibi's time.

In all probability therefore טיגון is given as an alternative rendering to that of Aquilas for either חור or כרפס. From the context it is clear, I think, that טיגון = Thinon refers to חור. It is probably a corruption of אטוגון = Othonion.²³⁰

²²⁸ Sachs, Michael, *Beiträge*. Berlin (1852), p. 131.

²²⁹ The LXX, on the other hand, with its Olorporphyron in v.7, disturbs the harmony.

²³⁰ Fine muslin-like linen. Cf. Proverbs, VII: אסון מצרים

C. Iakinthos – Tekhelet, Fabric, Stone or Flower?

A. *Iakinthos* as the Traditional Rendering of *Tekhelet*.

Thus a chain of tradition extending from the LXX (not later than 250 B.C.) to Aquilas (about 100 C.E.) attests the equivalence of *Iakinthos* for *Tekhelet* in the language of the Greek-speaking Jews. The testimony of Aquilas is of especial significance in view of the fact that his translation far from being based upon the LXX was in reality the outcome of an anti-Septuagint movement inspired by the highest representatives of tradition.

B. *Iakinthos* as the Name of a Certain Colored Fabric.

Iakinthos as the name of a coloured fabric is rarely met with in Greek literature. Homer only refers to the flower called :

υάκινθος: ουλας ηκε κομας, υακινθίνω ανθει ομοιασ.	Yakinthos: oulas ike komas, ýakinthíno anthei omoias.	Hyacinth: she [Athene] made the locks flow in curls like the hyacinth flower. ²³¹
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Xenophon, so far as I have been able to trace, contains the earliest known allusion to *Iakinthos* as a color designation; "Loron Iakinthibary," 6.4. The LXX would seem to be the oldest extant witness for the use *Iakinthos* as a term designating a certain coloured fabric.²³²

The translators of the Pentateuch must have found *Iakinthos* already in current usage as the Greek name for the fabric called *Tekhelet* in Hebrew.

C. *Iakinthos* as the Name of a Certain Stone.

It is by no means easy to ascertain the precise meaning of "*Iakinthos*" as a colour designation. The word occurs:

- (1) - as the name of the flower;
- (2) - as that of a precious stone.

²³¹ https://www.loebclassics.com/view/homer-odyssey/1919/pb_LCL105.395.xml

²³² However, in Arrian's description of Cyrus' tomb at Psargadae: "Ἐν δὲ τοῦ ἐκεῖντο αἱ δὲ οἰκουμένη... καὶ stolai Jakinthobareis legei oti ékeito, ai dé Porphyras ai dé alius chroas kte." () These statements are made upon the authority of Aristobulos, a constant attendant of Alexander the Great. The use of "*iakinthos*" as the designation of a certain coloured fabric is thus traceable to about the end of the 4th century B.C.

There seems to have been a variety of gems known by that name. In Pliny's terminology the word seems to designate a violet-coloured precious stone closely akin to the pure violet stone, amethyst, still known by that name²³³ but paler in shade than the latter.

that sparkling in amethyst violet is
diluted in blue

"Ille emicans in amethysto color violaceus
dilutus est in hyacintho."

On the other hand, there is evidence for a deep blue or a deep blue violet very closely bordering on blue being called Iankinthos:

In the vision of Tharsis, as we turn into
the sea he placed blue eagles the stone of
heaven has a likeness.

"visio tharsis quam nos in mare vertimus
Aquilas hyacinthum posuit qui lapis coeli
habet similitudinem."

Ambrosius is more explicit:

"hyacinth, whose name is the most
precious color in the color of blue, having
the color of the clear sky like sapphire"

"hyacinthus cujus species hyacinthino
colori nomen imposuit pretiosissimus est
coeli sereni colorem habens sicut
sapphirus."²³⁴

Solin (Collectanea ed. Momeen 1864, p. 152) says of the hyacinth:

²³³ Pliny, *Hist. Nat.*, XXXVII, ch. 9. For an exact reproduction of the nuance see: Mely, F. d., "Pierres Precieusesin: Vigoreux, Fulcran, *Diet, de la Bible*, Paris (1912).

²³⁴ Ambrosius, *Apologia*, Bk. XXI, ch. 30.

Among those things which we have mentioned are the blue glitter, the precious stone is found blue, indeed it is found to be blameless.	"Inter ea quae diximus nitore caeruleo, hyacinthus invenitur lapis pretiosus siquidem inculpabilis invenitur."²³⁵
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He thus emphasizes its blueness. Hieronymus also compares its colour to that of the ocean ("pelagi color").²³⁶ It is sometimes described as hyacinthus (Mely, V.I., p. 156.). Epiphanius enumerates several varieties of hyacinthus, one being the thalassitous (of the colour of the sea). While from the other church fathers, especially from Ambrosius, we should infer no other nuance for the hyacinth than that of deep dark blue ("Coeli sereni").

Epiphanius would seem to ascribe to it a reflex of violet or violet red.

εοικε δε υακινθος τη ερεα υποπορφυριζων ποσως	“eoike de yákinthos ti erea ypoporfyrizon posos.”²³⁷	But it seems the hyacinth of wool is very slightly purple
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The correct interpretation of the epithets derived from *Iakinthos* in the various connections in which these occur is a task often fraught with serious difficulty.²³⁸

Mr. F. de Mely²³⁹ says the hyacinth according to Ephiphanius is like "au ciel pur un peu pourpre (in the pure sky a little purple)," doubtless understanding by the last word a violet or violet red colour. I am not quite sure that this is necessarily what the patristic writer had in mind.

Epiphanius says of the sapphire:

²³⁵ Solinus, Cains Julius, *Collectanea rerum*. Ed. Mommsen, Berlin (1864), p. 152.

²³⁶ Hieronymus, Cf. Michael Psillus: "*Iakinthos* ... esti blattys Porphyos elainys to eidos. Mely, *ibid*."

²³⁷ Epiphanius, "De Gemmis," Bk. XII, ch. VI. Mely, *ibid*. The text is corrected by de Mely.

²³⁸ Bluemner, *ibid*.

²³⁹ Mely, "Hyacinth," Vigoreux, *ibid*.

“σάπφειρος πορφυρίζων, ὡς βλάττης πορφύρας τῆς μελαίνης τὸ εἶδος”.	“Sappheiros porphyrizon os blattys porphyros tys elainys to eidos.”	The sapphire is purplish, as the image of a dark purple dye.
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Did Epiphanius class under the sapphire-genus a predominant number of violets? Epiphanius further says:

“ἔστι γὰρ ὁ βασιλικός, χρυσοστιγής· οὐ πάνυ δὲ οὗτος θαυμαζόμενος ὡς ὁ διόλου πορφυρίζων”.	“Hrusosigys on panu dé ontos thaumazomenos, os ô diolon porphyrizon.”	“There is also the ‘Basilikos’, that is golden. ²⁴⁰ This one is certainly not that admired as the one that is completely purple”.
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Here he is plainly referring to the mineral now called lapis lazuli. He attributes greater beauty to another variety which is thoroughly "purple-like," implying however that the lapis lazuli is also covered by porphyrizon though to a small extent. Did Epiphanius' vision discern a reflex of violet in the lapis lazuli?

It may perhaps be that porphyrizon simply means that in the gem is reproduced the exact nuance of a certain well-known variety of purple fabric.

M. de Mely states that in Arabic mineralogy the hyacinth is divided into four species:

- | | |
|--|---|
| " 1. the “madzanabi,” light red; | " 1. le madzanabi, rouge clair; |
| 2. the “benefes,” clear, with a very dark shade; | 2. le benefes, limpide, à nuance très foncée; |

²⁴⁰ The literal translation of this word is “kingly” or “royal”, but it can also refer to the origin of the stone. There are at least two attestations of “βασιλικός” meaning “from Persia” (Amphis 27.3, Dsc.1.125) and at least one meaning “from Ethiopia” (Dsc.3.62).

- | | |
|--|--|
| 3. "the assiad-sisat," a distinct yellow color; | 3, l'assiad-sisat, d'une couleur jaune franche; |
| 4. purplish black with a slight surface tint of shimmering red to faint blue." | 4. le violacé noir avec une légère teinte superficielle rouge chatoyant en bleu faible." |

M. de Mely holds that it is to this last species that the early Christian writers refer, when in speaking of the hyacinth, they emphasize its resemblance to the colour of the sky or of the sea or otherwise allude to its blueness. I do not feel quite sure about the correctness of M. de Mely's view.

The minéralogie literature of the Arabs is too far removed from the patristic authors to be applied without further ado to the illustration of the minéralogie references occurring in the latter.

We have seen that the hyacinth of Hieronymus and Ambrosius cannot be identified with that of Pliny, an author with whom the former writers certainly had closer affinities than the Arabic mineralogists had with them.

Benjamin Musaphia (died 1767) in a note on the Aruch s.v. יקינט (= *Iakinthos*) makes the following statement:

אמר בנימין פ' בלשון יוני ורומי מין אבן טובה ירוקה ובתוכה פעמים כמו עפרות זהב ועוד בשם זה נקרא פרח אשר לו גוון תכלת

This identification by Musaphia of the hyacinth (*Iakinthos*) with the lapis lazuli is certainly based upon data supplied by ancient Greek or Latin authors.²⁴¹

The information derived from the above authors hardly places us in a position to ascertain the exact meaning of *Iakinthos* as a colour designation. On the ground of Pliny's description of the nuance of the gem, we should conclude that hyacinthus denoted a violet akin to that of the amethyst but of a paler shade. The evidence from the church fathers warrants the conclusion that the expression designated an intense dark blue or a deep violet not easily distinguishable from deep blue.

²⁴¹ The hyacinth of the Midrashists is however not to be identified with *lapis lazuli*. Compare Midrash Rabbah Exodus, section 38. with *ib.* Musbara, section 2.

Taking into consideration the fact that the Christian Bible commentators wrote of the gem called hyacinth with the full consciousness of what the word stood for in the Septuagint, while in Pliny nowhere is made mention of a coloured fabric of that designation, we are, I think, fairly entitled to decide that the indications afforded by the former rather than those furnished by Pliny are to be viewed as giving the right key to the solution of our problem. It is worth mentioning that Hieronymus, living in Judaea and studying under Jewish masters, must have had a visual acquaintance with *Tekhelet* or hyacinthus for in his days²⁴² *Tekhelet* shel *tzitzit* was still in practice.

Ambrosius in particular who defines the colour of the gem as that of the serene sky (i.e., a deep dark blue closely bordering on black) expressly states that the fabric borrowed its name from the precious stone. This statement may merely represent his personal opinion but it is of extreme importance for the determination of the colour of *Tekhelet*.

It is, as Franz Delitzsch says²⁴³ doubtful whether it was the stone or the flower that gave the hyacinth fabric its name. Ambrosius' authority can scarcely be appealed to in this connection as we do not know from what source he derived the assertion just quoted. The fact, however, that *Iakinthos* does not occur in minéralogie literature earlier than Pliny²⁴⁴ tends, I think, in favour of the latter alternative. Would a gem to which one of the purple varieties best known in antiquity owed its appellation fail to find its way into the catalogues of precious stones? Epiphanius indeed expresses surprise at the omission of the hyacinth from the list of gems ordered for the High Priest's breast-plate.²⁴⁵ It is not improbable that the reverse was the case: the fabric gave the name to the stone. We cannot, however, advance in this connection beyond the region of hypothesis.

D. Iakinthos as the Name of a Certain Flower.

It is just as hard if not indeed harder to ascertain the colour of the flower anciently termed hyacinthus.

²⁴² Hieronymus died in 420.

²⁴³ Delitzsch, Franz, *Iris*, p. 63.

²⁴⁴ See: P. de Mely, "Hyacinth," in Vigoureux, *Diet, de la Bible*, and idem, *Lapidaire Grec*, Paris (1897), p. 196.

²⁴⁵ Mely, "Hyacinth," Vigoureux, *ibid.* \ Mely, *Sapidaire*, p. 196.

It might be thought that it is scarcely correct to speak of the colour of the hyacinth, for may not the name in antiquity have been a generic one covering a number of varieties exhibiting all sorts of colours and shades?

If indeed it were proved that the hyacinth fabric derived its name from the flower, the objection would be of course utterly worthless. But this is at least dubious. Homer, however, compares the colour of hair to the hyacinth flower, indicating that he has in view a particular variety of a definite colour. As, however, it is simply impossible for us at this time of the day to ascertain the colour of that lady's hair of whom the wonderful bard sang:

“οὐλας ἦκε κόμας, ὑακινθίνῳ ἄνθει ὁμοίας”.	“Oilas ake komas, iakinthino anthei omoias,”	“she made the locks flow in curls like the hyacinth flower”.
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this indication alone would hardly carry us far on the way. Applying, however, the results obtained from the study of hyacinth as the name of a gem we should say that Homer refers to deep black hair, thus emphasizing the depth of shade of the hyacinth colour.

Similarly Theocritus²⁴⁶ describes the hyacinth as black, meaning very dark coloured. Philostrates also accentuates the intense darkness of the colour of the hyacinth:

“τὴν πανοπλίαν. ὑάκινθος μὲν οὖν λευκῷ μειρακίῳ πρέπει, etc.”.	“ <i>Iakinthos</i> men oun leuko meirakio prepei kai narkissos melani. ²⁴⁷ ”	“For the hyacinth befits a young white boy, etc.”.
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On the other hand, the hyacinth is sometimes spoken of in Greek literature as "kuaneos" (blue). Compare Columella "et caeruleus hyacinthos." Guided by the combination of this indication with the allusions to the darkness ("blackness") of the colour of the hyacinth we should come to the conclusion that the hyacinth of the ancient Greeks was a flower of a deep dark blue colour. The

²⁴⁶ Theocritus, *The Idyll*, Oxford (1866), Bk. X, ch. 28.

²⁴⁷ Philostrates, *Epistolae*, epistle III.

well-known Greek legend centering around the hyacinth would seem to refer to the violet-blue larkspur or to a species of iris.²⁴⁸

Vergil and Pliny describe the hyacinth as red. A recent writer, Joseph Bergel,²⁴⁹ misled by the references of these authors, even ventures so far as to convict the Talmudists of error in having defined *Tekhelet* as resembling the colour of the sky.

I may quote here the statements of Dr. Ed. Bonnet of the Museum National d'Histoire Naturelle, Section de Botanique, in reply to a query I had addressed to him on the subject:

“The “Iakinthos” of Theophrastus and Dioscorides ... according to the figure of the MS. Greek from the Bible Nat. of Paris and that of the Codex Coxerus of Vienna, it is either the Hyacinthus seriotireus Forg. X., or Hyacinthus orientalis L., the former has various greenish and reddish-brown flowers, the latter has blue flowers. Under the name of hyacinthus, Vergile confused several plants.”	"Le " <i>Iakinthos</i> " de Theophraste et de Dioscoride ... d'après la figure du MS. grec de la Bible Nat. de Paris et de celle du Codex Coxerus de Vienne, c'est soit le Hyacinthus seriotireus Forg. X., soit le Hyacinthus orientalis L., le premier a les fleurs variées de verdâtre et de brunrougeâtre, le second a les fleurs bleues. Sous le nom d'hyacinthus, Vergile a confondu plusieurs plantes."
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Tekhelet, whatever its exact nuance, was not of the colour of the former plant of which Dr. Bonnet speaks; Hyacinthus as a colour designation of the fabric so rendered by the Greek version must therefore have been related to the latter species of flower which is blue. The *Hyacinthus orientalis* is described in standard authors as "*intense caeruleus*." Pliny in describing the hyacinth as red refers either to a certain variety of Hy. orientalis, or to some other member of the genus Hyacinthus.

The hyacinth is however referred to in Dioscorides as: "Pleré porphyroeidous."

²⁴⁸ *Eneyel. Brit.* 11th ed., "Hyacinth".

²⁴⁹ Bergel, Joseph, *Studien*, Leipzig (1880), p. 49.

Hartmann²⁵⁰ gives several quotations from Greek poets in which the epithet "porphyreos" (purple-like) is applied to the flower.

It is partly on the ground of these allusions to the colour of the flower and of the indications found in Pliny and in Vergil that Hartmann comes to the conclusion that the

"hyacinth" - "Color was by no means blue but more in the red playful purple blue dark red blue violet."	"hyacinth" - "Farbe durchaus nicht blau sondern mehr ins rote spielend purpurblau dunkel rot blau violett gewesen sei." ²⁵¹
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He is followed by De Wette, Winner, Gesenius and Knobel who render *Tekhelet* by "violette Purpur." Hartmann's theory does not indeed rest on sure foundations. The allusions to a purple-like nuance may refer to certain varieties of hyacinth of a violet purpuric shade of colour: they do not necessarily describe the colour of the particular species after which the hyacinth was named.

Again, leaving out Pliny and Vergil, the epithet "purple" as applied in the Greek poets to the hyacinth may simply mean that the flower presents a colour recalling that of a well-known principal variety of purple fabric (hyacinth, *Tekhelet*).

Thus the red-bill (Poule Sultane) was called by the Greeks ("Porphyrio") on account of its colour.

Aristotle describes it as of a blue colour. There is, however, no need to go to Aristotle for the determination of the bird's colour. Purple dyeing has long died but Nature continues to live.

"Poule Sultane or Talève, Porphyrio, genus of birds of the order Echassiers	"Poule Sultane ou Talève, Porphyrio, genre d'oiseaux de l'ordre des Echassiers
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²⁵⁰ Hartmann, Anton, *Die Hebraenm beim Putztische*, Amsterdam (1809-10), V. I, p. 574; v.II, p. 128.

²⁵¹ Baehr, *ibid*.

Macroductyles... their plumage is, on the cheeks, on the throat, on the front and on the sides of the neck of a very pure turquoise blue; on the occiput, nape, thighs and abdomen, very dark indigo blue; on the chest, back, wings and tail of a bright indigo blue."

Macroductyles... leur plumage est, sur les joues, sur la gorge, sur le devant et les côtés du cou d'un bleu turquoise très pur; sur l'occiput, la nuque, les cuisses et l'abdomen, d'un bleu indigo très foncé; sur la poitrine, le dos, les ailes et la queue d'un bleu indigo éclatant."²⁵²

The red-bill clearly owed its name to its resemblance to the colour of a certain variety of purple.

The argument from Dioscorides, however, makes one pause a little and think. If, as Dr. Bonnet holds, that author, in speaking of the hyacinth, has only two species in mind, one being the *Hy. orientalis*, to which species is "*plere Porphyroeidous*" meant to apply? To the one the flowers of which present a variation of reddish brown? Or is it to the deep-blue *Hy. orientalis*? Did Dioscorides simply mean that the hyacinth flower recalls that of a certain chief variety of purple fabric?

Assuming now that the references in the Greek writers (Homer, Theocritus, Philostratos etc.) to the darkness of the hyacinth, to its blueness and to its purple-like colour, all apply to one and the same species we should not hesitate to identify the plant with the *Hyacinthus orientalis* Linné. The flowers of that species would then afford us a fair idea of what the *Tekhelet* colour was like, if the fabric owed its name to the plant.

As, however, the underlying bases of the conclusion so reached cannot be described as more than hypothetical they hardly furnish a solid foundation for the solution of our problem and further research is necessary.

D. Data Supplied by Pliny Concerning the Varieties of Purple Fabric in as far as These Have a Bearing Upon the Determination of the Colour of Tekhelet.

Pliny is our chief source of information on the ancient purple and its varieties. We naturally turn to him for light on hyacinthus. In the 9th book that author gives a scarcely full account of purple

²⁵² Bouillet, Jean Baptiste, "Poule," *Diet, de Sciences*.

dyeing. He names only two sorts of purple, *Purpura* Tyria or dibapha and *Purpura* amethystina, describing the latter as "color eximius ille." In another passage he divides purple into three varieties. Commenting upon the imitation of the colours of flowers by means of certain pigments he says:

"Enough has been said about scented flowers. In this sphere luxury, glad to have conquered nature with its unguents, has with its dyed fabrics gone on to challenge those flowers that are commended for their colour. I note that the principal colours are the three following : (1) red, as of the kermes-insect, which, from the loveliness of the dark rose, shades, if you look up at it in a bright light,* into Tyrian purple, double-dyed purple and Laconian purple ; (2) amethyst, which from violet itself passes into purple, and which I have called ianthine. I am discussing general types of colour, which shade off into many kinds. (3) The third belongs properly to the purple of the murex, but includes many kindred shades. One is the colour of the heliotrope, sometimes of a light, though usually of a deeper, tint ; another is that of the mallow, shading into a purple ; yet a third, seen in the late violet, is the

"Et de odoratis floribus satis dictum: in quibus unguento ricisse naturam gaudens luxuria, vestibis quoque purocarit eos flores qui colore commendantur. Has animadverto tres esse principales. Rubentem, in coco: qui a rosis migrante gratia idem trahitur suspectu, et in *Purpuras* Tyrias, dibaphasque ac Laconicas. Alium in amethysto, quia viola, et ipse in purpureum, quemque ianthinum appellarimus. Genera enim tractamus in species mutas sese spargentia. Tertium est qui proprie conchylii intelligitur, multis modis, alius in heliotropio, ad *Purpuram* inclinans: alius in viola serotina conchyliorum vegetissimus."²⁵³

²⁵³ Pliny, *ibid.*. Bk. XXI, ch. 8.

most vivid of the murex tints.”

In the same book Pliny in dealing with a certain species of *Viola* which he qualifies as "purplish" (*purpurea*) he remarks "ab his ianthina vestis."²⁵⁴ The species in question has been identified with the *Viola odorata* Linné. Nature has thus preserved for us an illustration of the colour of the *Purpura* ianthina. W. Adolf Schmidt²⁵⁵ comes to the conclusion that amethystina, ianthina, and hyacinthina are synonyms denoting one and the same purple-variety. The identification of ianthina with amethystina is based upon Pliny 21, 8, just quoted ("et ipse in purpureum quemque ianthinum appellarimus"). The equation of hyacinth with the two is founded upon the following reasoning: Pliny and Vergil emphasize the blackness or darkness of shade of the violet purple (*Purpura* violacea). Philo qualifies the hyacinth purple as black or dark: *Purpura* hyacinthina is the same as *P. amethystina* or ianthina. Another argument is derived from the fact that the *Purpura* violacea is classed as *Purpura* blatta or pure purple unmixed with other materials. Now the *Lex Valentina*²⁵⁶ divides *Purpura* blatta into two classes (a) oxyblatta; and (b) hyacinthina. Oxyblatta, as is shown by Schmidt being identical with the *Purpura* Tyria, hyacinthina must be identical with the *Purpura* violacea, ergo, etc. ... Dr. Dedekind accepts these equations. Tekhelet would thus be violet purple of the colour of the *Viola odorata* L. Dr. Dedekind, however, in subscribing on the one hand to the equations established by Schmidt and in maintaining on the other that the species furnishing *Tekhelet* must be identified with *Murex trunculus* is somewhat inconsistent. The amethyst or ianthina colour as described by Pliny, was the result of a mixture in certain proportions of the dyestuffs obtained from two different species, the one furnishing black and the other red pigment. It is precisely this fact which at once cuts away the ground from under the attempted identification of *Tekhelet* as handed down by Talmudic tradition with Pliny's *Purpura* amethystina or ianthina. Tekhelet according to the Talmud was dyed with the pigment of one particular species of which a description is given Menahot 44a. Schmidt being unacquainted with the Talmud was not aware of this fatal objection. On quite different grounds, however, Schmidt reaches a certain conclusion which if applied here might save his position. Having learnt from Bochart that according to Maimonides the colour of *Tekhelet* was sky-blue,

²⁵⁴ Idem, ch. 6.

²⁵⁵ Schmidt, *ibid.*, p. 28.

²⁵⁶ *Lex Valentina*, c. 3, 4. 40: "Quae tes venite."

(not violet or amethyst-like) he draws a distinction between the *Tekhelet* of the LXX, and Philo and that of Maimonides.

After the promulgation of the imperial decrees placing heavy restrictions upon the manufacture and use of both the *Purpura* Tyria and *Purpura* amethystina, the Jews, so Schmidt thinks, had perforce to replace the traditional *Tekhelet* by a variety of the *Purpura* conchyliata, the latter not falling within the scope of the imperial legislation respecting purple. He accordingly identifies Maimonides' *Tekhelet* with the heliotrope variety of conchylum. Now, as the *Purpura* conchyliata, according to Pliny, was dyed with only black purple pigment Schmidt might have met the argument from the Talmudic description of the *Tekhelet hillazon* by the assumption that already in early Talmudic times *Tekhelet* was a kind of *Purpura* conchyliata. It is, however, rather unlikely that such an important change in the manufacture of ritual *Tekhelet* took place in Tanaitic times. If that were the case would not Talmudic tradition have preserved some reminiscence of an alteration made in the ritual under the force of imperial persecution?

In view of Schmidt's identification of *Iakinthos* (Hyacinth purple) with *Purpura* amethystina and ianthina it strikes one as very strange that the Greek versions never render *Tekhelet* by any of these latter terms but always *Iakinthos*. Pliny on the other hand never mentions *Purpura* hyacinthina. This too is a fact which is hardly without significance. Was the hyacinth purple only one out of several species comprised in the designation *Purpura* amethystina or ianthina:

I am discussing general types of
colour, which shade off into many
kinds.

"Genera enim tractamus in species multas
sese spargentia."

I should remark in the first place that ianthina does not seem to me synonymous with amethystina. Amethystina is the generic name denoting varieties of purple more or less reproducing the colour of the amethyst gem. Compare Pliny:

India Amethysts ... all shine through
violet colors... The Indian amethyst has
the perfect shade of Tyrian purple at its
best, and it is this stone that the
dye-factories aspire to emulate.

"amethysti Indicae ... pelucent omnes
violaceo colore ... Indicae absolutum
felicitis *Purpurae* colorem habent, ad
hancque tingentium officinae dirigent
vota."²⁵⁷

Ianthina, on the other hand, is the designation of a certain species of *P. amethystina*. This is, I think, what Pliny means when he says:

Amethyst, which from violet itself
passes into purple, and which I have
called ianthine. I am discussing general
types of colour, which shade off into
many kinds.

"et ipse in purpureum, quemque
ianthinum appellarimus. Genera enim
tractamus in species multas sese
spargentia."

Purpura amethystina, it may also be noted, occurs far more frequently than ianthina.

That *Iakinthos* (hyacinth purple) was not synonymous with ianthina (ianthina purple) in Ephesian usage, can be shown to be so earlier than Diogenes Laertus can, I think, by an argument amounting to proof. Athenaeus quotes from Democritus Ephesius²⁵⁸ certain observations upon the extravagance of the Ephesians in matters of dress:

“Καὶ καλασίρεις
Κορινθιουργεῖς· εἰσὶ δὲ
αἱ μὲν πορφυραῖ

“Kai kalasires
kalinthiourgeis eisi de
ai mén porphyrai

“And then there are
Corinthian garments. Some
of them are purple, some of
them are violet coloured

²⁵⁷ Pliny, *ibid.*. Bk. XXXVII, ch. 9.

²⁵⁸ Democritus Ephesius is the author of a book on the temple of Diana. All that is known of him is that he lived before Diogenes Laertus by whom he is cited.

τούτων, αἱ δὲ ἰοβαφεῖς, αἱ δὲ ὑακίνθιναι”.	touton ai de iobareis ai de iakinthinai.” ²⁵⁹	and some of them are hyacinthine”.
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Ianthina and hyacinthina are plainly distinguished. Amethystina as the name of a coloured fabric, so far as I know, nowhere occurs in Greek literature.

Aquilas²⁶⁰ again may be cited as testifying that *ianthinos* and *hyacinthios* were held distinct at least in Asiatic Greek usage about 100 C E. עורות תחשים (*orot-tehashim*) which is rendered in the LXX by D. *iakinthina* is translated by Aquilas D. *ianthina*. The reason for this departure from the old version is quite unknown but it shows clearly that there was a difference between *ianthinos* and *iakintos*.

The colour of the *ianthina* is sometimes described as black which indicates a deep dark hue; it is also sometimes likened to that of the sea.²⁶¹ Now as the colour of the hyacinth fabric (*Tekhelet*) is, as will be seen later, similarly described on the one hand as black and on the other as resembling the colour of the sea, it would appear that the resemblance was greater than the difference between the two varieties of purple. Hieronymus in fact states that both *ianthina* and *hyacinthus* resembled the dark blue of the sky.

“Calceavi te hyacintho vel ut alii janthina... quod utrumque aerii et κυανέου coloris est”.	“ <i>Calceavite hyacintho</i> vel ut alii janthina ... quod utrumque aerii et kuxneon coloris est, etc ... “	“I provided you shoes of hyacinth, or of janthine, as others call it... for it is both of bluish and dark blue color”.
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²⁵⁹ Athenaeus, *Dipnosophistaron*, Bk. XII, ch. 29.

²⁶⁰ Aquilas, Exodus, ch. 25, v.6.: ד יהודה אומר: “עורות תחשים טייגון לשם צובעו נקרא” ירושלמי, שבת טייגון. probably corrupt for ינטיגון).

²⁶¹ Winckelmann, Johann Joachim, *Geschichte der Kunst des Alterthums*, Wien (1776). p. 394.1 state this upon the authority of the well-known classical archaeologist Winckelmann, who gives the following references, which I have not verified: "Excerpt Polyte L. 31, p. 177, 15-; Conf. Hadr. ium Animadv. L.2.e.2.; Bochart, Hieros, T.I, p. 730."

The difference must have consisted, I should think, in the greater blueness of the hyacinth variety, or what amounts to the same, in its being closer than the ianthina purple to the deep dark blue of the serene Asiatic sky or of the Mediterranean along the Syrian and Palestinian coasts.²⁶²

It would appear that, while in the preparation of ianthina the black purple-pigment was mixed in a certain proportion with the red dye of the buccinum, in the manufacture of hyacinthus black dye alone (from the *Purpura* or pelagia) was employed. It is to this that the difference may have been due. This is sustained by the Talmudic tradition which knows only of one species of mollusc as used in the dyeing of *Tekhelet*.

E. Allusions in Philo and Josephus to the Colour of Tekhelet.

I do not think it is possible to go much further than this in the direction of the determination of the *Tekhelet-nuance*.

Bähr ventures I think too far when upon the basis of certain indications found in Philo, in Josephus, in the Church fathers and in the Talmud he concludes that *Tekhelet* was an absolutely pure blue. Certain grades of violet are only with very great difficulty distinguishable from blue. That the colour of *Tekhelet* or hyacinth is likened to that of the sea or of the sky only proves that *Tekhelet* was not easily distinguishable from deep blue: a deep dark violet-blue would be classed by the ancients, as indeed by most people to-day, as a deep-blue. We have seen that the sea is sometimes described as resembling the colour of the ianthina (*Viola odorata* L.), and that Hieronymus likens the ianthina-colour to that of the sky.²⁶³

If, as seems almost certain, *Tekhelet* is not comprised in the *Purpura* amethystina to which Pliny refers, it is to be sought among the genus of purple-fabric termed by the Roman naturalist vestes conchyliatae, conchylium? It is worth while remarking that it ought not to be supposed for a moment that the data furnished by Pliny with reference to purple have universal application embracing all localities and all ages. Pliny in all probability drew his information on the subject from Italian sources. His statements therefore refer in the first place to purple as manufactured in the Italian dye-houses at, or about, his time. In Phoenicia and in Palestine, things may have been somewhat different. Italian taste and fashion may have held in small favour the hyacinth purple properly so called, preferring the violet shades to those inclining more to blue. The *Purpura*

²⁶² Theocritus, 10c. cit.

²⁶³ "Calceani te hyacintho, vel ut alii ianthino: cum loti fuerint pedes et omni sordi purgati, celceantur hyacinthinis vel ut alii ianthinio, quod utrumque aerii et kuxneon coloris est."

conchyliata on the other hand, though less expensive than the *Purpura* Tyria and the amethystina, had a charm of its own. Pliny admires the delicacy of shade of the vestes conchyliatae. It is quite possible that *Tekhelet* is not comprised even in the *Purpura* conchyliata. Schmidt, as already has been said, identifies the later *Tekhelet*, that of which Maimonides speaks, with the heliotrope variety of Pliny's *Purpura* conchyliata. The identification is really due to Bochart though the latter makes no distinction between earlier and later *Tekhelet*. I do not think the theory has a great measure of probability. The characteristic mark of the vestes conchyliatae was their lightness or paleness of shade in contradistinction to the dark or deep tones of the *Purpura* blatta. But the *Tekhelet* is called black by Philo, and Schmidt's distinction between earlier and later *Tekhelet* not seeming to me probable, I do not feel at all inclined to accept the identification of *Tekhelet* with Pliny's heliotrope conchyliata purple.

Schmidt's argument from the Lex Valentina is indeed not to be easily disposed of. It shows clearly that in the course of the centuries separating that Lex from Aquilas' translation, a change had supervened; hyacinthina replacing amethystina as the generic name for all *Purpura* blatta not falling under the appellation of *Purpura* Tyria or dibapha.

With the investigation of the causes responsible for that change we need not occupy ourselves here. Suffice it to remark that the terminology of the Lex Valentina need not necessarily be the same as that of the Septuagint.

Philo in his homiletic explanation of the construction of the Tabernacle says that *Tekhelet* was meant to symbolise air for "by nature the air is black."²⁶⁴

Josephus copies Philo making however an important addition ...

“τὸν δὲ ἀέρα βούλεται δηλοῦν ὁ ὑάκινθος. (...) ἀποσημαίνει δὲ καὶ ὁ τοῦ ἀρχιερέως χιτὼν τὴν γῆν (...)	“ton de aera bouletai deloun o’ <i>Iakinthos</i> ... aposimainei de kai o ton archiereos chiton ten gen ... ὁ de <i>Iakinthos</i> ton polon astrapais mén ... kai o pilos de mo dokei ton ouranon	“For the hyacinth is proper to signify the air. (...) Now the vestment of the high priest (being made of linen), signified the
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²⁶⁴ Philo, De Congressu.

ὁ δὲ ὑάκινθος τὸν πόλον, ἀστραπαῖς etc.”	tekmerioun iakinthinos pepoiemenos ou gar an alios uperanetitheto auto to onoma ton theon te.” ²⁶⁵	earth. The hyacinth denoted the sky, being like lightings...”
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The comparison of the hyacinth with the sky-colour is not borrowed from Philo but it is certainly not original with Josephus.²⁶⁶ As he adds nothing in explanation of his statement that the hyacinth symbolises the sky, he must have been sure that his readers would readily grasp the point: the resemblance of the hyacinth fabric to the sky-colour must have been self-evident.

In another passage Josephus speaking of the hyacinth coverings of the Tabernacle says:

“Great amazement would seize those who viewed these (veils) from afar, for they seemed to differ in nothing from the colour of the sky.”	“polle d’ ekpleksis elambane tous porrothen theomenous. Ten gar chroan tois kata ton ouranon sumbainousin ouden edokoun diapherein.”	πολλή δ’ ἐκπληξίς ελάβανε τους πόρρωθεν θεωμένους. Την γὰρ χρώαν τους κατά τον ουρανών συμβαίνουσιν οὐδέν εδωκούν διαφέρειν.
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"Great amazement would seize those who viewed these (veils) from afar, for they seemed to differ in nothing from the colour of the sky."²⁶⁷

It is scarcely possible to trace the source whence Josephus drew this statement. Was it oral Midrash? In all probability Josephus reflects his personal experience of the illusion created by the sight of *Tekhelet* from a distance.

Close resemblance to sky-colour is a necessary inference from this assertion of Josephus' but it hardly warrants absolute identity of colour, or in other words, we cannot be sure that if *Tekhelet*

²⁶⁵ Josephus, *ibid.*, book III, chs. 6-7.

²⁶⁶ Cf. Philo (De Vita Mosi) on the High Priest's tunic; ילקוט שמעוני פקודי רמז ת"ט

²⁶⁷ Josephus, *ibid.*, book III, ch. 4.

were closely examined by a specialist in colour discrimination it would be declared by him to have absolutely the same nuance as the cloudless Asiatic sky in bright sunshine.

F. Textual and Critical Study of R. Meir's Homily on the Tekhelet Colour.

Next after Philo and Josephus comes the oft-quoted saying of R. Meir (floruit 125).

Rabbi Meir says: "Why has *Tekhelet* been singled out from all other colours? Because *Tekhelet* is like unto the sea and the sea is like unto the sky and the sky is like unto the sapphire and the sapphire is like unto the Throne of Glory, for it is written: 'And they saw the God of Israel; and the place under his feet was like a paved work of brilliant sapphire, and like the colour of heaven in clearness,'²⁶⁸ and it is written '...like the appearance of a sapphire-stone, the likeness of a throne.'"²⁶⁹

This famous homily has come down in 8 recensions: the one just quoted which I shall designate by (a) and the following

(b) תניא היה רבי מאיר אומר מה נשתנה תכלת מכל מיני צבעונין מפני שהתכלת דומה לים וים דומה לרקיע ורקיע דומה לכסא הכבוד שנאמר ותחת רגליו כמעשה לבנת הספיר וכעצם השמים לטהר וכתוב כמראה אבן ספיר דמות כסא (Menahot 43B)

(c) ר' מאיר אומר וראיתם אותם לא נאמר אלא וראיתם אותו מגיד הכתוב שכל המקיים מצות ציצית כאלו הקביל פני השכינה שהתכלת דומה לים וים דומה לרקיע ורקיע דומה לכסא הכבוד שנאמר וממעל לרקיע אשר על ראשם (שלה) (Sifri

(d) תני בשם ר' מאיר וראיתם אותה אין כתיב כאן אלא וראיתם אותו מגיד הכתוב שכל המקיים מצות ציצית כאלו מקבל פני שכינה מגיד שהתכלת דומה לים והים דומה לעשבים עשבים דומין לרקיע ורקיע דומה לכסא הכבוד והכסא דומה לספיר דכתיב ואראה והנה על הרקיע אשר על ראש הכרוב כאבן ספיר כמראה כסא (Yerushalmi Berakhot 7b I, 2)

(e) ד"א מלך הכבוד אמר חזקיה מה נשתנה תכלת משאר מיני צבעונין שצוה האלהים להיות בציצית מפני שהתכלת דומה לעשבים והעשבים דומים לים והים דומה לרקיע והרקיע דומה לקשת והקשת דומה לענן והענן דומה לכסא והכסא דומה לכבוד שנאמר ונתנו על ציצית הכנף פתיל תכלת הוי ויבא מלך הכבוד (Midrash Rabbah)

²⁶⁸ Exodus, Ch. XXIV, v.10.----- Ezekiel 1, 26.

²⁶⁹ Hullin 89a; Compare; Menahot 43b; Tosaphot, Sotah 17a.

(f) אמר ר' מאיר מה נשתנה תכלת מכל מיני צבעונין שהתכלת דומה לרקיע ורקיע דומה לכסא הכבוד שנא' ויראו את אלהי ישראל וגו' (פ' שלח Midrash Rabbah)

(g) חזקיה אמר ואית דאמרי לה בשם ר' מאיר תכלת דומה לעשבים עשבים דומים לאילנות אילנות לרקיע רקיע לנוגה נוגה לקשת וקשת לדמות שנאמר כמראה הקשת אמר חזקיה אם לובשין ציצית לא יהיו סבורין שמא תכלת הם לובשין אלא שיהיו מסתכלין באותה ציצית כאלו שכינה שרויה עליהם וראיתם אתו וזכרתם (Yalkut Shimoni Ps. 4 ch. 12)

(h) ר' נתן אומר חביב מעשה הארון כנגד כסא הכבוד של מעלה... ואף בשעה שהיו נוסעין לא היו פורסים עליו לא בגד ארגמן ולא תולעת שני אלא בגד כליל תכלת ללמדך שהארון היה דומה לו לכך היה הבגד תכלת מלמעלה פניו כנגד הרקיע הדומה לו וכו' (במדבר"ר Midrash Rabbah)

דתניא ר' מאיר מה נשתנה תכלת מכל הצבעונין מפני שהתכלת דומה לים וים דומה לרקיע ורקיע דומה לאבן ספיר ואבן ספיר דומה לכסא הכבוד דכתיב ויראו את אלקי ישראל ותחת רגליו וגו' וכתיב כמראה אבן ספיר דמות כסא (חולין פ"ט).

(a) - Exodus XXIV, 10. ----- (~) Ezekiel 1, 26.

(a) and (b) are practically the same.

(c) offers an interesting variation inasmuch as it provides a Pentateuchal setting for the homily; it is also remarkable by the omission of the interrogation מה נשתנה. Compare (d). In the Talmud (Men. 43a) the דרש upon אותו is attributed, though in a different form, to R. Simon ben Johai, a contemporary of R. Meir.

(d) agrees closely with (c) but there is an important difference — the introduction of עשבים (asabim): "Tekhelet is like unto the sea and the sea is like unto *asabim* (plants or grass) and *asabim* are like unto the sky and the sky is like unto the Throne of Glory," etc.

(e) strikes by its plethorousness; it is also noteworthy on account of the ascription which attributes the homily to Hezekiya instead of to R. Meir.

(f) is distinguished by its conciseness.

(g) is preceded by the statement that some attribute the saying to R. Meir. It would appear that the homily in the form which it has in (e) represents an application made by Hezekiya of R. Meir's saying to the Aggadic interpretation of Psalms (90, 17).

(h) substantially agrees with (a), (b), and (c); R. Meir's saying here serves as a basis for an homily by R. Nathan, an associate of R. Meir, on the significance of the Holy Ark as a representation of the Throne of Glory.

On comparing (g) with (e) we note the replacing of ים (sea) in (g) by אילנות (trees); ים (sea), it will have been observed, occurs in all the other recensions.

(d), (e), and (g) agree as against (a), (b), (c), (f), and (h) in introducing *asabim* in the chain of similitudes; but while in (d) *asabim* appears second, in (e) and (g) it stands first, next to *Tekhelet*.

G. Tekhelet and the Colour of the Sky

The point of R. Meir's homily on *Tekhelet* is clearly the similarity of the colour to that of the Throne of Glory as seen in prophetic vision. The resemblance of *Tekhelet* to sky-colour was not first pointed out by R. Meir; it must have been clear to everybody. Josephus, as already has been remarked, assumes his readers to be fully cognisant of the fact. Josephus, we have seen, makes two assertions about the hyacinth (*Tekhelet*) colour (a) that it is black (dark) of hilo and (b) that it reproduces the colour of the sky. To the reader unacquainted with the subtropical sky this might appear somewhat difficult: the colour of our sky even in the finest weather is rather bright than black-blue. Braun hits the right point when he warns the reader against identifying the *Tekhelet*-hue with that of the sky of our temperate climates. (*De Vesti Sacerdotum, Hebr. Cap. XII, "thecheleth."*)

Compare Rosenmüller:

"With the ether or the cloudless sky ... which appears in the hot regions of Asia and Africa as a saturated black playing a bluish color"

"Mit dem Aether oder dem unumbewolkten Himmel ... der in den heissen Gegenden Asiens und Africas als eine gesättigte Schwarze ins Bläuliche spielende Farbe erscheint"²⁷⁰

²⁷⁰ Rosenmüller, Ernst Friedrich Karl, *Scholia in Vetus Testamentum*, Leipzig (1788-1835). Commentary on Exodus, ch. XXV. Compare also; Maimonides, *Hilkhot tzitzit*, II, 2 and *Hilkhot Klei Hamikdash*, VIII.

The Sumerian ideogram *sagin-gig*, i.e., wool, sky-blue dark is as Professor Langdon of Oxford has informed me, very probably the equivalent of the Semitic *takiltu* (*Tekhelet*). Thus for the Sumerians, as for Josephus, *Tekhelet* had the appearance of the dark blue of the serene Asiatic sky in bright sunshine. The light blue of the sky in somewhat dull weather was not regarded as the real colour of the sky. This illustrates the indication "and like the colour of the heaven in clearness."²⁷¹

The dark blue fringes adorning the corners of the garments of Asiatic captives depicted on a monument discovered in the tomb of Rekhma Ra at Thebes were probably meant to remind the wearer of the clear skies of the Deity.

That the relation subsisting between *Tekhelet* and the colour of the sky was not first discovered by R. Meir nor even by Josephus needs of course no proof but it may not be out of place to draw attention in this connection to the following baraita: "the minimum number of links is seven in correspondence to the seven Heavens and the six spaces (or horizons) intervening between them."

²⁷² The reference is to the series of "windings" (חוליות של כריכות) made with the *Tekhelet*-thread around the white threads of the *tzitzit*. As this baraita is not gainsaid by any authority it doubtless records a long established practice most probably anterior to R. Meir. R. Meir's homily being mere Aggadah would scarcely have given rise to so universal a practice; the baraita doubtless reflects an idea generally current.

H. Tekhelet and the Colour of the Sea.

The different recensions of R. Meir's saying call for careful study. We shall start first with (a) and (b). It is remarkable that in these as indeed in all the other recensions excepting (f) the comparison is instituted, contrary to expectation, not directly with the sky but first with the sea (*yam*) and through it with the sky. Before attempting to account for this phenomenon we should try to gain a clear conception of the significance of *yam* in this connection.

The colour of the sea is not the same all over. Here, however, the reference is undoubtedly to the Mediterranean, or rather to the Mediterranean off the Syrian and Palestinian coasts. The study of the colours of the various seas is but of recent growth. The matter is adequately treated by O. Krümmel in his textbook of Oceanography. In the latest edition of the British Encyclopaedia there

²⁷¹ Exodus, Ch. XXIV, v.10.

²⁷² Menahot 39a.

is a very good article on the subject: "The colour of ocean water far from land is an almost pure blue, and all the variations of tint towards green are the result of local disturbances:

"The usual cause is turbidity of some kind and this in high seas is almost always due to swarms of plankton. The colour of sea water as it is seen on board ship is most readily determined by comparison with the tints of Forel's Xanthometer or colour scale which consists of a series of glass tubes fixed like the rings of a ladder in a frame and filled with a mixture of blue and yellow liquids in varying proportions.

"For this purpose the zero, or pure, blue is represented by a solution of one part of copper sulphate and 9 parts of ammoniac in 190 parts of water. Observations with the Xanthometer have hitherto not been numerous, but it appears that the purest blue (0-1 on Forel's scale) is found in the Saragasso sea, in the North Atlantic and in similarly situated tropical or sub-tropical regions, in the India and Pacific Oceans. The Northern seas have an increasing tendency towards green, the Trimingen sea showing 5-9 Forel, while in the North sea the water is usually a pure green.

"The blue of the sea water as observed by the Forel scale has, of course, nothing to do with the blue appearance of any distant surface due to the reflection of a cloudless sky.²⁷³ Over shallows even the water of the tropical oceans is always green. There is a distinct relationship between colour and transparency in the ocean; the most transparent water which is the most free from plankton is always the purest blue while an increasing turbidity is usually associated with an increasing tint of green. The natural colour of pure sea water is blue and this is emphasized in deep and very clear water which appears almost black to the eye... The greatest transparency hitherto reported is in the eastern basin of the Mediterranean where J. Huksch found the disk visible as a rule from 2 to 7 fathoms, and off the Syrian coast even to 33 fathoms."²⁷⁴ Combining now the two statements: (1) that the greater the transparency the deeper is the blue, and that (2) off the Syrian coast the greatest transparency has been reported; we at once obtain the result that *Tekhelet* was very much like the deep blue of the Mediterranean along the Palestinian coast. The assertion תכלת דומה לים (*Tekhelet* is like the sea) scarcely however warrants *absolute* identity of colour. The verb *damah* דמה "to be like" is elastic enough, although by no means excluding *absolute likeness*. Where absolute identity of colour is insisted upon, the Mishnah employs the

²⁷³ Contrast this with Lewysohn, *ibid.*, Par. 366, p. 282.

²⁷⁴ *British Encyclopedia*, 11th ed., "Oceanography."

Kaph-comparationis.²⁷⁵ That such is not the case here is, however, on the other hand, no indication as to the contrary. R. Meir's object in this instance, be it duly emphasized, is not to give a definition of *Tekhelet* but merely to explain its symbolic significance.

I. Further Study of R. Meir's Homily in its Various Recensions; Maimonides' Definition of *Tekhelet*.

Seeing that what R. Meir's saying really aims at is the establishing of a similarity between the *Tekhelet*-colour and that of the Throne of Glory which is "like the sapphire stone" what need was there, we may well inquire, for bringing in the "sky" (רקיע) and the sea (ים)? Why not say directly "*Tekhelet* is like unto the sapphire stone and the sapphire stone is like unto the Throne of Glory"? Was not the resemblance between *Tekhelet* and the sapphire close enough? Emphanus states: "The sapphire presents the appearance of the blackish blatta purple." Porphyras tes melaines to eidos. Is the *porphyra melaine* not to be identified with *Tekhelet* or *Iakinthos*?

Perhaps the introduction of intermediary links is due to the consideration that owing to the comparative rarity of the sapphire, the explanation if based on the similarity of that gem alone might fail to carry conviction into the minds of many. But this hardly accounts for the presence of both (the sky) and (the sea). Why did not R. Meir simply say "*Tekhelet* is like the sky and the sky is like the sapphire and the sapphire is like the Throne of Glory?" Because the sky-colour is not always deep blue?

(f) actually omits "the sea" but in view of the fact that it appears in a very late collection (c. middle of the 8th century) it may be doubted whether that recension is to be preferred to those recorded in the Talmud and in the Sifre. Was the *Tekhelet* colour really more like the colour of the sea than that of the serene Palestinian sky? Rashi (Sotah 17a) appears to have thought so:²⁷⁶

איצטריכו כל הני משום דתכלת לא דמי לרקיע כל כך אלא דומה לדומה

On Menahot 43b. he is apparently less critical, introducing an homiletic element into his interpretation.

דומה לים שנעשו בו נסים לישראל ... וכתוב ספיר. ובכסא הכבוד

כתוב ספיר אלמא רקיע כבמחזה כסא ותכלת לים וים לרקיע

²⁷⁵ Cf.; גנעים פ"א, ז"א ; גרה ב"ה" וכד: חולין, מ"ג; ירושלמי, סוכה, פרק ג'; "הירוק ככרתי הדג ... אונה כרתיני" וכו'.

²⁷⁶ Sotah 17a; Cf. Hullin 47b.

In explaining, however, the reference to "the sea" as intended to be reminiscent of the miracles God wrought for Israel on the Red sea, Rashi hints at the same time that *Tekhelet* was more like the sea than the sky.²⁷⁷ On penetrating his meaning this is seen not to be doubleness of motive: the explanation of the presence of yam (the sea) as due to the scientific exactness on the part of the author (R. Meir), really impairs the force of the theory; for if the resemblance of *Tekhelet* to the sky = colour of the Throne of Glory is the reason of its having been chosen for the *tzitzit*, then since *Tekhelet* is rather more like the sea, another colour, one more nearly reproducing the sky colour should have been prescribed by the Torah for that purpose. It is this objection which Rashi very probably wishes to anticipate by the hint that *Tekhelet* has the additional recommendation of being reminiscent of the miracles performed on the sea.

Whether this is what R. Meir actually meant is at least dubious. R. Meir's associates would often acknowledge their inability to penetrate the depth of his mind.²⁷⁸ We should not be more ambitious than they. Rashi's explanation of ים as reminiscent of סוף ים קריעת ים סוף is derived from an anonymous homily in the Sifre.

"Why is it called *Tekhelet*? ... Aliter: because the Egyptians were annihilated in the sea."²⁷⁹ This presupposes the likeness of *Tekhelet* to the colour of the sea. It is not impossible that originally there existed two distinct sayings of Rabbi Meir:

(a) תכלה דומה לים "*Tekhelet* is like unto the sea," as in the Sifre

(b) תכלת דומה לרקיע ורקיע דומה וכו' "*Tekhelet* is like unto the sky and the sky is like unto, etc."

Afterwards the two sayings may have melted into one producing "*Tekhelet* is like unto the sea, etc."

(f) however, in view of its late setting, can hardly be adduced in support of this hypothesis: the omission of *yam* in that recension may be due to a desire for conciseness on the part of the compiler.

Again, it is possible that R. Meir who was great both as a popular preacher and as an academic teacher would in his popular discourses explain *Tekhelet* as reminiscent of the miracles of the sea

²⁷⁷ "ותכלת לים וים לרקיע"

²⁷⁸ עירובין י"ג, ע"ב

²⁷⁹ te-kelet from *Kalah*: to become annihilated, extinct, etc.; See Hagigah, 13899 אין דורשין במעשי המרכבה and, cf. Megillah 25a; ד יהודה ד מאיר ד יהודה ד חנא קמא ד" ד יהודה ד מאיר

Frantz Delitzsch²⁸² sets down the mention of *asabim* simply to a confusion of blue with green. This however does not explain the purpose served by the introduction of *asabim*.

It is in fact somewhat unjust to load R. Meir and his fellow Tanaites with colour blindness. The decision of certain ritualistic questions required a particularly fine colour sense. It is true that ירוק (*yarok*)²⁸³ covers both green and blue, but this is rather a case of classification than of confusion. For practical purposes the Talmudists divided colour into four classes:

- (1) – *shahor*, black, שחור
- (2) – *adom*, red, אדום
- (3) – *yarok*, green, yellow and blue, ירוק
- (4) – *lavan*, white, לבן

Very deep blue shades would in strict halakhah be referred rather to black.²⁸⁴ Paler or brighter blue shades would be classed under *yarok*.

It is not impossible that the chain of similitudes leading to the comparison of *Tekhelet* with the Throne of Glory is not meant as a colour scale at all: the purport may be to trace the similitude of the Throne of Glory throughout the universe. *Tekhelet* is like the sea and the sea is like grass (*yarok*) which may be regarded as constituting the coloration of the earth; the earth and the sea therefore present colours congeneric with *Tekhelet*; similarly the sky which resembles the Throne of Glory is congeneric in colour with the sea and the earth: hence the whole of nature reminds man of the divine presence. The same explanation holds for (e) only that there the earth begins the series.

Lastly it is, I think, not improbable that we really have here a series of colour gradations, but that *asabim* is used in a limited sense, standing for blue plants or flowers, the species being too well known to need particularisation. The reference may be to the hyacinth or to some other deep blue plant.²⁸⁵ On this hypothesis (e) would have a greater claim to correctness than (d). Though *asabim*

²⁸² Delitzsch, Frantz, *Iris, Farbenstudien und Blumenstücke*, Leipzig (1888), p. 15.

²⁸³ See: שער אפרים. 02; יורה דעה, סי' ל"ח.

²⁸⁴ See: כבד ולא ובר, חולין מ"ג.

²⁸⁵ Cf. Sifri: עשבים ... ירוקים ... שחורים ... אדומים ובר; כי האזינו:

generally denotes common grass, it is also used for flowers of various colours. In reality it covers all plants not fit for human consumption.²⁸⁶

Very often *asabim* occurs in association with the weeding of grain.²⁸⁷ Now we know that blue flowers such as the blue-bottle for instance are largely represented among grain weeds. It is possible that in Palestine this was the case to a very great extent. The omission of *asabim* in (a) (b) and (c) might be due to a desire to obviate misconception. Similarly the position of *asabim* in (d) may have been occasioned by a desire to avoid being misunderstood as defining *Tekhelet* as green "the sea is like *asabim*" would not be so easily misinterpreted.

Neither Bochart nor Braun make mention of the occurrence of *asabim* in variant recensions of R. Meir's saying. Both authors, however, refer to Aben Ezra's assertion on the authority of the Talmudic sages (Rashi 25:4) that *Tekhelet* is *yarok*. ואנו נסמך על רז"ל שהוא ירוק

It is, however, doubtful whether Aben Ezra means green or blue. If the former, his authorities must have been the recensions (e) and (g) "*Tekhelet* is like *asabim*."

Dr. Dedekind is of the opinion that Aben Ezra and his authorities in describing *Tekhelet* as *yarok* (green according to Bochart and Braun) must have had in mind the green stage in the development of the purpurigenic matter.²⁸⁸ Dr. Dedekind²⁸⁹ refers to a specimen of green purple presented to him by the late Lacaze-Duthiers which owes its tint to the arresting of the photographic development at the green stage. Aben Ezra, Dr. Dedekind thinks, may have come across green purple. I very much doubt the correctness of this view. Aben Ezra was well informed; he must have known that *Tekhelet* was not the only variety of purple.

If he happened to see purple of a green tint would he on that account jump to the conclusion that *Tekhelet* must have been green? It might, however, be rejoined that Aben Ezra knowing that *Argaman* was red²⁹⁰ and holding that there were only two varieties of purple, *Tekhelet* and *Argaman*, would have no choice but to identify *Tekhelet* with green and purple, if the latter variety was pointed out to him as genuine purple. But Aben Ezra really refers to Talmudic or Midrashic authority and not to his personal experience. Dr. Dedekind in a private communication

²⁸⁶ See: שביעית, ירושלמי, Pietrekon ed., p. 18b.

²⁸⁷ זרעים Passim.

²⁸⁸ See Aben Ezra, ch. I, passim & commentary on the Pentateuch.

²⁸⁹ See: Dedekind, *Beitrag*, v.IV, p. 363, etc.; also: *Archives de Zoologie*, exp. et gen., Paris (1848).

²⁹⁰ Aben Ezra; Commentary on Exodus Ch. 25.

to me with reference to my treatment of *asabim* draws attention to his explanation of Aben Ezra's *yarok*. Tekhelet *domeh l'asabim* ""Tekhelet is like grass" can, however, hardly be so interpreted: the green stage of development is as much a characteristic of *Argaman* as of *Tekhelet*. Again it was certainly to the final tone not to any of the transitory stages that the name *Tekhelet* was given. A theory devised for explaining the significance of *Tekhelet* would have had little meaning if it were only applicable to a passing stage of the dyeing and one, moreover, which is common to all purple varieties. How would Dr. Dedekind explain *asabim domim l'yam*, etc. ועשבים דומים לים "and grass is like the sea."?

J. Kala-ilan (indigo) as Imitation of Tekhelet—A Clue to the Determination of the Colour of Tekhelet.

It is somewhat strange that none of the authors who, so far as I know, treat seriously of the determination of the *Tekhelet* colour²⁹¹ has taken advantage of the fact recorded in the Talmud that *Tekhelet* was visually indistinguishable from *kala-ilan* which is indigo²⁹² according to the Aruch, the authoritative lexicon of the Talmudim and Midrashim.²⁹³

The Aruch also renders אסטיס (*Isatis tinctoria* wood) by indigo. "Isatis is indigo Arabic *Nil*."²⁹⁴ The Arabic authors designate both indigo (*Indigofera tinctoria* and *argentea*) and *Isatis tinctoria* by the same word *nil* (or *nileh*).

As *isatis* is designated by its Greek or Latin name, *kala-ilan* doubtless denotes the genuine indigo.²⁹⁵ It would be of some interest to trace the derivation of this composite expression.

²⁹¹ Bochart, Braun, Adolf Schmidt, G.E. Leiner, Israel Lifschutz (Cf. Excursus to Ch. VII), and Dr. Dedekind.

²⁹² Or, indicum. On *Isatis tinctoria*, as a substitute for indigo, see: Jaubert, *La garance et l'indigo*. Paris (1900), p. 63, with special reference to England in the 16th cent.

²⁹³ That the *Tekhelet* colour was regarded by the Tanaites as well as by Philo and Josephus as akin to black is evident from Sifre Num.

ד אלעזר ב"ר שמעון אומר למה נקרא שמה תכלת על שם שנתכלו המצרים בבכורות שאמר ויהי בחצי הלילה וה" הכה כל בכור וגר

Cf. Rashi ib. ע"ש שיכול בכורות ומכתם היתה בלילה וכו'.

²⁹⁴ Aruch, S.v.

²⁹⁵ See: Tosephta, פרק ג', עבודה זרה, Read: שרשו, and compare: I. Depieuvre's account of the manufacture of indigo: "On fait tomber les feuilles dans de très grandes cuves en maçonnerie dîtes trempoires. On voit dans de l'une de ces batteries un paniken ou contre-maître à turban rouge et huit coolies ou ouvriers qui battent l'infusion avec des batons pendant environ deux heures, etc." Depieuvre, *Traité de la teinture*, v.III. Paris (1893), "Indigo." The indication about the fastness of *Kata Ilan* also supports the identification with indigo. See: Depieuvre, ib.

The Talmudic name for indigo is in all probability a loanword from India. The Indian names for indigo are *nilini*, *nilam*, *nili*. The Sanscrit *kala* properly means black but the deep indigo blue is also called by that name.²⁹⁶ May not קלא אילן *kala-ilan* mean *kala* derived from trees (*ilan* – tree) in contradistinction to the deep blue of mineral origin (the "ancient blue," "Egyptian," or "Alexandrian blue").²⁹⁷ In view of the fact that the indigofera plant often attains the height of 5 feet it might well be popularly called *ilan* (tree).²⁹⁸ Or may perhaps *kala-ilan* be a corruption of *kala-nilan*, the black or dark *nilan* (indigo) or of *kala-lan* (*lan* = indigo in Chinese)?

Deep indigo blue may thus be taken as reproducing the colour of *Tekhelet*.

In deep shades as Professor Green of Leeds has informed me indigo is *not a pure* blue.²⁹⁹

Most people would indeed be unable to distinguish deep indigo, from deep *pure* blue, but to the experienced eye a slight reflex of violet is visible. Compare Pliny

From this the most indigo influence	"Ab hoc maxime auctoritas indico Ex
comes from India ... when it is rubbed	India venit ... cum teritur nigrum at in
black but in washing it makes a wonderful	deluendo mixturam <i>Purpureae</i> caeruleique
mixture of purple and blue.	mirabilem reddit." ³⁰⁰

Maimonides remarkably enough makes no mention of *kala-ilan* in connection with *Tekhelet* imitations. He names two such colours *isatis* and שחור (*shahor*), black. The latter word has been misunderstood: *shahor* here is not used in the ordinary sense of black but is the Hebrew rendering

²⁹⁶ Alkali is the name of a certain Indian sect whose members dress, as a matter of religion, in no other colour but dark blue. See: *British Encyclopedia*, 11th ed., "India."

²⁹⁷ See: Fremy, *Encyclopédie Chimique*. Paris, 188.

²⁹⁸ See: ירושלמי כמא' פרק ה' הלכה ל'. סוכה ל"ה; ע"א רשי' ר"ה חייבין בערלה, v.10, p. 95.

²⁹⁹ Editor's note: Rabbi Herzog has attached a sample of colour on p. 204 of the original work, which appears as a gray spot only in our copy. The same page contains the following text beneath the sample: "Sample of deep indigo. Kindly supplied to me by Monsieur Vallette, Chimiste en-Chef at the Fabrique des Gobelins, 42 Avenue des Gobelins, Paris. M. Vallette's reply with reference to the scientific definition of the nuance of the sample:

'Ministère de l'Instruction Publique et des Beaux Arts, manufacture nationale des Gobelins. Paris, le 26 Mar. 1914.

Cher Monsieur, Excuser moi si j'ai tant tardé à vous envoyer l'echautillon d'indigo... D'après la classification des couleurs de Chevreul, l'indigo est d'une couleur bleu-violet. Veuillez ... Ch. Vallette."

³⁰⁰ Pliny, *Hist. Nat.*, book 35, para. 27.

of the Sanscrit *nil* by which the Arabs in Maimonides' times as at the present day designated indigo.³⁰¹ *Shahor* in Maimonides is thus the equivalent of *kala-ilan* (indigo) in the Talmud.

M. Sachs identified *kala-ilan* as an adaptation from *kallainon-callainum*. In connection with his suggestion that גלקטיגון the rendering of the Yerushalmi for תחש is a corruption of *galairon kallainon*, that author observes:

"At any rate, this gloss is already recognized by Musaffia, but is misunderstood by his successors; designated as Indigohlan.

"For" *kelailon* "one spoke search" *kelainon* "and through the accidental separation of the word into two one thought, overlaid by (*ilan*) *Ilan* of a tree or a bush was driven, caused this indigo-colored wave to be sold for that. "

"Jedenfalls ist durch diese Glosse das von Musaffia bereits erkannte, aber von seinen Nachfolgern unverstandene קלא אילן (*kala-ilan*) erklärt (Nedar.³⁰² 41 u. sonst) das werder einen Stoff noch eine Pflanze bezeichnet, sondern die blaue Farlu, vom Aruch als Indigohlan bestimmt.

"Für "kelailon" sprach man such "kelainon" und durch die zufällige Trennung des Wortes in zwei dachte man, durch (*ilan*) אילן verlastet, an einen Baum, oder eine Staude. Bertrug, der mit dem (*Tekhelet*) תכלת dem verschriftsmässig gebotenen getrieben wurde, veranlasste, diese indigoblau gefärbte welle für jenes zu verkaufen."³⁰³

³⁰¹ *Nil* in Hindustani denotes black as well as dark blue. "The origin of the Greek and Roman name, Nilus is quite unknown" (Encycl. Brit. 11th ed., s.v. "Nile"). Perhaps it is connected with the Indian *nil*, black, dark, the dark, or black river. Cf. I Chr. ch. 13, v.15: His, ch. 13, v.3. Cf. Arabic: Nil-Misir. the Nile of Misr (Egypt).

³⁰² Mistake for Menahot 41. Sachs has misunderstood Musaphia. The latter's note א"ב ב"י בלשון יוני מין צבע refers to the Aruch's statement פירוט אינדיקן, not to קלא אילן. See: Aruch, s.v. קלא אילן.

³⁰³ Sachs, *ibid.*, v.I, p. 132. All this is bad philology. *Kelainos* (Greek for dark amber perhaps connected with the Indian "kala") has really nothing to do with "kallainon." I have not found "kelailon" in any of the thesauri I have consulted.

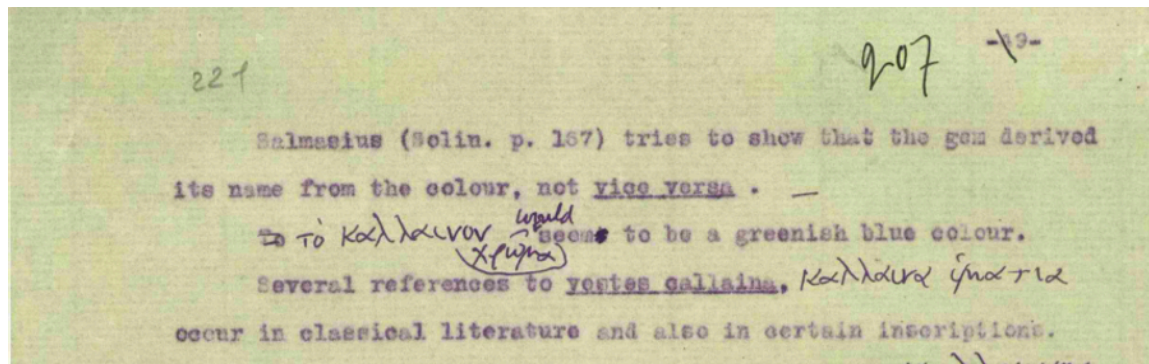
Jastrow (Dictionary of the Talmudim, etc. s.v. קלא אילן) adopting the derivation proposed by Sachs, states plainly that *kala-ilan* is an adaptation from the Latin *callainum*.

The determination of the etymology and precise meaning of *kallainon* presents serious difficulties.

Pliny mentions a certain gem under the name of *callais* or *callaina*. In one place Pliny says that the *callais* resembles the sapphire but is of a paler nuance "*callais sapphirum imitatur, candidior et littoroso mari similior.*" In another the Roman naturalist describes its colour as "*e viride pallens,*" pale green. It would appear that *callais* and *callaina* are to be distinguished.

The *kalais* has been identified with the turquoise. The turquoise, however, is generally blue, though certain varieties present a green playing into bluish. The standard *thesauri* asserts on the authority of an anonymous writer that the Greek *kallainon chroma* answers to the Latin *color venetus*.

Salmasius³⁰⁴ tries to show that the gem derived its name from the colour, not vice versa.



"To *kallainon chroma*" ("τὸ καλλάϊνον χρῶμα") ("the beautiful color [the color that shifts between green and blue]") would seem to be a greenish blue colour.

Several references to *vestes callaina* "*kallaina imatia*" ("καλλάϊνα ἱμάτια") ("beautiful garments [garments whose color shifts between green and blue]") occur in classical literature and also in certain inscriptions.

³⁰⁴ Saumaise, Claude de, *Caji Julii Solini Polyhistoria*, Trajecti ad Rhenum (1689), p. 167.

If as Sachs holds *kala-ilan* is identical with "kallainon" (callainum) it would follow that *Tekhelet* was a greenish blue. This is, however, not very probable. All the evidence at our disposal points to the identification of *kala-ilan* with indigo which is not a *greenish* blue.

"Kallainos" (callainus-a-um) occurs only as a colour designation, never as the name of a dyestuff: *kala-ilan* in the Talmud denotes the colour and the dyestuff producing it. "Kallainon" nowhere expressly appears as synonymous with indigo (indikos, indicum).

On the other hand, indigo (הינדיקון) never occurs in the Talmudim and the Midrashim. Should "kallainon" be identical with "indikos" (indigo) we should have to account for the phenomenon that while the Greeks and the Romans termed indigo variously by "kallainos" and "indikos," the Jews exclusively adhered to the former appellation. Though, from the fact that only the latter has survived in the European languages, it would appear that the former if used for describing indigo must have been at all events the less common one.

Bochart, though he makes no mention of *kala-ilan*, refers to "kallainon" asserting that "kallainos" and "iakinthos" denote one and the same colour, his authority being Epiphanius:

From purple, indeed, and from deep red
and hyacinth, to show the beauty of the
wool.

Ia de purina, ina eite kokkera endulata
kai jakinthina ina deikse ten kallainen
erean.³⁰⁵

Bochart makes no attempt to define the colour designated by "kallainos." It is, I think, within the realm of probability that "kallainen" here is a textual corruption of "kalanilen" or "kalailan" *kala-ilan* (קלא אילן) = indigo.³⁰⁶

The sense of the passage in question does not, however, require identity of colour with "iakinthos" but only a certain degree of similarity. Epiphanius writes here in an homiletic vein, his object being to interpret the symbolic signification of the coloured fillets adorning the angels depicted in the Apocalypse of John. These, as he explains, are emblematic of the national colours of the Assyrians, Babylonians, Medes and Persians respectively. It may be that the favourite

³⁰⁵ Epiphanius, Alogie, ed. by Higby, sect. 34, haeres, p. 954.

³⁰⁶ Epiphanius being a native of Palestine would designate indigo by the name current in that country. Epiphanius, it may be mentioned, is also said to have been of Jewish extraction.

colour of the national dress of the Persians in Epiphanius' time was a greenish blue such as was described by the term "kallainos."

It is perhaps the "chroma kallainon" which is meant in the Mishnah Berakhot 1a where the time for the reading of Shema in the early dawn is said to begin according to R. Eliezer משיכיר בין תכלת כרתי לכתרתי from the moment when כרתי becomes distinguishable from *Tekhelet*. *Karti* is used in the Talmud for designating leek and a certain colour variety. As a colour designation the word does not necessarily mean leek-green exactly reproducing the pale green of the leek-plant. It is rather a generic name for green. Similarly "prasinus" in Greek from "prason" (leek) denotes green.³⁰⁷ As the name of a coloured fabric ³⁰⁸ כרתי may mean a greenish blue.³⁰⁹

As the fabric appears to have been highly expensive it should perhaps be identified with that variety of purple, the colour of which Pliny describes as "austerus in glauco et irascenti similis man."

Dr. Dedekind is in possession of a specimen of greenish blue purple dyed by Lacaze-Duthiers.³¹⁰

K. Tekhelet Colour Interpretations

A. The Gaonic Tradition; Karaitic Interpretation.

The earliest extant rendering of *Tekhelet* by an Arabic word is that occurring in a responsum of R. Nahshon Gaon "Rabbi Meir (said) "*Tekhelet* like the sea and the sea is like the sky and the sky is like the Throne of Glory': its Arabic name למאסמא ³¹¹(i.e., sky colour) لون السماء lawn alsama'ee <https://translate.google.com/?sl=en&tl=ar&text=sky%20color&op=translate>". This doubtless embodies the oral tradition of the Academies. R. Saadya Gaon renders *Tekhelet* by "al samanjun (اسمنجون)" colour of the sky

(<https://translate.google.com/?sl=ar&tl=en&text=%D8%A7%D8%B3%D9%85%D9%86>

³⁰⁷ Deep as well as pale shades.

³⁰⁸ כרתי also occurs as the name of a certain gem. See Targum 1,6 כרתניון and LXX "prasinon" for שחם. Perhaps כרתי as a gem "kalais."

³⁰⁹ See: רבנו יונה אלפסי ברכות פ"א משנה ב' Cf. גיסין ל"א ע"ב גוהרקא דד בא ופרוס עליה סרב לא דברתי: where the Aruch is wrongly quoted as saying: "כרתי הוא צבע הינדרר"ש". The writer's mistake was occasioned by a false construct of: "ירוק כרתי" ד"ה תוספות חוליו מ"ק ע"ב ד"ה "ירוק כרתי" ib., in the Vilna ed. of the Talmud. Cf. also: פרשה מקוהלת ברכות פרק ס' תכלת היא צבע ירוק רומא קצת לכרישיך

³¹⁰ Dedekind, "La Pourpre verte," *Archives de Zoologie*, exp. et gen. (1898).

³¹¹ 2a לונמסמא See Ch. V, p. 156, note ib.

%D8%AC%D9%88%D9%86&op=translate). The Karaites, the bitter antagonists of the Talmud and the Geonim, here follow the traditional rendering.³¹²

B. The Samaritan Tradition.

Among the Samaritans *Tekhelet* would seem to have been extinct for centuries. They have lost all particular knowledge of the matter but have nevertheless preserved the tradition of the colour.

It would appear that on the extinction of *Tekhelet* the Samaritan authorities interpreting the significance of the rite as symbolic of the thread of *Tekhelet* on which was suspended the High Priest's breast plate devised to replace the *Tekhelet* in such a way as to retain the symbolism.

I corresponded on the subject with the present High Priest of the Samaritans Jacob ben Aharon of Nablus (Shekhem), Palestine.³¹³

The precise nature of the substitute for *Tekhelet* is not quite clear to me from the High Priest's reply.

In compliance with my wish to have some important extracts with reference to *Tekhelet* from the Samaritan authoritative commentaries on the Pentateuch, the High Priest forwarded me a copy of two such passages from אב סכוה סעד (Abu Al-Hasan of Tyre) and אב אל-חסן הצורי (Abu Al-Hasan of Tyre) respectively. In the extract from אב חסדה *Tekhelet* is defined as ... צבע (אלאזרק) הפתוח אסמג'ין

³¹² See Jephath the Karaite's commentary on the Pentateuch, section שלח Cf. above, n. 310; and Elijah ben Aharon the Karaite: "ציצית גן עדן"

³¹³ בשם ה'.

→ שלום
תכלת.
אנחנו נעשה ציציות מן שנים עשר מין ממיני שנים עשר האבנים אשר על חשן האפוד מתרככת על פתיל תכלת.
וגלל עשוה מספר שנים ושלשה ציצה
אבותינו עשו תכלת היה בימיהם משי כמו השמים והו' יעשו פתיל ממנו ואנחנו נעשה הנמצא ביומינו ככה יכלתן — ביום החמישי
בשבוע י"ד לחדש הרביעי והוא תמוז שנת נ"ב וה"ק וג' אלף למושב ישראל לארץ כנען
היום יום ב' בשבוע כ"ב לחדש אב והוא החמישי שנת נ"ב וה"ק וג' אלף לישראל
תשובה על השאלות שאלתה אתם ...
(א) צבע התכלת האמת אקרון כמו צבע השמים: לא מדם (החלזון), ולא מעורנו(?): רק נעשה אתו מן שנים עשר מראה
(ב) התכלת אין דומה אקרו ולא אנחנו נעשה כה
(ג) התכלת מצבוע שנים עשר מראה
(ד) התכלת עתקנו מאבותינו עשוהה כאשר דברתי לך מלמעלה רק מעתקים אן אבותינו הראשונים עשו אתה מראהו כמראה השמים
(ה) פתיל התכלת הוא אינו מצמר ולא מפשתיים: רק שש משזר (חריר)
— בלשון ערבי
יעקב בן אהרן הכהן בשכם

הוא מראה השמים. In their explanations of the significance of *tzitzit* and *Tekhelet* these commentators practically reproduce the Jewish Aggadah and Rashi.

C. The *Tekhelet*-colour According to Rashi.

Reference has already been made to Aben Ezra's definition of *Tekhelet* as *yarok*. Rashi the great Franco-Jewish exegete likewise interprets the word as צבע ירוק.³¹⁴

Does Rashi understand by *yarok*, green or blue? From his comment³¹⁵ תכלת ירוק הוא וקרוב לצבע כל מיני צבעונין יפין לחלום חוץ מן תכלת ירוק הוא ומי שפניו ירוקים on³¹⁶ כרתי שקורץ פור"ש it appears that he conceived the *Tekhelet* colour as green playing into bluish. The translation current in the Jewish schools which at least in an instance like this undoubtedly is derived from good old tradition knows only of one rendering of *Tekhelet*, viz., blue. There can be no doubt that this was also the usual rendering in Rashi's days. The school translation was not exactly based upon R. Meir's saying but went back to oral tradition dating from the time the Jews first settled in Germany, France, etc. Rashi's view of *Tekhelet* shows that he preferred consulting written sources, to relying upon oral tradition. According to him, as already explained, the position of Yam (sea) in R. Meir's famous homily indicates that the nearest likeness of the *Tekhelet* colour is presented by the sea. Rashi would therefore turn to the sea for an illustration of what *Tekhelet* must have looked like.

He would seem to have derived his idea of the sea colour from the British Channel or from the North Sea which as we know are of a green tint here and there playing into bluish. Hence, so at least it seems to me, he came to regard *Tekhelet* as essentially a green colour playing into blue.

Rashi is not however consistent throughout. In his commentary³¹⁷ reproducing a saying found in the Sifre, Rashi states that *Tekhelet* resembled the dark sky at dusk (sombre blue): "דומה לרקיע: המשחיר לעת ערב."

VII. THE PROCESS OF DYEING

A. Fibres Eligible for Ritual *Tekhelet*.

No other material but wool was admissible for *Tekhelet*, whether *Tekhelet* shel mikdash (sacerdotal and cultural) or *Tekhelet* shel *tzitzit* (see Excursus). תכלת עמרא הוא declares the Talmud:

³¹⁴ Cf. Pentateuch Commentary Exod. 25.

³¹⁵ Ib. ברכות, ט ע"ב.

³¹⁶ Ib. ברכות נ"ז, ע"ב.

³¹⁷ Num. Ch. XV, v.37.

³¹⁸ " *Tekhelet* is woollen." The same applies to *Argaman* and *tola'at shani* (scarlet) as far as these stuffs were employed in the Sanctuary.

In Greek and Latin authors, *Porphyra*, *Purpura* and their derivatives stand for woollen or silken stuff dyed with purple pigment. Silk purple was probably not unknown in Phoenicia and Palestine, but its use in the temple was excluded by tradition. There can be but little doubt that purple dyeing in its early stages was confined to wool. Silk purple being a later extension of the industry naturally failed to gain admission into the Sanctuary, or the ritual (*tzitzit*).

Luther's rendering of *Tekhelet* by "Gelbe Seide" is doubly wrong.

It would be interesting to trace the source of Luther's error. He may have been misled by Aben Ezra on Esther 1,6. Aben Ezra, however, never meant his remark והיא משי to be universally applicable.³¹⁹

Abrabanel's argument, needless to say, is devoid of the slightest force. As minister of the finances to Ferdinand, Abrabanel would often see purple. It would seem that the purple fabrics used at the Spanish court consisted exclusively of silk. It was probably that circumstance which caused Abrabanel to write on the Torah in this instance like a chancellor of the Exchequer.

One wonders how Abrabanel could so completely lose sight of several sugyot in the Talmud³²⁰ and of the Mishnah.³²¹

B. The Stage at Which the Dyeing Took Place.

"The ancient purple wool fabrics had not been dyed in yarns or even in fabric, but raw. It was only from the dyeing factory that the purple wool passed into the	"Die antiken purpurnen Wollstoffe waren nicht im Garne oder gar im Gewebe, sondern roh gefärbt worden. Erst aus der Färberei ging die Purpurwolle in die
--	--

³¹⁸ Yevamot 4b.

³¹⁹ Compare: Abrabanel's commentary on Exodus 25.

"עוד אמר תכלת וארגמן ותולעת שני. והרלב"ג כתב שהיה כל זה צמר במראות והצבעים ההם. ואין זה נכון כי הצמר קרא אותו הכתוב עלים אבל התכלת והארגמן ותולעת השני הם כולם משי וכו'."

³²⁰ See Excursus to this chapter. A curious document ascribed to a Roman consul makes mention of "silk *Tekhelet*" worn by the Levites in the procession which took place annually seven days before the Day of Atonement.

³²¹ Kil'aim ch. 9: See שבט יהודה by Judah ibn Virgo and סדר דורות Warsaw (1897), p. 167.

spinning mill and from there into the
weaving mill.

Spinnerei über und von dort in die
Weberei."³²²

Tekhelet seems to have formed no exception to the rule. The Mishnah³²³ in enumerating the thirty-nine principal labours which are forbidden on Sabbath takes as an illustration of some of these the processes connected with the making of woollen cloth: in the series which begins with the shearing of the wool, dyeing precedes spinning and weaving. The order in this, as well as in the other series is, as the Gemara states, in strict accordance with fact. I should add that the series are based upon the operations carried out in connection with the construction of the Tabernacle and have therefore in view the manufacture of *Tekhelet*, etc...

Moed Katan 19a speaks of the spinning of " *Tekhelet* for *tzitzit*":

וטווה על יריבו תכלת לציציתו בין במדן בין בפלך.

Though *Tekhelet* sometimes stands in the Talmud for *tzitzit* as a whole, yet the expression "*Tekhelet* for *tzitzit*" hardly leaves a doubt that *Tekhelet* in the strict sense is meant here. Eruvin 96b points in the same direction.

Nowhere, however, is there an express statement declaring the order to be an essential requirement, though indeed Pentateuchal authority might be adduced as pointing in that direction.

"And every man, with whom was found *Tekhelet* and *Argaman*, ... brought there."³²⁴ "And all the women that were wise hearted spun with their hands, and they brought that which they had spun of the *Tekhelet*, and of the *Argaman*, etc.."³²⁵ V.23 speaks of dyed raw wool, while v.25 refers to the spinning of the coloured materials.

From Josephus we further learn that the wool for the use of the Tabernacle was in some cases dyed when still attached to the skin. But it is hard to discover what authority he may have had for the additional information he thus incidentally affords us.³²⁶

³²² Schmidt, A., *ibid.*, p. 153.

³²³ Cf. שבת, פרק כלל גדול, משנה ב'.

³²⁴ Exodus ch. 35, v.23.

³²⁵ Idem, v.25.

³²⁶ It has no support in the Masoretic Text, nor is it sustained by the LXX.

A passage in the Midrash Tanhuma might be mistaken as affording evidence of the prevalence of a practice in certain Palestinian purple factories of having the wool dyed before its being shorn off the skin, but the text is palpably corrupt and on being duly corrected the passage indicates nothing of the kind.³²⁷

C. Process of Dyeing as Recorded in the Talmud.

A recipe in the proper sense for the dyeing of *lekhelet* is not to be found anywhere, at least so far as I am aware of. The account given by R. Samuel b. Judah leaves very much to be desired. "Abayi said to R. Samuel b. Judah, 'That *Tekhelet* how do ye dye it?' He said to him. 'We take (lit. bring) *hillazon* blood and drugs (*sammanin*) put them into a kettle, boil the mixture, and then take out something of the liquid in an egg-shell, and test the sample with a bit of (soft) wool.'³²⁸ We throw away that egg-shell and burn the trial sample of wool.'" The following inferences are to be drawn from this account:

Wool dyed as a trial sample is unfit (i.e., for ritual *Tekhelet*): 2) *Tekhelet* must be dyed "lishmah " (for its own sake); the testing of the dye renders it unfit (i.e., for ritual *Tekhelet*, etc..).³²⁹

Are we to infer from the conciseness of R. Samuel's answer that Abayi had only asked for information in so far as concerning the halakhic aspect of the dyeing process? No particulars are given about the "drugs" employed together with the blood derived from the *hillazon*. This is very unfortunate. Commentators differ. "It is very strange that extraneous matter should have been mixed with the *Tekhelet* dye, but perhaps it was the combination of the *hillazon* pigment with these drugs that constituted the *Tekhelet* dye."³³⁰

Rashi's note is of extreme importance: "ve'sammanim. "It is the practice of dyers to imbue cloth with serif שרף which is called "beitze." Rashi refers to the treatment of cloth with alum-mordant in order to fix the colour to the fibre. (German: 'AlaunBeitze'). The commentator's object is evidently to meet by anticipation the difficulty referred to in the Tosaphot. The *sammanim*, Rashi holds, are simply mordants and have nothing to do with the production of the colour.

³²⁷ ד הושעיא הגדול שונה אם רוב אנשי העיר מלאכתו דרך מותר לו לישא את כפיו כשם שיש בדרום עירות צבעות ארגמן ומבין ידיהם צבעות וכי'

Tanhuma section נשא Lublin (1896). Correct: "עירות צובעות ארגמן," "towns engaging in the dyeing of *Argaman*."

³²⁸ Cf. Pliny, IX, 38: "vellus elutriatum mergitur in experimentum et donec spin satis fiat uritem liquor."

³²⁹ Menahot 42b.

³³⁰ Tosaphot, *ib*.

Maimonides, it would appear, is of the opinion that the drugs (sammanim) only served to cleanse the dye from impurities: "How is *Tekhelet* dyed? The wool is soaked in chalk and washed until it is clean, and then boiled with 'ahala' and the like, as is the practice of dyers, in order to prepare the wool for absorbing the colour. The blood of the *hillazon* is then put into the vat (kettle) together with drugs such as kimonia (cimolia), as is usual in dyeing; the liquid having been raised to a boiling heat; the wool is immersed therein, remaining in that condition until it has the colour of the sky and this is the *Tekhelet* used for tzitzit (*Tekhelet shel tzitzit*).³³¹

Cimolia is a cleansing substance, reference to which occurs several times in Pliny.³³²

Samuel b. Hofni leaves us somewhat in the dark as to his view on the question. "The information has come down to us that it (*Tekhelet*) was dyed with the blood of an aquine (marine) animal called *hillazon* mixed with another (substance)."³³³

This rather gives the impression that the sammanim formed an essential part of the dye, assisting in the production of the requisite colour.

Appearances, in the Talmud, I feel, point in the opposite direction. The absence of all specification of the sammanim in question, tends to indicate that the latter stuffs were not essential to the production of the colour. But if R. Samuel b. Judah, Abbayi's informant, was under the impression that the latter was only interested in the halakhic aspect of the dyeing process; then R. Samuel's silence on the nature and specification of the sammanim would not warrant the inference which seems to underlie Samuel ben Hofni's statement. It is hard to arrive at a definite conclusion.

VIII. THE FASTNESS OF THE *Tekhelet* DYE

In older sources there is no explicit statement on the fastness of the *Tekhelet* dye. It is however implied in the prescriptions for the tests whereby indigo might be distinguished from *Tekhelet* that the latter dye was faster than indigo (*kala-ilan*) which as we know has the reputation of being very fast to light and to soap.³³⁴ "This applies to *kala ilan* which is not removable by means of soap."³³⁵

Professor Rosenstiehl, professor of dyeing at the Conservatoire National des Arts et Métiers has,

³³¹ Maimonides, *Hilkhot tzitzit*, II, 2. With reference to this preparation of the wool alluded to by Maimonides. compare Pliny, (ib., 9, 3) "elutriatum velus," and Plato (Critias, 11).

³³² Pliny, ib., XX, 81, etc.

³³³ See my article in J.Q.R. July 1914.

³³⁴ "צפון." Compare: Baba Kama 93b.

³³⁵ This does not of course mean that *Ka/a-ilan* is not *impaired* by washing with soap.

however, informed me that indigo, though fast to soap, is impaired by strong rubbing (frottage)³³⁶. Does it follow that *Tekhelet* was not superior to indigo in that respect, for otherwise the somewhat elaborate tests might have been dispensed with? The inference would seem to have the support of no less an authority than R. Gershom ben Judah "The Light of the Exile (960-1028). "Rabbi Jehudah would hand it over to the washer, Reb. Hanina's practice was to protect the *tzitzit* by a sort of wrapper in delivering the garment to the laundry. Rabina would insert the *tzitzit* in a kind of pocket specially designed for the purpose which he would sew up before handing over the garment to the washer.³³⁷ R. Gershom in his commentary annotates as follows: "R. Jehudah would hand over the garment with *Tekhelet* to the washer asking him to take care that the colour of the *Tekhelet* does not get spoiled ... he (sc. R. Hanina) would wrap the *Tekhelet* wound with other threads in order to protect its colour against deterioration, etc."³³⁸ According, however, to Rashi's interpretation there is no reference here to the effect of washing upon the *Tekhelet* colour.³³⁹ The explanation of the passage given by the Gaon Rab Amram, an earlier author than R. Gershom, though not agreeing with that of Rashi, also involves no allusion to the impairability of *Tekhelet*:

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Maimonides' Code contains an important statement which is, however, too general to be of much avail in the present inquiry . . . "As for the *Tekhelet* prescribed for *tzitzit*, it's dyeing must be of a certain kind which produces a colour abiding in its beauty and which does not become altered, etc."³⁴¹ This is somewhat vague, giving no indication of the extent of the durability and fastness of the *Tekhelet* dye, but it undoubtedly implies fastness to light.

The inalterability of the purple dye in general has already been discussed.

In the experiments made by William Cole with the dye of *Purpura lapillus* the first washing somewhat allayed the colour, though it afterwards continued insusceptible to alteration by washing. This fact, however, scarcely has any bearing upon the passage Menahot 41 b. as interpreted by R. Gershom. The language of the Talmudic statements cannot reasonably be made to apply only to the first washing.

³³⁶ My own experiments have so far not confirmed Professor Rosenstiehl's assertion.

³³⁷ Menahot 41b.

³³⁸ R. Gershom's commentary, *ib.* in the Wilna ed. of the Talmud, 1884.

³³⁹ Rashi, *ib.*

³⁴⁰ R. Amram Gaon, *Itiur tzitzit*. 2.

³⁴¹ Maimonides, *Hilkhot tzitzit*. I, 1.

Of far greater importance is the information supplied by Lacaze-Duthiers that the dye of *Murex trunculus* is not fast to washing ("ne resiste pas au lavage"). This fact must also be taken into consideration in connection with the study of the *Tekhelet hillazon*, or the *Tekhelet*-giving species of mollusc.

IX. TESTS FOR DETECTING FRAUDULENT IMITATIONS OF *Tekhelet*

A. Allusions and References to Imitation Purple in Homer, Pliny, and Vitruvius.

Imitations of purple with vegetable dyestuff would seem to have been pretty common already in Homeric times, if the expression "aliporphyra" (ἀλήπορφύρα = "crimson") has been rightly explained as signifying marine in contradistinction to vegetable or imitation purple. Personally I am not quite sure about this. Ctesias speaks of the imitation of purple in India by the means of a dye obtained from certain native plants in terms which give the impression that in his time the vegetable purple (*Porphyra sotane*)³⁴² was still very rare among the Greeks. Not only in Homeric times but even centuries after, the term "porphyra" used without any qualifying epithet stood for nothing but marine conchylian purple. The LXX in rendering *Argaman*, which as we know uses marine purple, never employs any other expression than "porphyra." Aquilas especially would have indicated somehow the marine character of *Argaman* if ambiguity were possible.

The coining however of a special word aliporphyra for distinguishing marine from botanic purple would presuppose a high degree of possibility of confusion on the point in very early times.

Are we to suppose that "porphyra" originally designated a vegetable or botanic dye being either the names of the plant producing it or owing its appellation to some other reason; that the marine purple was named "porphyra" on account of its resemblance in colour to the latter; and lastly that in Homeric times the marine purple had not yet completely superseded its vegetable predecessor, so that it was necessary to distinguish the former through characterising it as sea purple "aliporphyra"?

What occasion is there, besides, in those particular passages for emphasizing the marine origin of the "porphyra" referred to?

³⁴² Cf. W. Adolf Schmidt op. cit., p. 100.

May not "aliporphyra" rather mean sea-like purple, resembling the colour of the Mediterranean sea, dark sapphire blue, *Tekhelet*, as distinct from the brighter or reddish purple, *Argaman*?

But whether Homer alludes to "sotane porphyra" or not, Pliny and Vitruvius speak plainly of purple imitations with vegetable dye.³⁴³

I cannot recall any references to tests in Greek and Latin authors. In the majority of cases, probably, the test would consist in subjecting the fabric to a thorough washing and rubbing with soap and scalding water.

B. Tests for Tekhelet in the Talmud.

For *Tekhelet* the Talmud records two testing processes: one due to R. Isaac b. R. Jehuda, (Menahot 43.) the other to R. Avira in whose name it was reported by R. Ada.³⁴⁴ In the first case (I) a sample of the wool in question was allowed to soak overnight in a mixture of alumine, fenugrec juice and urine forty days old³⁴⁵ (or according to a variant reading urine of a forty days old child). If the colour remained unimpaired the *Tekhelet* was proved genuine. The other test (II) consisted in putting some of the wool into an over fermented dough made of barley flour, and baking the dough. If after the baking operation was over, the sample on being taken out showed a change for the better in the quality of the colour, the wool would be pronounced genuine *Tekhelet*, if for the worse, it would be rejected.³⁴⁶

The *Tekhelet* imitations were usually made with indigo which being fast to light and washing could not be easily detected as a fraud.

C. Chemical Aspects of the Tests.

In test (I) we miss an indication of the proportions in which the several constituents are to be mixed. What is the value of these tests from the chemical point of view? Professor A.C. Green, professor of dyeing and tinctorial chemistry at the University of Leeds, informs me in his reply³⁴⁷ to this and other questions:

³⁴³ Pliny, 22, 33: 21, 26, 97; 9, 41, 64; 18, 31. Vitruvius 7, 13.

³⁴⁴ Menahot 43.

³⁴⁵ So Samuel b. Hofni.

³⁴⁶ Menahot 43b, 44a; Maimonides' Code omits alumine in Test I, but the reading of our copies has the support of Samuel b. Hofni (d. 1034), Chief of the Academy at Sora.

³⁴⁷ His highly instructive letter is dated July 29th, 1913.

1) — It would seem clear from the quotations given that the tests prescribed have the object of ascertaining whether the dye is easily 'reduced' (hydrogenated). Indigo is more readily hydrogenated and removed from the fibre in the form of its leuco compound than is the brominated indigo (of which the purple probably chiefly consists). In both cases the action doubtless depends on the evolution of hydrogen by the fermenting organic matter.

— It seems likely that the *Tekhelet* was faster than indigo.

— Indigo like all 'vat' dyes is very fast to soap. In pale and medium shades it is not very fast to light, in which respect it is surpassed by the brominated indigos.

— Brominated indigos are all brighter in shade than indigo itself.

— All 'vat' dyes are fixed on the fibre by oxidation. In the bath the dye is not present as such but as a soluble leuco or hydro compound. If the oxidation on the fibre is not complete the dye will be easily removed by washing."

D. Origin of the Tests.

We are told absolutely nothing about the authorship of these tests whether they were invented by the Amorains whose names they bear or whether they really dated from earlier times.

The Tosephta Menahot³⁴⁸ which contains the important halakhah declaring all non*hillazon Tekhelet* unfit, mentions nothing about the existence of a criterion for distinguishing false from true *Tekhelet*, nor is there any allusion to a test of this nature in the Baraita d'*tzitzit*.

On the other hand the Baraita d'*tzitzit* states that *Tekhelet* picked up at random, though elaborated in the form of *tzitzit*, is ritually unfit because *Tekhelet* for *tzitzit* must be obtained from a dealer of recognised competence and reliability:

המוצא תכלת אעפ"י שהיא שזורה פסולה שאין לוקחין תכלת אלא מן המומחה.

Partially disagreeing with this an halakhah states in the Talmud³⁴⁹ that if the *Tekhelet* in the above case is in the form of threads, thus indicating its destination for *tzitzit*, it is fit.

In the Talmud the halakhah is cited in the name of the Amora R. Elazar, a description which would seem to indicate that it was not current as a Tanaitic baraita. But R. Zera at any rate

³⁴⁸ Menahot, ch. 8.

³⁴⁹ Erubin 96b.

regarded it as Tanaitic for he said to his son Ahabah, "Go out and communicate to them the baraita."

אלעזר המוצא תכלת בשוק לשונות פסולין חוטין מופקין כשרה R. Zera's version however shows a certain improvement. Raba, it is true, somewhat angrily exclaimed "Does the mere fact of its being communicated by Ahaba the son of R. Zera hang it round with jewels?" But the great Amora does not thereby convey a suspicion about its Tanaitic origin.

Neither, however, in the form in which it is quoted in the name of R. Elazar, nor in that expressed by R. Zera with a claim to Tanaitic origin, is there a statement giving the reason for the halakhah as is the case in the Baraita d'tzitzit. שאין לוקחין וכו

From the Talmudic discussion it is clear that the ground is lishmah (לשמח) that it is the rejection in the one case is due to the apprehension that the *Tekhelet* might be shelo lishmah or not specially dyed and prepared for *tzitzit*; the acceptance in the other case is based on indications in the *Tekhelet* in question that it was specially worked for *tzitzit*.³⁵⁰ But there is no allusion in the Sugya by Erubin 96 to the possibility of the *Tekhelet* being kala-ilan or imitation *Tekhelet*.

Does then the Baraita imply that this must be ascertained by means of testing? It would then follow that a testing process for *Tekhelet* already existed in Tanaitic times. But the inference is at least dubious. The dictum of the Baraita d'tzitzit, that *Tekhelet* must be obtained from a person of recognised trustworthiness and competence, also occurs in the Talmud Menahot 43. Does not this conflict with Erubin 96b? The Tosaphists indeed comment upon the difficulty. Their solution amounts to saying that just because of the law in rejection of *Tekhelet* obtained from a doubtful source, there is a strong presumption that *Tekhelet* bearing internal evidence of its having been prepared for *tzitzit* by its owner, emanates from a reliable source. This might do as far as concerns the Babylonian Talmud, but it fails to reconcile the Palestinian Baraita d'tzitzit with the former. The latter is outspoken enough.

The Palestinian practice would seem to have been stricter in this respect than that obtaining in Babylonia.

³⁵⁰ Cf. Rashi, *ib.*

E. The Character of the Tests Are They Obligatory, or Optional?

We are now brought face to face with a difficult question: Were those tests obligatory? Had *Tekhelet* obtained from a trustworthy and competent source to be submitted to a test before being passed as Kosher (ritually fit)? A baraita quoted in Menahot 43b states: "There exists no test for *Tekhelet*, it must not be obtained from any one but a person of acknowledged competence and reliability."

תכלת אין לה כריקה אינה ניקחת אלא מן המומחה.

Prima facie this conflicts with R. Isaac b. Judah and R. Avira as reported by R. Ada who prescribe tests for *Tekhelet*. The Talmud notes the contradiction. A modern method of dealing with discordant tests would have steered clear of the difficulty by introducing the factors of time and evolution: In Tannaic times the tests of R. Isaac and R. Ada had not yet been discovered. This method, however, all too freely employed by modern criticism of the Bible, is but rarely resorted to in the Talmud. The Talmud reconciles the discrepancy by explaining the Baraita as meaning that tests are useless because no test can ascertain whether the stuff is not trial-*Tekhelet*, or dyed as an essay to see whether the dye had already reached the desired degree of perfection: טעימה. In that case it would of course be unfit on the ground of shelo lishmah, that it is not expressly dyed for the ritual purpose. *Tekhelet* must therefore be obtained from an authoritative source. But if so, one might reasonably inquire, what is the good of the tests of R. Isaac and R. Ada? If the *Tekhelet* has been, as it indeed must be, procured from a proper authority who perforce must be believed with regard to lishmah he might as well be trusted right through? There is apparently no escape from the conclusion that the tests are by no means obligatory, their value being only of a negative nature. If applied, uncalled for of course, to *Tekhelet*, they have the effect of vitiating it, if the results tell against its genuineness.

That this is the opinion of the greatest codifier of the Talmud is, I think, as clear as daylight. "*Tekhelet*, may not be obtained except from a mumheh (reliable authoritative person), it being feared lest it was dyed shelo lishmah (for other than the ritual purpose). Though obtained from a mumheh, if it is tested and found to be dyed with one of the other blackening dyes which are not durable then it is unfit, etc."³⁵¹

³⁵¹Maimonides, Hilkhoh tzitzit, II 4-5, Cf. Keseph Mishnah, ad locum.

An earlier authority, however, Samuel b. Hofni (died 1034), gaon and chief of the Academy at Sora (Babylonia) seems to hold that the tests are meant to be obligatory. "On account of the great difficulties which the preparation of *Tekhelet* involves it must not be obtained except from a person of acknowledged honesty and truthfulness and even so it had to be tested to make sure that it was not dyed with a dye other than the one indicated (by the Law)."³⁵²

Samuel b. Hofni would seem to have thought that the language of the Talmud implies the obligatory character of the tests. But how to escape from the difficulty discussed in the preceding paragraph? Singularly enough the German archaeologist W. Adolf Schmidt, who knew as much Talmud as Samuel b. Hofni knew German, here quite unconsciously to be sure comes to the rescue of the distinguished head of the greatest Judaeo-Babylonian Academy.

The Republic of Letters is no mere figment of the imagination!

Schmidt, on the ground of an allusion found in a certain papyrus, maintains that purple dyeing was not confined to the coastlands. If Schmidt is right then the inland dye-houses owing to the difficulty of preserving the molluscs in fit condition during the course of the transport would probably prefer to procure the dye already extracted. Care would of course be taken to protect the dye against the action of light on the way from the coast to the factory.

It might thus happen that a maker of *Tekhelet* having his establishment far removed from the coast and procuring his dye from an indifferent source would be under the necessity of testing *Tekhelet* in order to ascertain its genuineness. The bedikah (test) in that case would be obligatory for the *mumheh* himself.³⁵³

Dr. Dedekind, however, strongly dissents from Schmidt in this instance.³⁵⁴

³⁵² R. Samuel b. Hofni, *Treatise on the tzitzit*. unique Arabic Ms., Saint Petersburg Imperial Library, ed. R.I. Herzog, ch. 9.

³⁵³ An homily in the Sifre שלח calling down divine retribution upon hypocrites pretending to have Tekhelet in their tzitzit while in reality they have kala-ilan shows that this sort of religious as distinct from commercial fraud was widespread already in Tanaitic times. Cf. Chapter V, p. 125 Cf. 61 בבבא מציעא. Cf. מכילא משפטים and תוספתא בבא קמא

³⁵⁴ Dedekind, Beitrag, i, pp. 179-186.

X. THE RITUAL USES OF *Tekhelet*

A. Allusions to the Secular Uses of the *Tekhelet*.

Allusions to the secular uses of *Tekhelet* are very few. Neither *Tekhelet* nor *Argaman* ever appears in connection with the royal apparel of Jewish kings in Biblical times.

David when dancing before the Ark at the head of a most solemn procession is girded with "a linen ephod."³⁵⁵ We are told nothing about the nature of the mantle he wore on the occasion. The Chronicler, however, informs us that David was clothed with a robe of fine linen like "the Levites that carried the Ark," the distinguishing mark of the king being the linen ephod which was "upon him".³⁵⁶

It is significant that the Chronicler who, according to the critical school of modern Biblical exegesis, is actuated by the desire to paint the Jewish kings in the dazzling colours of the Assyrian and Persian world conquerors, assigns no purple whether *tekhelel* or *Argaman* to the uniform worn by the ideal king of Israel in the performance of that most important national function. Possibly an observation on the absence of purple underlies the homily on this verse in the Midrash Raba.³⁵⁷

In Canticles the seat of Solomon's palanquin is spoken of as being made of *Argaman*

מרכבו ארגמן.

The mention of *Tekhelet* and *Argaman* among the objects of tribute sent by Hezekiya to Sennacherib has hardly much to do with the point under consideration. The "virtuous woman" is depicted as clothing herself in shesh and *Argaman*; *Tekhelet* is conspicuous by its absence.

In the Talmud, reference is made to garments made wholly of *Tekhelet*.³⁵⁸

³⁵⁵ II Samuel, ch. 6, v.14.

³⁵⁶ I Chron. ch. 15, v.27.

³⁵⁷ Num. Sect. 4. The remark of Pseudo-Rashi on I. Chron. Ch. 15, v.27, is worth noting in this connection. Cf. also Z.W. Einhorn's commentary on the passage referred to in the text: Midrash Rabbah, Bamidbar Rabbah. 4. Wilna, edition 1887.

³⁵⁸ Menahot 39a, 41b.

B. The Sacerdotal and the Cultural Tekhelet.

The ritual use of *Tekhelet* was two-fold (I) for sacerdotal and cultural purposes (II) for the *tzitzit*.

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Tekhelet appears as occupying a somewhat higher position than *Argaman* in the ladder of sanctity. Thus the me'il (coat) of the High Priest was made wholly of *Tekhelet*. Similarly the sis on which was engraved the tetragrammaton was attached to the misnephet by means of a thread of *Tekhelet* (פתיל תכלת). And so was the hoshen (חשן). Numbers 4 also supplies one hint in the same direction, *Tekhelet* being ordered there for the covering of the furniture and utensils of the Inner Sanctuary, *Argaman* for those of the Outer Sanctuary.

The Pentateuchal passages have reference only to the Tabernacle. The account of the First Temple in I Kings 5-7 which, of course, is far from complete, omits all mention of textiles. The parallel passages in Chronicles refer to *Tekhelet* and *Argaman* but in very general terms.

Ezekiel's sketch of the future contains no allusion to *Tekhelet* or *Argaman* even in connection with the priestly garments. In the Second Temple *Tekhelet* and *Argaman* were employed for the High Priests garments in accordance with the Pentateuchal prescriptions and also for the thirteen veils hung at the gates.³⁶⁰ There is, however, a division of opinion with regard to the girdle worn by the ordinary priests.³⁶¹ According to Rabbi,³⁶² it also contained a texture of *Tekhelet* and *Argaman*, while R. Eliezer ben R. Simeon holds that it consisted wholly of linen.³⁶³

Maimonides, in accordance with a well-known rule laid down by the Talmud with regard to the decision of disputes between Rabbi and contemporary authorities, adopts the former opinion as law.³⁶⁴ That this was actually the practice in the Second Temple we know from Josephus. There is no indication of the grounds for the opinion of either Rabbi or of his opponent, but it is not impossible that Rabbi, in his capacity of a Jew who was proficient in the Greek language, based his opinion on the evidence of Josephus.

³⁵⁹ I-Exod. Ch. 25, v.4; ch. 26, vs. 1-4-31-36; ch. 27, v. 16; ch. 28, vs.6-8-15-31-33-37; Ch. 25, vs.6-23-24-35; Ch. 26, vs.8-11-35-37; ch. 38, v.23; ch. 39, vs. 1-2-4-8-21-22-24-29-31; Num. ch. 46, vs.7-9-11-12. II-Num. ch. 25, v.37.

³⁶⁰ Jonah, v.54.

³⁶¹ Cf. Exod., ch. 28, v.36 with v.40.

³⁶² R. Jehudah the Prince.

³⁶³ Jonah, v.12.

³⁶⁴ Maimonides, *Hilkhot Kolei Hamikdash*, ch. VIII, v.1, and compare *Keseph Mishnah*, *ib.*

It is not, I think, improbable, that the wrappers used by the Levites for their musical instruments were also made of *Tekhelet* cloth.

"R. Joshua said: This is like the saying: "When he (scilicet, the ram) is alive, he gives forth only one sound, but after his death he produces seven sounds." How are these produced? His two horns serve for a drum, his bowels for harps. Some say, also his wool for *Tekhelet*."³⁶⁵

How could *Tekhelet* be made use of for musical instruments?

The explanations given by the commentators do not seem to me satisfactory. Now the Tosephta,³⁶⁶ speaks of the naps of the Levites, doubtless meaning pieces of cloth used for wrapping up the musical instruments.³⁶⁷ It would seem that these were made of *Tekhelet* cloth. *Tekhelet* thus came to be associated, very loosely of course, with instrumental music.

I have found no evidence of the use of *Tekhelet* or *Argaman* in connection with divine service outside the Temple, as for instance for the mantles of the scrolls of the Law, for the covers spread on the desk on which was placed the Torah during the public reading in the Synagogue, or for the curtains of the Holy Ark.

In Menahot 35a it is said that a disciple of R. Akiba had the straps of the tefillin³⁶⁸ made of *Tekhelet* and that Hyrcanus the son of R. Eliezer had them made of *Argaman*.

C. The *Tekhelet* in the Tzitzit.

And the Lord said unto Moses, as followeth, Speak unto the children of Israel, and say to them that they shall make themselves fringes on the corners of their garments throughout their generations, and that they shall put upon the fringe of the corner a thread of *Tekhelet*. And it shall be unto you for a fringe, that ye may look upon it and remember all the commandments of the Lord, and do them, and that ye seek not after (the inclination of) your own heart and (the delight of) your eyes, in pursuit of which ye have been led astray. In order that ye may remember, and do all my commandments, and be holy unto your God. I am the Lord, your God, who brought you out of the land of Egypt, to be your God, I am the Lord, your God.³⁶⁹

³⁶⁵ Kinim. ch. 3, Mishnah 8.

³⁶⁶ Kelim, Baba Mesia, ch. 5, v.7.

³⁶⁷ Cf. Note by R. Elijah of Wilna, in the Talmud, Wilna, ed. 1884.

³⁶⁸ Deut. Ch. 6, v.8; Exod. Ch. 13, v.9.

³⁶⁹ Num. ch. 15, vs.37-41.

By modern criticism the passage is assigned to the source known as H or the Holiness Code, the date of whose compilation is placed between c. 595-570 B.C.E. The corresponding verse in Deuteronomy:³⁷⁰ "Thou shalt make thyself fringes upon the four corners of thy vesture wherewith thou coverest thyself," from the fact that it appears in a code earlier than H, according to the critical view, and from its comparative simplicity, is naturally regarded by higher critical exegesis as embodying the law of *tzitzit* in its older, or original, form.

In the tomb of Rekhma-ra, prefect of Thebes, has been found a representation depicting Asiatic and Aethiopian tributaries, the garments of some of whom are fringed with blue threads at the corners, the colour being dark indigo blue.³⁷¹ This discovery does not, it is true, stand alone, but it is of special importance as showing the pre-Mosaic³⁷² existence of *tzitzit* in some form. The determination of the colour of *Tekhelet* is treated in another chapter, but I would remark here that whatever the precise shade may have been, deep indigo blue might very well do as a pictorial representation of *Tekhelet* by a pre-Mosaic Egyptian artist with whom *absolute* exactness in the reproduction of the colour of the object depicted would not probably count for an essential. It is thus difficult to deny that there is some relation between the blue fringes represented on the Rekhma-ra monument and the thread of *Tekhelet* ordered for the fringes in Numbers XV,37. Two facts, however, are to be carefully noted in this connection:

- (a) - The fringes on the Rekhma-ra monument consist entirely of blue;
- (b) - Deuteronomy XXII, 12 omits all mention of *Tekhelet*.

Upon the critical view, Deuteronomy XXII, 12, representing the *original* form of the Law, should have indicated somehow the colour of the fringes.

The reason for *tzitzit* is given in the Pentateuch itself: "That ye may look upon it and remember all the commandments of the Lord, etc." but it is left unexplained how the mere sight of the *tzitzit* acts as a reminder of the divine commandments. The noble end is apparently attained simply by the fact that the *tzitzit* forms the distinctive badge of the Israelites' dress, keeping him in constant remembrance of his being God's elect, a privilege which entails the observance of a great many

³⁷⁰ Deut. ch. 22, v.12.

³⁷¹ Rekhma-ra lived under Tothmes III (18th dynasty).

³⁷² Rekhma-ra lived under Tothmes III (18th dynasty).

precepts designed to guard him against "following his heart and his eyes" and to keep him "holy unto his God." But what reason is there for the choice of precisely this emblem?

It is, I think, highly probable that the Aggadic explanation of *Tekhelet* as significant of the sky "which is like unto the throne of Glory" substantially underlies the Pentateuchal text. The meaning, however, of the "fringes" as distinct from the "thread of *Tekhelet*" hardly admits of so ready an interpretation.

The exact form of the *tzitzit*, the number of threads, etc., according to the traditional interpretation, is a subject which hardly falls within the scope of this work. The reader unacquainted with Hebrew may refer to Kitto's Cyclopaedia, s.v. Fringes.

Though the rite of *tzitzit* is still observed to a considerable extent by professedly Orthodox Jews,³⁷³ and in a smaller measure even by reformers, *Tekhelet* has long ceased to form part of the *tzitzit*.

XI. THE DISAPPEARANCE OF THE *Tekhelet*

A. History of *Tekhelet*-dyeing in Israel; Centres of Production.

The history of *Tekhelet*-dyeing in Israel is buried in obscurity. Tradition singles out the territory of Zebulun as the centre of purple production in Palestine. "Zebulun complained before the Holy One. Blessed be He, 'O Lord of the Universe, unto my brothers Thou hast given fields and vineyards, but unto me Thou hast given mountains and hills; unto my brothers Thou has given lands but unto me Thou hast given seas and rivers.' God answered him: 'They will all stand in need of you because of the *hillazon*': for it is said "They will call the tribes unto the mountains..., for they will suck the abundance of the seas and the treasures hid in the sand."³⁷⁴ R. Joseph taught "*Sephunei* refers to the *hillazon*,"³⁷⁵ etc.

King David in specifying the various materials prepared by him for the future temple, makes no mention of *Tekhelet* or *Argaman*.³⁷⁶

This circumstance tends to show that the production of purple was a home-industry in Davidic times, so that there was no need to store the article in providing for the requirements of the

³⁷³ See: *Jewish Encyclopedia*, s.v. "Fringes."

³⁷⁴ Deut. ch. 33, v.19.

³⁷⁵ Megillah 6a. Compare: *Sifre*, Deut. ch. 33, v.29; and *Targum Jonathan*, *ib.*

ויאחרון חלזונים ויצבעון בים דמיה תכלת לחוטי גוליתיהון

³⁷⁶ I Chron. ch. 29; cf. *ib.* II, ch. 2, vs.213-6-; chs. 3, v.14. cf. also *ib.* I, ch. 29, v.26 with Exod. ch. 25, vs.3-4-7.

projected sanctuary. It is scarcely necessary to add that the inference has its roots solely in the authority of the Chronicler, the value of which is greatly deprecated by the critical schools of modern Bible exegesis. But even upon the critical view, it would, I think, not improbably follow that at least in the Chronicler's age the manufacturing of *Tekhelet* and *Argaman* was practised on the Palestinian coasts.

The occurrence of *Tekhelet* and *Argaman* in the enumeration of the articles of value sent by Hezekijah to Senaherib is hardly relevant here.

A baraita reported by Rab Joseph³⁷⁷ interprets part of Jeremiah,³⁷⁸ as meaning that Nebuzradan left some of the poorest people of the land to engage in the fishing of the *hillazon* on the coast extending from the Ladder of Tyre to Haifa. This would point to that stretch of country as the home of Jewish purple manufacture.

A baraita³⁷⁹ speaks of the Hittite city Luz as the centre of *Tekhelet* production *par excellence*.

With reference to Judges³⁸⁰ the baraita states: "This is the same Luz where *Tekhelet* is (or was) dyed; it is the same Luz whose inhabitants Senaherib did not (or could not) deport; which Nebukadnesar did not (or could not) destroy; nor dare even the Angel of Death pass through it, but its old men and women when they have grown weary of life go out of the city walls and die, etc..." The context gives the impression that the very site of Luz was no longer known when that baraita originated.

It is interesting to compare the Aggadah asserting that the resurrection of the body will begin with the spinal bone "luz" as its starting point.³⁸¹ It is hard to determine the exact relation of the two Aggadoth.

Sanhedrin 12a also alludes to Luz as preeminent in *Tekhelet* manufacture. "A pair came from Reket, carrying in their hands things made at Luz - i.e., *Tekhelet*, etc..." This close association of Luz with *Tekhelet* does not seem to me explicable except on the supposition that there existed an old tradition connecting the discovery of *Tekhelet*-dyeing with a city, of the name of Luz. This may well have been a city in the vicinity of the Syrian coast, belonging to the great Hittite empire

³⁷⁷ 26 שבת a.

³⁷⁸ Jerem., ch. 52, v. 16.

³⁷⁹ Sotah 46b.

³⁸⁰ Judges, bk. I, ch. 26.

³⁸¹ Cf. תוספות בבא קמא ט"ז ד"ה והוא; Cf. בראשית רבה.

in Northern Syria. The allusion, however, in Sanhedrin 12a hardly proves that down to the date of that missive (c. second quarter of the 4th century C.E.) Luz retained its position as mistress of the art of *Tekhelet* dyeing. The baraita (n. 378), just noted, indicates that already in the Tanaitic age Luz passed for a sort of terrestrial Paradise, a forbidden city to the Angel of Death.

As purple dyeing was probably confined, at least in the main, to the coasts, it is very unlikely that Jerusalem ever harboured a dye-house of *Tekhelet* and *Argaman* of which the Temple made considerable use. The Tosephta³⁸² states that planting, ploughing and sowing were prohibited within the city area in Jerusalem. The reason as stated in Baba Kama 82b, was that the manuring of the ground, which these operations would necessitate, might be productive of a bad smell in the Holy City.

That no provision was made against the establishment of purple dye-houses on a similar ground proves nothing, if purple dyeing was, as seems probable, mostly limited to coasts. This perhaps affords a point against Schmidt's view that the production of purple was exercised to a considerable extent in inland localities far removed from the sea.³⁸³ Against this however should be weighed the consideration that if the manufacturing of purple really produced a very offensive smell its establishment would not be permitted within a certain area from the boundaries of any Palestinian city, not only Jerusalem.³⁸⁴

Geographia Graeca³⁸⁵ names Sarepta Caesarea, Neapolis and Lydda as purple supplying cities, thus indicating that the industry covered an area comprising the coasts of Syro-Phoenicia, Galilee, Samaria and Judaea. Migdal Sabaja in the neighborhood of Lydda (Lud) would also seem to have contained an important purple market.³⁸⁶

B. Palestine as the Source of Supply of Ritual Tekhelet to Babylonian Jewry.

The impression created by a careful perusal of Menahot is that it was from Palestine that Babylonian Jewry, at least in the later Amoraic age, procured the *Tekhelet* they required for the *tzitzit*.

³⁸² Tosephta, Negaim, ch. VI.

³⁸³ See: Dedekind, Beitrag I, pp. 179, 899.

³⁸⁴ See: Baba Bathra, 25a.

³⁸⁵ *Geographia Graeca*, Jerusalem, Fratres Minores (1897), v.II, pp. 5-13, 29.

³⁸⁶ Cf. סינרי פלגס כמגדל צבעיא, ירושלמי, תענית.

This possibly means dealers in purple; cf. *pelagia*.

“Abayi said to Rab. Samuel bar Jehudah, 'That *Tekhelet* - how do ye dye it?' He said to him, etc..
.”³⁸⁷ Rab. Samuel b. Jehudah who emigrated from Palestine about 337 C.E. is chiefly noted for a number of interesting *halakhot* he brought to Babylonia from the academies in the Holy Land. The language of the question put to him about the process of *Tekhelet* dyeing implies in all probability that such knowledge is expected from him on account of his Palestinian origin. It is not improbable that he was also known to have actually exercised in the Holy Land the trade of *Tekhelet*-dyer.

"Mar of Mashkhi brought *Tekhelet* in the lifetime of Rab. Ahai, etc..."³⁸⁸

The terms of this record too, so it seems to me, point to Palestine as the source of the importation intended for the use of the daughter community in Babylonia.

The impression thus gained from Menahot receives very appreciable support from the *historic* epistle referred to above.

"A pair came from Reket (Tiberias) and the eagle (Romans) caught them; and they held in their hands things manufactured at Luz (*Tekhelet*), etc..."

This highly interesting document (c. 353-354) implies, as will be shown later, that the fact of their carrying with them *Tekhelet* was responsible for the arrest of the two scholars delegated by the Palestinian authorities to convey to the Babylonian community news of the most vital importance for the religious life of the latter. These men, I contend, would hardly have run the great risk, were not Babylonia Jewry absolutely dependent on Palestine for the supply of *Tekhelet*. It would perhaps be overstepping the limit of legitimate inference to deduce from the present text the prevalence of a regular practice with the emissaries sent from Palestine for the purpose of announcing the fixing of the calendar to carry with them at the same time *Tekhelet* for the religious use of the communities of the Exile. But that such may have been the case is far from improbable.

The regular visits of these learned messengers from Zion³⁸⁹ whose trustworthiness must have been beyond all doubt, would certainly afford the best facilities for satisfying the law requiring *Tekhelet* for *tzitzit* to be procured from none but an absolutely confidential source.

³⁸⁷ 42 תענית, סירושלמי.

³⁸⁸ *Ib.* 43.

³⁸⁹ See: 25, "שליח ציון", בביצה,

C. Ritual Tekhelet and the Restrictions Placed by the Emperors upon the Manufacture and Sale of Purple.

The imperial edicts concerning the fabrication of purple, its sale and use would form a most interesting porphyrologic study, the more so as the subject has not yet received adequate treatment. The researches of Amati³⁹⁰ are certainly not to be despised but they should be corrected by the more thorough investigations of W. Adolf Schmidt.

How was the *Tekhelet* industry affected by the imperial decrees regarding purple in general? Caesar and Augustus restricted the use of purple to the governing classes of society.³⁹¹ It is doubtful whether the decrees issued by them also included *Tekhelet* or to give it its Latin name hyacinthus; but even if such were the case, these liberal minded emperors would probably grant exemptions in favour of the proper observance of the rite of *tzitzit* by their Jewish subjects. The temple in Jerusalem, at all events, would remain entirely immune from the effects of restrictions of that nature. But even for *tzitzit* it is likely that special privileges were unnecessary: the early imperial edicts would hardly go to the length of prohibiting the appending of purple threads to the corners of one's garments.

Nero (died 68), evincing greater porphyric zeal than his predecessors, prohibited outright the sale of the Tyrian and of the amethyst purple, restricting the use of both to the emperor alone.³⁹² It is dubious whether *Tekhelet* was comprised in the term *Purpura amethystina*, as accepted in Nero's time.

The considerations advanced in connection with the decrees of Caesar and Augustus apply here as well.

An homily of R. Huna reported in the Midrash Rabbah on Genesis might suggest, on the face of it, that in the days of that Aggadist *Tekhelet* in the *tzitzit* was limited to members of the Synhedrion.

R. Huna said "she was touched by divine inspiration. *Hotamkha* חותמך (thy signet) refers to kingship as it is said, 'Even if Jekonja, etc...' ³⁹³ *Petilkha* פתילך (thy cord, thread) to the Sanhedrin

³⁹⁰ Amati, Paschal, *Marco Elephantutio ... de postitione Purpurarum*, Caesena (1784).

³⁹¹ Suetonius, *Vita Caes*, p. 43; Dio Cassius, bk. XLIX, p. 161.

³⁹² Idem, *Vita Neronis*, p. 32.

³⁹³ Jerem. ch. 22.

who are distinguished with a *petil* as it said *petil Tekhelet, umatkha* ומטך (thy staff) to the messianic king, etc..."

The author of the homily probably was a contemporary of Rabbi or R. Judah the Prince, the compiler of the Mishnah (175-219) in whose time Palestinian Jewry lived in tolerable circumstances. It is highly improbable that the government then forbade the use of *Tekhelet* in the *tzitzit* by the general public.

At all events a badge ordered by the Torah for the dress of every Jew would not come to be regarded as the proper insignia of the Synhedrion because by a cruel decree of the oppressor it had become confined to the latter, nor would this sad fact be put into the mouth of Tamar as part of a Sibyl, foretelling the greatness of the tribe of Judah.³⁹⁴ The reference is, I think, to a band or lace of *Tekhelet* adorning the official robes of the members of the Synhedrion somewhat after the manner of the Roman senators.³⁹⁵

Under the emperor Constantius (337-362) the restrictive measures with regard to the use of purple were very slackly enforced.³⁹⁶ The use of *Tekhelet*, however, would seem to have been strictly prohibited to the Jews. The prohibition would probably be due to the fact of *Tekhelet* being connected with the Mosaic ritual. Constantius throughout his reign pursued a policy of relentless Jew-baiting. Of this we have eloquent testimony in the epistle sent by the Palestinian religious authorities to Raba, the virtual head of Babylonian Jewry.

"(a) A pair came from Reket (Tiberias) and the eagle (the Romans) caught them;

(b) and they held in their hand articles made at Luz (*Tekhelet*).

(c) But by virtue of God's mercy and their own merits they have escaped safely.

(d) The offspring of Nahshon (first prince of the tribe of Judah) desired to appoint one *nešib* (intercalate a month) but the Aramean (the Romans) would not permit it;

³⁹⁴ Kingship was the heritage of the house of David. The presidency of the Synhedrion from about 31 to the final dissolution of the Patriarchate was held by a line of *nessim* (Chiefs, princes) beginning with Hillel the Elder who traced his genealogy to King David and continuing from father to son till Gamaliel VI.

³⁹⁵ Under Alexander Scroues (222-235) the Jews enjoyed complete religious liberties. It goes without saying that they had no difficulty with the practice of the *Tekhelet* rite. Germana, the slave of R. Judah II, the prince (religious head of the Jews (225-229)) is said to have been a dealer in *Tekhelet*. Yerushalmi, *Abodah Zarah*, II. 9. This is one of the only two references to *Tekhelet* extant in the Palestinian Talmud.

³⁹⁶ Amati, *Ib.*, ch. LXXXIII.

(e) nevertheless the lords of the assemblies (the sages, Synhedrion) met together and appointed another *nešib* in the month of the death of Aaron.³⁹⁷

The imperial authorities thus interfered with the regulation of the calendar for the proper observance of the festivals. The mere presence of (e), its position in the context, the cryptic expression used for *Tekhelet* - all point to the existence of an imperial prohibition against *Tekhelet*. Was this part of a general edict against the observance of the Jewish rites or part of the legislation restricting the use of purple? Against the former supposition it might be urged that *Tekhelet* being also used for secular purposes, the mere possession of it would not make the owner liable to punishment. Was the decree so thoroughgoing as to forbid the Jews even the secular use of *Tekhelet*? Or was the *Tekhelet* found in the possession of "the pair" wrought in the form required by the law for *tzitzit*?

The persecutions under Constantius drove from Palestine a number of teachers of the Law including R. Samuel b. Judah who gave to Abayi at the latter's request an account of the process of *Tekhelet*-dyeing. As Abayi died about 338 while R. Samuel b. Judah's emigration from the Holy Land took place between 337 and 338 it is not improbable that the conversation of so much importance for the study of *Tekhelet* occurred very shortly after the latter's arrival in Babylonia. May not the emigration of R. Samuel b. Judah have had something to do with the imperial prohibitions against *Tekhelet* with the manufacture of which that Amora was not improbably closely associated?

It is not impossible that apprehensions were entertained at the time in Babylonia that under the stress of continued persecution the art of the fabrication of *Tekhelet* would vanish and that it was for that reason that Abayi seized the first opportunity to interrogate the newcomer from Palestine on the dyeing process, so that a record might be preserved of it in the Babylonian schools to which now passed the custody of the knowledge of the Torah.

An edict of the year 383 restricted the manufacture and sale of both *purpura oxyblatta* and *purpura hyacinthina* solely to the imperial factories. It would be of some interest to learn how *Tekhelet* fared under the imperial monopoly. The imperial factories, it is true, were not precluded by that edict from selling to the people purple of the most precious sort, the law merely

³⁹⁷ Sanhedrin, 12a.

stipulating that no one but the emperor was to dress himself in a costume made wholly of purpura oxyblatta or hyacinthina.

But as *Tekhelet* for *tzitzit* had to be dyed *lishmah*, the Jews could not procure it ready made from gentile factories. Did Jewish dyers of *Tekhelet* in Palestine enjoy special exemptions? Or were the imperial dye houses in Jewish territory mostly manned by Jews. W. Adolf Schmidt maintains that purpura conchyliata was always exempt from the restrictive measures regarding purpura blatta. Much will depend on the part played by the "drugs" said in the Talmud to have been employed in the fabrication of *Tekhelet*. If these were tinctorial materials, then *Tekhelet*, at least as manufactured in the Amoraic age, would fall under the generic appellation of purpura conchyliata and so would not be affected by the purple legislation, if Schmidt's view is correct. But the point requires deep investigation.

D. Limits of Time Within Which the Total Extinction of Tekhelet shel tzitzit - the Tekhelet of the tzitzit - Must Be Placed.

Tekhelet was imported into Babylonia by Mar of Mashki "in the years of Rab Ahai." It was probable that this R. Ahai is identical with the Amora of that name who was described by the Palestinian teachers of the law as "the light of the eyes of the exile." (מאיר עיני הגולה). As he died about 506 this would be the latest record of an importation of *Tekhelet* for *tzitzit* into Babylonia.

The phrase "in the years of Rab. Ahai" indicates a considerable lapse of time; the passage is probably a late Saborean addition. It may safely be asserted that at the time of the completion of the Talmud (c. 570) *Tekhelet* still continued in practice for *tzitzit*, for there is nowhere in the Talmud the slightest allusion to the discontinuance of the rite.

On the other hand in the Sheiltot d'Rab Ahai, a ritual work composed in Palestine about 760 all mention of *Tekhelet* is omitted. The disappearance of *Tekhelet* from the Jewish ritual thus falls between the final redaction of the Talmud by the Saboraim (c. 570) and the composition of the Sheiltot (760). From the entire absence of a reference to *Tekhelet* in the Sheiltot, I should conclude that *Tekhelet shel tzitzit* של ציצית תכלת must have been long extinct by the *beginning* of the eighth century.

The Arab conquests of Palestine about 639 entailed the total destruction of the purple dyehouses administered by the imperial officials.³⁹⁸ Was this the real cause of the extinction of *Tekhelet*?

Benjamin of Tudela (travelled 1160-1173) makes mention of purple dyeing on the Tyrian Coast.³⁹⁹ It would thus appear that the industry revived some time after the Arab occupation. The interval must have been a fairly long one seeing that the Jews who in Benjamin's time played an important part in the industrial life of Tyre⁴⁰⁰ had made no attempt to resuscitate *Tekhelet*-dyeing; the chain of tradition must have been too long broken.

It is probable that the fixing of the *halakhah* (religious practice) in accordance with the opinion which held *Tekhelet* not to be a *Sine Qua Non* of the *tzitzit* was responsible to a great extent for the gradual extinction of ritual *Tekhelet*.

In the Midrash Tanhuma and Midrash Rabbah section שלח it is stated: "at the present time we have no *Tekhelet* but only *lavan* (white thread) in the *tzitzit*, for *Tekhelet* has been hidden (treasured up)."

ועכשיו אין לנו תכלת אלא לבן תכלת נגנז

The redaction of these Aggadic collections falls about 750. There is probably an allusion here to the Sifre, Deut. 33.

E. References to *Tekhelet* shel *tzitzit* in the Gaonic Literature.

Mar Sar Shalom, Gaon (d. 859) speaks of *Tekhelet* as of a thing of the past:

ביד ישראל כשהיתה תכלת

Rab Nahshon Gaon (d. 889) in a responsum partly cited in the *Ittur* gives the Arabic equivalent for *Tekhelet*, saying nothing further. His silence implies that the inquirers to whom his answer was addressed had only asked for the interpretation of the word, not for information about the existence of the thing, its non-existence in the ritual being universally known.

³⁹⁸ Amati. *ib.*

³⁹⁹ מסעות בנימין מטודלא ed. Asher p. 30b. דף ל' ע"ב. "ושם ימצא סיקר הטוב" דף ל' ע"ב. It would appear that in Benjamin's time only red purple (ארגמן) was manufactured at Tyre. (סיקר = red.)

⁴⁰⁰ *Ib.*, "צידון ... יהודים בעלי אומנות צובעים באים אל, ל. הדרוגים/7 Cf., "כמו ד מאות יהודים ויש להם ספינות בים" דף כ"ט.

In the Code of R. Simon Kahira written about 900 the non-existence of *Tekhelet shel tzitzit* is implied though not expressed.⁴⁰¹

Rab Sherira one of the last representatives of the Gaonic school (930-1000) in his account of the ceremony of the induction of the exilarch (ריש גלותא) makes mention of the use of *Tekhelet*, *Argaman* and *tola'at shani* for decorating the throne-like seat of the Prince of Captivity.

The reference to *Tekhelet* is no indication of the existence of *Tekhelet shel tzitzit* in Sherira's time. Cloth of a colour resembling *Tekhelet* may have been obtainable but certainly not such as was manufactured by Jews in strict conformity with the requirements of the law for *Tekhelet shel tzitzit*. But it is highly possible that the term *Tekhelet* is not meant in its strict sense but is merely used as a colour designation, standing for dark blue (indigo, wood).⁴⁰²

R. Samuel b. Hofni Gaon (d. 1034) in the treatise on *tzitzit* gives considerable attention to *Tekhelet*. There is no allusion to the contemporary non-existence or otherwise of *Tekhelet shel tzitzit* in the two chapters at my disposal, viz. the ninth edited by me and the tenth edited by Dr. Israelsohn.

F. References to *Tekhelet shel tzitzit* in the Post-Gaonic Literature.

Alfassi (born at Kala-Ibn-Hammad in the neighborhood of Fez in 1013, died at Cordova, Spain, in 1103) expressly states in his great work: "at the present day we have no *Tekhelet*."⁴⁰³

Maimonides in his commentary on the Mishnah (completed in 1168) makes the following statement: "The *tzitzit* precept comprised two precepts, the first requiring fringes to be appended to the corners of one's garments... and this is called *laban* (white), it being either of white wool or of white linen..., the second ordering a thread of *Tekhelet* wool to be wound round those fringes, which thread is called *Tekhelet*, as it is said: 'and let them put upon the fringes of the corner a thread of *Tekhelet*.' But we now have no *Tekhelet* because we do not know how to dye it; for not all woollen that is coloured like *Tekhelet* actually is *Tekhelet* (in the strict sense of the word), but only a certain kind which we are unable to fabricate at the present day; our *tzitzit* therefore consists of *lavan* (white) only."⁴⁰⁴

⁴⁰¹ See: אגרת רב שרירא

⁴⁰² See: ספר החינוך, Section ציצית

⁴⁰³ Alfassi, *Hilkhot tzitzit*.

⁴⁰⁴ Menahot. Ch. IV, s. 1.

In a responsum relating to *tzitzit* Maimonides similarly declares "We have no *Tekhelet* at the present day."⁴⁰⁵

R. Aaron Halevi, one of the greatest Rabbinical authorities in Spain (d. 1300) in his compendium of the Laws, in the section devoted to *tzitzit*, notes with regret that "already many days have elapsed for Israel without the fortunate man being heard of who had *Tekhelet* appended to his *tallit*."

If the collection of responsa *Besamim Rosh* (בשמי"ר ראש) ascribed to Asheri (1250-1327) be authentic, then an attempt was made in the last decades of the thirteenth century at the rediscovery of the *hillazon* and the consequent restoration of *Tekhelet* in Israel. The work has, however, long been condemned as an eighteenth century forgery.

The fall of Constantinople (May 29, 1453) marks the complete extinction of purple dyeing in the Old World.

R. David ben Zamra born twenty three years after the occurrence of that great event throws out, in a responsum of his, a few remarks in explanation of the disappearance of *Tekhelet* in general: "it is possible", he says, "that the species (i.e. the *Tekhelet-hillazon*) is still to be found, but that it is not known how it can be fished. There is, moreover, no need for it; *Tekhelet*-like dye being easily obtainable, I mean *Isatis* (*Nil* in Arabic): the dyeing with this pigment has reached such perfection that the colour is not removable from the cloth even by means of the most thorough washing."⁴⁰⁶

It is worth noting that the remarkable researches carried on by gentile inquirers from William Cole to Lacaze-Duthiers found no echo in Jewish circles.

G. An Attempt made by G.E. Leiner of Radzin to Restore *Tekhelet* shel *tzitzit*; History of the Radzin-*Tekhelet*.

It was not until 1887 some 28 years after Lacaze-Duthiers' famous experiments that a regenerator of *Tekhelet* arose in Israel in the person of Rabbi Gershon Enoch Leiner of Radzin, Russian Poland. Leiner seems to have been one of those unfortunate beings who owing to the circumstances in which birth has placed them, miss the destiny appointed for them by nature. Gifted with a genius for invention and a striking aptitude for research Leiner might have accomplished much in the domain of science had he been granted the necessary opportunities.

⁴⁰⁵ שו"ת רדב"ז ס"י תרפ"ה. Compare also Maimonides' code: *Hilkhot tzitzit*.

⁴⁰⁶ *Jewish Encyclopedia*, v.s. "Hasidim".

The son of a neo-Hasidic wonder-rabbi⁴⁰⁷ he nevertheless managed to acquire a knowledge of several European languages, and a familiarity with mechanics and medicine. His love for novelty showed itself first when as a young man of 23 he began the publication of a work designed to furnish with a *Gemara* the sixth order of the Mishnah not covered by either the Babylonian or the Palestinian Gemara. In later life when already holding in succession to his father the leadership of a Hasidic sect he caused the construction of a mill furnished with machinery of his own invention, which it is told, was capable of turning out over 80,000 lbs. of flour daily. This was an astounding figure for Polish manufacture in those days. The enterprise, by the way, eventually involved Leiner and some of his *hasidim* in complete financial ruin.

In 1887 Leiner announced to the world in a pamphlet entitled *Sefunei Temunei Hol* that after much toil and labour he had at last hit upon a species of dye-giving mollusc answering fully to the traditional descriptions of the *hillazon-shel-Tekhelet*. The species in question, as the reader will recall, is the *Sepia officinalis*.

Towards the close of his announcement the rabbi makes the following important statement: "I have in my possession a quantity of the ink-like secretion of that species, but no chemist is able to analyse it. When on betaking myself to a Mediterranean coast I have secured some of these animals alive and I shall try, with God's help, to extract the *Tekhelet*-dye from this *hillazon*."

The next year saw the establishment of a *Tekhelet* dye-house in Radzin. In a publication of the same year composed at Venice, Leiner gave a very concise account of his visit to Naples, and of arrangements made by him for the supply of the *hillazon* (i.e., *Sepia officinalis*) from "a small island at the end of an arm of the Western sea."

By means of the application of certain colourless drugs, he announced he had been successful in extracting the *Tekhelet* dye from the secretion of the species in question. He gave no particulars but he offered to show the process of the dye production to anyone who liked to see it. The news at once raised a veritable commotion in Russian Jewry.

The followers of the Radzin rabbi hailed the discovery with boundless enthusiasm. Tales quickly gained circulation of colossal operations carried out on the Italian coast, in quest of the *hillazon*.

⁴⁰⁷ Idem.

It was also whispered that as a result of a conversation the Hasidic leader had had with the Pope, the latter was seized with such admiration for the rabbi of Radzin that he commended him to the notice of the Czar.

The chiefs of the other Hasidic sects, however, invariably assumed an attitude of intense opposition.

The objections emanating from those quarters centered mainly around a statement found in the writings of R. Isaac Lurya, the father of the new *Kabbalah*, to the effect that from the destruction of the Temple until the coming of the Messiah the *tzitzit* must consist, for certain mystic reasons, entirely of *laban* (white threads). A similar assertion by R. Israel of Koznitz was likewise urged by Hasidic antagonists.

Another argument against Leiner's *Tekhelet* was drawn from a passage in the Zohar where⁴⁰⁸ the Sea of Gennesereth (*Kinneret* ?) is declared to be the abode of the *Tekhelet-hillazon*.

This objection really hoisted Leiner upon the horn of a dilemma. He would have had either to deny the authenticity of the passage in question, and so incur the charge of heresy on the part of Hasidism in general, or to cast his discovery to the winds. To escape from the difficulty Leiner took refuge in sophistry.

Among the *Mitnagdim* or non-Hasidim, the Radzin *Tekhelet* also failed to gain acceptance. Doubts were expressed about the possibility of rediscovering the *hillazon* and the dyeing process in all its particulars. Its lack of durability and fastness was pointed to as disproving the claims of the Radzin *Tekhelet*.

The statement about the periodical appearance of the *hillazon* once in seventy years likewise furnished an argument against Leiner's pretended discovery.

The two foremost Rabbinical authorities at the time in Russia were R. Isaac Elhanan Spektor, Chief Rabbi of Kovno (Latvia, d. 1896) and R. Israel Joshua, Chief Rabbi of Kutna (Poland, d. 1893). Leiner left no stone unturned in order to elicit from these celebrities a favourable opinion about his *Tekhelet*, but he met with hardly any success.

⁴⁰⁸ The statement of the Zohar conflicts with the Talmud and is improbable itself. The sweet-water sea of Genesaret, however, harbours a wealth of shells of diverse colours. See Hebrew daily מוריה Jerusalem Dec. 10, 1913: "דיגת הפנינים בארץ ישראל"

The controversy about the new *Tekhelet* was not long in finding an echo in the Holy City. There lived at that time in Jerusalem R. Joshua Leib Diskin (d. 1897) known as "the Rabbi of Brisk," who was really the greatest Talmudist of the age.

A Jerusalem votary of the Radzin-*Tekhelet* tried in vain to induce Diskin to interfere in the matter.

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The outspoken opposition of many rabbis of note, the attitude of neutrality amounting to disapprobation on the part of the highest authorities, and the pronounced hostility on the part of the chiefs of the other Hasidic sects, all combined to relegate the Radzin *Tekhelet* to the narrow circle of a small sect consisting of some seven to eight thousand families. The dye-house founded by Leiner continues to the present day.

It would have never occurred to me to subject a specimen of the *Radzin Tekhelet* to chemical analysis in order to ascertain whether the colouring matter employed at Radzin was really derived from the secretion of *Sepia*, had it not been for the following circumstance. In a letter addressed to Professor Friedlaender, I had made mention to the *Tekhelet* manufactured at Radzin. The learned professor in his reply⁴¹⁰ asked me to procure him a receipt of the dyeing process.

⁴⁰⁹ In the original Ms. at the bottom of p. 266, misnumbered "22," there is a smear of colour, identified "Radzin *Tekhelet*" in the handwriting of the late Rabbi Herzog. Since we have not seen the original Ms., only photocopies of it in black and white, we can not describe, or copy the colour. (Editor's note).

⁴¹⁰ "Darmstadt, Grüner Weg 44, d. 2 Januar 1913.

Sehr Geehrter Herr,

Ich danke Ihnen bestens für Ihren interessanten Brief von 10 III ... Ihre Mitteilungen über Tekhelet haben mich ausserordentlich interessiert ... Es wäre mir nun sehr wichtig, wenn Sie mir mitteilen koennten, ob für die Herstellung der Schaufaden eine Vorschrift oder Tradition existiert, oder ob noch Faerbungen aus den ersten Jahrhunderten vorhanden sind (wohl sehr unwahrscheinlich)... Deshalb ist mir das Farbenverfahren aus Radzin, wenn Sie es mir unter Diskretion mitteilen, von Wichtigkeit, etc."

After the lapse of some time I forwarded to Professor Friedlaender the translation of a dyeing receipt communicated by a certain Mr. Joshua Meir Keitelgisser replying in the absence of R. Mordecai Joseph Leiner, the son and successor of R. Gershon Enoch Leiner.⁴¹¹ Together with that copy I sent of Professor Friedlaender a sample of *Tekhelet* I had received from Radzin through the medium of the above named gentleman. Here is the professor's reply:

Dear sir,

Darmstadt 4. IV. 1913

Unfortunately Due to a long illness, I was not able to answer your interesting letter earlier. As far as the Radzin dyeing

Sehr geehrter Herr,

Durch laengere Krankheit war ich leider verhindert frueher auf Ihren interessanten

"Darmstadt, Gruner Weg 44, January 2, 1913.

Dear Sir,

I thank you very much for your interesting letter of 10 III ... I am extremely interested in your communications on *Tekhelet* ... whether there are still dyes from the first centuries (probably very unlikely) ... That is why the color procedure is from Radzin, if you inform me under discretion, of importance, etc. "

....בעזה"ש" יום ג' בשלח שנת שוב"ע ח"י"ם ברכ"ה ראדזין (2) החיים והשלום יחדיו יצמדו על ראש כבוד⁴¹¹

אחדשכ"ח! מכתבו הסגור מיום ד בא העבר הערוך להאדמו"ר שליט"א לנכון הגיע, והיות כי איננו בפה ביתו לשעה, שנסע מפה זה איזה ימים, ובידי יש כח למלאות דרישת כת"ה, אבוא בזה להודיע כי החבילה של תכלת מקבל כת"ה ע"י פאסט ד חוטין חותם בתור חותם כדת תוה"ק. מוסגר בזה. ואשר כת"ה דורש הנהו לדעת בכדי להודיע שהתכלת הנמצא בפה הוא מתמצית רם החלזון ולא ממין צבע זולתו, ואנכי הנני הודיע בטוב מלאכה הזאת, הנני לבאר לפניו את כל מיני הסממנים המתעברים אל הדם החלזון וכל מי שיוודע ומכיר מהות הסממנים ידע כי הנם כולם משוללי כל צבע, ומראה כולם לבן, ומהם כמראה מים בעלמא, לבד הדם שהוא בעל מראה, דם החלזון הנמצא בתוך השלחופית מראהו שחור כדיו וקרוב עד כי ישבר ויהא לרציצים מרוב חוזקו. הדם הזה ואחרי השהי' בתור Potasz שמים ביורה עבה מאד ומצטרפים בה שחיקת ברזל היוצא מתחת המוריגה וגם סם לבן כשלג הנקרא הבערת אש גדולה וחזקה בשעות ארבעה או חמשה, עד כי התבערה בוערת חוצה ופנימה כאשה של גיהנם, אזי ניתכת הדם הברזל שחוק והסם הלבן ויעשו לבתר אחד. אח"ז מריקים מתוך היורה העבה את כל המרקחת הזאת, ומשימים אותה ביורה גדולה מאד ומים צלולים הרבה עד מאוד, ומבעירים אש תחת היורה הגדולה, והמרקחת הזאת עם המים הצלולים מתבשלים איזה ימים (רעת לנבון נקל כי מים צלולים מהצורך מדי פעם להוסיף ולשטוף, כי טבע האש לכלות המים בכח הבישול), אח"ז שמים את כל התבשיל הזה על משמרת ומקבלים את המים הצלולים שהדם נתבשל בהם, ונשאיר תמצית הדם כלול ב, היינו המרק, ושמם אותה המרק שוב ביורה נקי' על גבי האש, ומתבשלת שוב זמן, עד שנעשית ע"י הבישול גושית, ואח"ז מריקים אותה ע"ג ספלים ומתדבכת בדפני ושולי הספלים גלדי גלדי ומסננים ושופכין המים מתיר הספלים, ומקבלים את כגלדין הדקין, והוא עיקר ותמצית הדם. מראה התמצית הזה הוא כמראה מלח עבה ביומא דעננא (לבנה כהה) דינקעל ווייס. חלק מזה המלח משימים לתוך יורה זכה ומים צלולים משימים גם את הצמר הטו"י לשם ציצית ולשם Tartar.deporat. Amoni muriadic. Acid, Sulfuric במרה וגם סממנים, היינו תכלת של מצוה, ומבעירים אש תחת היורה, וכן שוהים עד כי קוללת הצמר את הצבע מתוך היורה והמים נשארים ביורה. ושוהים שוב כשיעור הראוי, ומכינים שוב יורה מלאה מים צלולים, ומעריבים בתור המים מעט מן הסמים ומבעירים אש תחת היורה עד כדי חימום, ושמם שוב הצמר הצבוע, ומשהין אותה בכדי שיעור, והוא גמר Acid. Sulfuricum. צביעתה. כי אחרי שקלטת הצמר את הצבע בהיורה שבה הדם חלזון עם הסממנים, שטרודה למבלע לא פלטה על החוטין מראה הראוי, וחבוקה וטמונה בה, ובזו היורה של מים חמים האחרונה מתעורר הגוון האמתי גם למעלה, כמו שנמצא בלוע בתוך הצמר ... זהו כל אופן ... עשיית הצבע וצביעת הצמר לתכלת של מצוה, ואין יותר בלתי מכיר ורו"ש יהושע מאיר קייטילגיסער הכותב בבית כאדמו"ר שליט"א ...

process is concerned, the main thing is characteristically missing from it, namely the dye with which the woolen thread is dyed. It is a very common modern tar dye. The information about the use of *Sepia* off. is only misleading and it is quite impossible to use it to produce this color. Even with the purple snails I know, I think it is impossible to produce a pure blue color ...

Brief zu antworten. Was zunächst das Farbenverfahren aus Radzin betrifft, so fehlt in demselben charakteristischerweise die Hauptsache, nämlich der Farbstoff mit dem der Wollfaden gefärbt. Derselbe ist ein ganz gewöhnlicher moderner Teerfarbstoff. Die Angaben über die Verwendung von *Sepia off.* sind nur irreführend und es ist ganz *unmöglich* damit diese Färbung zu erzeugen. Auch mit den mir bekannten Purpurschnecken halte ich es für unmöglich ein reines Blau herzustellen...

I rubbed my eyes on reading the preceding lines. Tests carried out at the Fabrique des Gobelins yielded about the same result:

Ministry of Public Instruction and Fine
Arts Manufacture National Goblines

Paris, May 7, 1913.

Sir,

I have examined the blue sample you sent me as you wish. I do not know of any natural blue color other than indigo capable of dyeing textile fibers securely. As for the *sepia*, it gives brown and not blue and still this brown is not convenient

Ministère de l'Instruction Publique et des
Beaux-Arts Manufacture Nationale des
Gobelins

Paris le 7 mai 1913.

Monsieur,

J'ai examiné suivant votre désir l'échantillon bleu que vous m'avez adressé. Je ne connais pas de couleur bleu naturelle autre que l'indigo capable de teindre solidement les fibres textiles. Quant à la *sepia*, elle donne du brun et

to fix on fiber. The blue of the enchattillon sent has all the characters of the Prussian blue obtained by wilting in iron salt and potash prumate...

non du bleu et encore ce brun n'est-il pas commode à fixer sur fibre. Le bleu de l'enchattillon envoyé presente tous les caractères du bleu de Prusse obtenu par fanage en sel de fer et prumate de potasse...

Ch. Vallette

I wrote again to Professor Friedlaender asking whether his verdict represented the result of a chemical analysis or was simply based upon the impossibility of producing a like colour with the dye secretion of *Sepia*. To this the eminent tinctorial chemist replied as follows:

Dear sir,

Forgive the delay in my response to your requests. I was sick for several months and could not do the examination of the thread exactly. This has now happened and I can tell you with all certainty that the dyes are made with two very modern tar barbs, namely a mixture of an acid green and an acid violet of the triphenylmethane series which together give the blue shade. Furthermore, it is quite impossible to obtain this shade with *Sepia* according to the recipe, which had absolutely no influence on the result and only serves to mislead. You can just as easily leave them out. The dyer has kept

Sehr geehrter Herr,

Verzeihen Sie die Verspätung meiner Antwort auf Ihre Anfragen. Ich war mehrere Monate krank und könnte die Untersuchung der Faden nicht genau durchführen. Das ist inzwischen geschehen und ich kann Ihnen mit aller Sicherheit sagen, dass die Färbungen mit zwei ganz modernen Teerbarbstoffen hergestellt sind, nämlich einer Mischung eines Säuregrün und eines Säureviolett der Triphenylmethan-reihe die zusammen die blaue Nuance geben. Es ist ferner ganz *unmöglich* dieser Nuance mit *Sepia* nach den Recept zu erhalten, die überhaupt ohne jeden Einfluss auf das Resultat

silent about the main thing, namely the use of tar dyes. I have no objection if you use this result literarily. If you publish it in English it would be advisable if you had it confirmed by an English authority, for example, Prof. Green in Leeds ...

Prof. Friedlaender

Darmstadt, Grüner Weg 44

gewesen ist und nur zur Irreführung dient. Man kann sie ebensogut weglassen. Die Hauptsache hat der Färber verschwiegen, nämlich die Verwendung der Teerfarbstoffe. Ich habe nichts dagegen, wenn Sie dieses Resultat literarisch verwenden. Wenn Sie es englisch publicieren würde es sich vielleicht empfehlen wenn Sie es von einer englischen Autorität z.B. von Prof. Green in Leeds bestätigen lassen würden...

Prof. Friedlaender

Darmstadt, Grüner Weg 44

H. Results Obtained from the Chemical Examination of Samples of the Radzin-Tekhelet.

Following Professor Friedlaender's kind advice I addressed a sample of Radzin *Tekhelet* to Professor Green with a view to a chemical examination being practised upon it.

At the same time I asked him whether the dye secretion of *Sepia officinalis* had ever been chemically analysed, the idea occurring to me at the time that perhaps the chemical constitution of *Sepia off.* might include the two stuffs referred to in Professor Friedlaender's reply. Here is the answer I received from the Leeds Professor;

Department of Tinctorial Chemistry and Dyeing.

The University, Leeds

July 30th, 1913

Isaac Herzog Esq.M.A.

29, Rue des Francs Bourgeois, Paris

Dear Sir,

We have tested the sample of wool furnished and find that it is dyed with Prussian Blue. The colouring matter has therefore no relationship whatever to the natural dyestuffs of the Mollusca. So far as I am aware the secretion of the *Sepia* has never been examined. It would undoubtedly form a very interesting study...

A.C. Green

The Radzin *Tekhelet* thus stands self-condemned, or the results of chemistry are to be questioned.

I should hesitate very much before condemning of fraud a man of the stamp of the late G.E. Leiner.

It would seem that the late Hasidic Chief was victimized by some fraudulent Italian chemist. On arriving in Italy, Leiner, as he states himself, worked hard with a view to discovering a process for the extraction of the *Tekhelet* dye from the *Sepia off*.

Attracted by Leiner's offers of high remuneration, some clever but swindling specialist in tinctorial chemistry contrived, it would appear, to concoct Prussian dye with *Sepia* secretion, in such a manner as to conceal the presence of the dye.

It is the same source, I should think, which has been supplying the Radzin dyehouse with the necessary quantities of *Sepia* ink-bags filled with a solidified black secretion which though purporting to be the natural colouring matter is in reality nothing but an artificial compound in which the ink-like secretion of *Sepia* only serves to cheat the eye. It would appear that the defrauder also managed to become the sole contractor to the *Tekhelet* factory at Radzin.

Investigations carried out in Italy might perhaps clear up the mystery, as it is not improbable that Leiner previously to his falling into the swindler's net had made an announcement in the Italian press offering a huge sum for the discovery of a process whereby a blue of a certain nuance might be extracted from the secretion of *Sepia officinalis*.

Notes by Dr. A. Dedekind.

Keeper at the Egyptian Museum of the Austrian Imperial Court, Vienna:

In the second supplement, line 9, etc. say the passage 'What is Dr. Dedekind's mission \ etc ...

Perhaps you can point out that I submitted P. lapillus with the colors of violet, or blue marked with the word blue, although I would know very well that *Purpura* lapillus does not occur in the Mediterranean.

On page 33 of your second supplement you say that 'the information provided by Dr. Germain would be in line with Jewish tradition ' - that is not right. A Talmudic message otherwise expressly states that blue as a tone is vegetable (= green); that is just a preliminary stage of a definitive purple color. The *Janthina* is purple from the beginning, so it has no intermediate color of green (vegetable). This means that Blue has nothing to do with *Janthina*, but is a purple snail. Cf. Schleiden, *Das Meer* (3rd edition) under purple.

Vienna, 21 May 1914

A. Dedekind.

In der zweiten Beilage Zeile 9 u.s.w. sagen Sie der Passus 'Was Dr. Dedekind's omission\ etc.. .

Eventuell können Sie hervorheben, dass ich P. lapillus mit in die Kategorie von den vermöge des Wortes תכלת markierten Farbenton von Violett, resp. Blau mit eingereicht habe, obwohl ich sehr wohl wüsste, dass *Purpura* lapillus im Mittelmeere nicht vorkommt.

Auf Seite 33 Ihrer zweiten Beilage sagen Sie, dass 'die Auskunft von Dr. Germain sich im Einklang mit der Jüdischen Tradition befände' -, das doch ist nicht richtig. Eine Talmudistische Nachricht sagt sonst ausdrücklich, dass תכלת als Ton ירק (= grün) sei; das ist eben ein Vorstadium einer Fefinitiv-Purpurfarbe. Das *Janthina* ist von allen Anfänge an violett, hat also gar kein Farbenzwischenstadiums von grün (ירק). Damit ist gesagt, dass תכלת mit *Janthina* gar Nichts zu tun hat, sondern eine Purpurschnecke ist. Cf. Schleiden, *Das Meer* (3. Auflage) unter purpur.

Wien, am 21 Mai 1914.

A. Dedekind.

APPENDIX A

THE LAST TWO CHAPTERS OF

SAMUEL BEN HOFNI'S

כתאב אהכאם שרע אלציצית

BY ISAAC HERZOG, Paris

I

Samuel ben Hofni Gaon, head of the academy of Sora (died 1034) is undoubtedly one of the most remarkable personalities of the gaonic school. Like his famous predecessor Saadya, Samuel b. Hofni was at once an eminent Talmudic authority, a philosophical thinker and a Biblical exegete. A philosopher of less originality and an exegete of a lower order than the sage of Fayum, he none the less possesses sufficient interest to deserve close study.

While the philosophical and exegetical sides of Samuel's literary activity have received considerable attention, its halakic aspect has been wellnigh neglected. The fact does not stand alone. It may be taken as exemplifying the comparative neglect into which has fallen the Halakah that department of Jewish learning which more than any other is justly entitled to be called Jewish science (חכמת ישראל). To confine ourselves to the present instance. It was certainly not so much on account of his philosophical culture as on that of his mastery of the Halakah that Samuel b. Hofni occupied the gaonic chair at the Academy of Sora. In his case, however, the paucity of the material available might perhaps be urged as an excuse.

Dr. I. Israelsohn, who had rendered a real service to Jewish literature by his excellent edition of Samuel's Commentary on the Pentateuch, recently made an effort in the direction of drawing from obscurity what remains of the Gaon's halakhic writings.

In the Hakedem of September, 1909, Dr. Israelsohn published from an unique manuscript at the St. Petersburg Library the tenth or last chapter of Samuel ben Hofni's treatise on *tzitzit* כתאב אהכאם שרע אלציצית.

The reason for singling out that particular chapter is given by Dr. Israelsohn in the following words which I may be permitted to quote:

'Among the 7 surviving capitulas, it is especially the last one that captivates our attention not so much by its content as by a strange Mishnah variant it offers. In this capital, the author deals with the question "whether, in the absence of purple blue threads (Container), the duty of the show threads is omitted" and proceeds from the Mishnah 4 Tributes. While now in our texts the Mishnah The tinder does not inhibit the heart and white does not inhibit the biodegradable is ... it is quoted by our author in its first half in a diametrically opposed sense, namely The tinding inhibits the white. The possibility of a copist error in our handwriting is completely excluded in the given case, since the Mishnah cite. as it says in the manuscript, is translated into Arabic accordingly and the whole discussion about the question in question is based on it ... All that remains is the condition that the text before him really contained the reading he cited. But even in this case it is very striking and strange that Samuel ben Chofni, to whom Halacha had to be present in all its parts as Gaon, was misled by an apparently incorrect reading.'

'Unter den 7 erhaltenen Capiteln ist es besonders das letzte, welches unsere Aufmerksamkeit fesselt nicht so sehr durch seinen Inhalt als durch eine merkwürdige Mischna-Variante die es bietet. Der Autor behandelt in diesem Capitel die Frage, "ob in Ermangelung von purpurblauen Fäden (מכלת) die Pflicht der Schaufäden wegfällt" und geht hierbei von der Mischna 4 מנחות, I aus. Während nun in unserem Texte die Mischna התכלת אינה מעכבת את הלבן והלבן אינו מעכב את התכלת lautet ... wird sie von unserem Autor in ihrer ersten Hälfte in diametralentgegengesetztem Sinne citiert und zwar התכלת מעכבת את הלבן. Die Möglichkeit eines Copistenfehlers in unserer Handschrift ist im gegebenen Falle vollkommen ausgeschlossen, da das Mischna-Citat. wie es in der Handschrift lautet, entsprechend in's Arabische übersetzt ist und der ganzen Discussion über die in Rede stehende Frage zu Grunde gelegt wird ... Es bleibt nur die Voraussetzung übrig dass in dem Texte, der ihm Vorgelegen, wirklich die von ihm angeführte Lesart gestanden hat. Aber auch in diesem Falle ist es sehr auffällig und befremdend dass Samuel ben Chofni, dem doch als Gaon die Halacha in allen

ihren Teilen gegenwärtig sein musste, sich von einer augenscheinlich falschen Lesart hat irreführen lassen.'

In thus qualifying as 'augenscheinlich falsch' the reading adopted by Samuel b. Hofni. the editor obviously means that its utter untenability becomes manifest in the course of the development of the Halakah in the Gemara. And, as a matter of fact, this is really the case, for with reference to the attempted reconciliation of the opinion of רבי with that of the משכה סתם, the גמרא expressly says:

וכד thus presupposing in the Mishnah "התכלת אינה מעכבת את הלכן מאי היא וכד."

Yet it is scarcely conceivable that the Gaon should have been guilty of such slackness of attention. The principal of a Rabbinical Seminary in Sora could be relied upon to exercise greater circumspection in giving an exposé of a sugya. Is it not possible that his text of the Gemara differed as much from that of our editions as that of his Mishnah? The attentive reader of the Talmud will have noticed that from the beginning of the sugya, לימא מתניתין, down to התינה, just quoted, there is nothing irreconcilably conflicting with the Gaon's reading in the Mishnah. Would it not be just sufficient to assume the omission in Samuel's copy of precisely this fatal portion of text from התינה to שכולה תכלת?

The passage in question occurs again in the sugya where it receives a further development:

איתמר נמי אמר ליה לוי לשמואל לא תיתיב אכרען- עד דמפרשת לי להא מילתא התכלת אינה מעכבת את הלכן והלכן אינו מעכב את התכלת מאי היא א"ל לא נצרכא... תינה לבן דאינו מעכב את התכלת תכלת דאינה

(ibid.) מעכבת את הלכן מאי היא א"ל רמי בר חמי וכו' (ibid.)

How deal with this? Now this very passage beginning א"ל לוי לשמואל and ending תכלת is cited bodily by Samuel b. Hofni himself. Evidently it cannot conflict with his reading in the Mishnah, for the Gaon would scarcely so utterly forget himself. The truth is,

I think, that Samuel b. Hofni took the הלכה proposed by Levi to Samuel for solution not as our Mishnah Menahot 4,1 but as a ברייתא of some sort. In his discussion of the question of the relation

subsisting between תכלת and לבן, while reproducing practically the whole of the sugya. the Gaon omits, as we should indeed expect, — שכולה תכלת התינה from the portion of the Gemara immediately referring to the Mishnah.

וראם אהל אלתלמוד אן יתרצו קול רבי חתי יואפק קול אלמתניתין בקולהם אמר רב יהודה אמר רב אפילו תימא רבי לא צריכה ליקדם דתניא מצוה להקדים לבן לתכלת ואם הקדים תכלת ללבן יצא אילא שחיסר מצוה ופסרו קולהם אילא שחיסר מצוה וקאלו מאי חיסר מצוה אי נימא חיסר מצוה דלבן וקיים מצוה דתכלת לרבי עכובי מעכב הדאדי פתרכו חרא אלוגה וצארו אלי וגה אחר והו אן קאלו אמר רב יהודה אמר רב חיסר מצוה נעשה מצוה ולא הוי מצוה מן המוכתר ואכרו דלן- בקולהם אמר ליה לוי לשמואל לא תיתיב אכרעך עד דמפרשת לי להא מילתא התכלת אינה מעכבת את הלבן והלבן אינו מעכב את התכלת מנא לן אמר ליה לא נצרכא אלא לסדין בציצית דמצוה לאקדומי לבן ברישא ואי אקדים תכלת ברישא לית לן בה, תם קאל התינה לבן דאינו

מעכב את התכלת דאינה מעכבת את הלבן וכו" (Hakedem, loc. cit.)

We may now, I believe, assert with a high degree of confidence that in the time of Samuel ben Hofni there existed a different recension of the גמרא corresponding to the varia lectio מעכבת התכלת in the משנה.

That the reading of our copies is the original one will be readily conceded. The corresponding omission in the Gemara, presupposed by Samuel ben Hofni's treatment, must have been occasioned by the incorrect Mishnah reading, the first תכלת — coming to be regarded as mere anticipatory dittography.

תכלת ולבן פנקול אן אלכלאף. The Gaon registers three different opinions regarding the question of פימא בין אלקדמא כאן פי דלך אלי ג צרוב, אלאול הו קול סתם משנה נעני סתם מתניתין התכלת מעכבת את הלבן והלבן אינו מעכב את התכלת ותפסיר הלך הו אן אלתכלת אדא פקדת אוקפת וגוב אלציצית אלדי סמאה אלקדמא לבן לביאצח בל אסקטת וגובה מהמא פקדת אלתכלת, פאמא אלציצית אלתי הי לבן פאנהא אן פקדת ווגדת אלתכלת למ יסקט וגוב אלתכלת בפקד אללבן. ואלעיכוב פי אצל אללגה הו אללבת ואלוקיף ען אלשי לאנה תרגום ולא יכלו להתמהמה ... ואלצרב אלתאני הו קול רבנו הקדוש אלדי סמוה רבי והו אן אלתכלת מהמא פקדת יסקט וגוב אללבן ומהמא פקד אללבן יסקט וגוב אלתכלת חית יקול וראיתם אותו מלמד שמעכבין זה את זה דברי רבי. ואלצרב אלתאלת הו קול אלגמעאה פי אלבר אניה וחכמים אומרים אין מעכבין ואראדו בדלך

אנה אדא פקד אהדהמא למ יסקט וגוב אלאכר. (ibid.)

A very serious objection against his Mishnah reading is the entire absence in the Talmud of an explanation of the first opinion or the opinion of סתם משנה according to him, whereas the other

two receive due treatment. The difficulty by no means escaped his notice, but he deftly made use of it for inferring the rejection by the Talmud of the *סתם משנה*.

ובעד דכרנא לדלך ועוד אלי תביין אלהלכה פי אי אלאקיאל הי פנקול אן אלהלכה הי כקול אלחכמים אלדי רווה פי אלבראניה וליס אלהלכה פי דלך כסתם מהניתין ואלדי יודל עלי צחה הלך הו אן אהל אלתלמוד כאצו פי דכר וגה אלמתניתין אלבראניה ותכלמו עלי צחתהא ותרכו אלכלאם עלי

(ibid.)... *סתם משנה*

I shall have occasion to deal more fully with this point in a subsequent article when I hope to discuss the place of Samuel ben Hofni as an halakist.

II

The ninth chapter though not of such importance for the history of the Talmudic text as the tenth or last, nevertheless offers some interesting points. My interest in it was aroused while studying the הלכות in Maimonides's Code. In giving a description of the חלזון or species of mollusk used for the dyeing of תכלת. Maimonides states דמו שחור כדיו. This particular is not traceable to any known Talmudic or Midrashic source. We could speak with greater confidence if we had at our disposal the now lost ירושלמי קדשים. Did the great codifier identify the תכלת של חלזון with *sepia officinalis*, which secretes a black fluid? Cf. Lewysohn, *Zoologie des Talmuds*, § 369. I should rather think we have here a combination of Talmudic and Aristotelian authority. Aristotle in speaking of the purple producing mollusca supplies the following information:

There are many kinds of purpuræ ...	Eiai δέ τῶν πορφύρεων γένη πλείω ... καί
Most of them contain a black pigment; in	το αἴθος αἰτῶν αἱ μὲν πλεισται μέλαν
others it is red, and the quantity of it	εχουσιν, ενιαυ δ' ἐρνθρό και' μικρόν, κτλ.
small. (Project Gutenberg, Aristotle,	(Hist. Anim. v. 15. 4.)
History of Animals, Book V Ch. XIII: 3)	

Maimonides, conceiving the Tekhelet colour as a deep dark blue ("פרקב", הלכות ציצית, passim), was probably led to identify the חלזון של תכלת with that class of marine snails which, according to Aristotle, furnish a black dye, and so added this further mark of identification to the description

given in the Talmud (Menahot 44 a). There still remains one detail to be accounted for. What authority may he have had for כדיו? Aristotle gives no indication about the degree of blackness. In this connection it is worth noting that the Greek word με'λαν also denotes 'ink'. May not the Arabic version, bent on reproducing this shade of meaning, have rendered με'λαν by 'ink-black'? Aristotle in all probability was accessible to Maimonides only through the medium of the Arabic. My efforts to discover the Arabic translation of the passage in question have hitherto proved fruitless. In the manuscript copy extant at the British Museum, the only one I know of, the fifth book of the History of the Animals, so Dr. Barnett informed me, is totally missing.

Samuel b. Hofni's treatise on ציצית appearing to me likely to throw light on this obscure point, I applied to the Director of the Imperial Public Library at St. Petersburg for a transcript of the chapter on תכלת. Thanks to the courtesy of His Excellency and to the kind offices of Dr. I. Markon I have been placed in possession of a copy. My expectation has not indeed proved true, but the chapter as already remarked is by no means devoid of interest.

TEXT

ואלפצל אלתעסא

אלקול פי צפה אל תכלת

פנקול אן תעלי קאל ונתנו על ציצית הכנף פתיל תכלתי ונאנה אל כבר באנה כאן יצבג בדם חיואן מאוי יסמי חלזון מע ארלאט אכר4 ופי דלך קאלו חלזון זה גופו דומה לים' בריתו דומה לדג ועולה אחד לשבעים שנה ובדמו צובעין תכלת לפיכך דמיה6 יקרים וכאן יגב מיניכון צבג אל תכלת של ציצית בקצד להא יניח" מן אולהא לקולהם בענן צביעב לשמה וקאלו פי שרך דלך אמ' ליה אבה לרב שמואל ב"ר יהודה הא תכילתא היכי צבענן' לה אמ' ליה מתיינן דם חלזון וסממנים ושדינן9 להו ביורה ומרתחינן ושקלינן פורתא בביעתא וטימינן לה באודרא ושדינן ליה לההוא דבביעתא וקלינן ליה לאוררא שמע מינה תלת שמע מינה טעמה פסלה1" ושמע מינה טעומה פסולה ושמע מינה בעינן צביעה לשמה ואקשו וקאלו היינו טעימה לשמה היינו צביעה לשמה' 1 ופרקו בקולהם אמר רב אשי מה טעם קאמר מה טעם טעומה פסולה משום דבענן צביעה לשמה' ולצעובה אמר אל תכלת מא כאנת תשתרא אלא מן משהורי באלתקה ואל אמאנה וכאנת מע דלו תמתחן לולא תיכון מצביגה בגיר אלצבג אלמכצום,3' ופי דלר קאלו תכלת אין לה בדיקה ואינה נקחת אילא מן המומחה ספרים יש להן בדיקה ונדחק מכל אדם ואקישו תכלת אין לה בדיקה והא רב יצחק בריה דרב יהודה בריק לה מיתי מנביא גילא ומיא דשבלילתא ומי רגלים בני ארבעים יום ותר' לה מאורתא לצפרא אי איפרד חזותה פסולה ואי לא כשרה ורב אחא בריה שירא משמיה דר' אבא אמ' מיתא חמירא ארסכא דספרי4' ואפי לה אי אשתנאי למעליותא כשרב ואי לא פסולה וסימניך שינוי שקר שינוי אמת, ופרקו וקאלו מאי אין לה בדיקה נמי מישום טעימה, מר ממשיכי אית' בשני רב אחאי ברקיה בדרב יצחק בריה דרב יהודה ואשתנאי לגריעותא בדקוה בדרב אמאי' ואשתנאי למעליותא אמר

להו רב אחאי הא לא תכלת היא ולא קלה אילן היא אילא שמע מינה שמעותא אהררי איתמר. ר' מאני דייק ואבין כחומרי מתניאיתא אמ' להו ההוא סאבא הכי עבור קמאי דקמך ואצליח בעיסקיהו. פאן אשתרי אזאר עליה ציצית וכאן שראה מן ישרי" כאן דלך דלך ג... ולו אשתראה מן גוי תאגר גאז איינא פאן אשתראה כאן עליה חלהא(?) ותעליך(?) בדלהא, ופי דלו קאלו הלוקח טלית מצויצית מן השוק מישראל הרי היא בחזקתה מן הגוי מן התגר כשרה מן ההדיוט 17 כפסולה אף על פי שאמרו אין ארם רשאי למכור טלית מצויצית בשוק עדשיתיר ציציותיה, וקד תבין ממא קדמניא פ' כלאמנא אין תפסיד מן ההדיוט כותי והו אלסאמרי לאנהם קד קאלו פי מוצע אכר מאן הדיוטות כותאי

HEBREW TRANSLATION

והפרק התשיעי

מאמר בענין התכלת

נאמר כי העליון אמר... ובא לנו הידיעה שהיו צובעים בדם חיה של ים ששמה חלזון בתערובת דבר אחר ועל זה אמרו חלזון זה... והצובע התכלת לתכלית(זו) היה צריך להשגיח עלה מתחלתה כמו שאמרו בענן צביעה לשמה ואמרו בענין זה אמר ליה אבה... ומפני הקושי שבתכלת לא היתה נקנית אלא מן המפורסמים לאנשי אמת ואמנה. ואף על פי כן היתה נבדקת שמא נצבעה בצבע אחר שלא מן המפורש ועל זה אמרו תכלת אין לה בדיקה... והקשו ואמרו תכלת... ותירצו מאי אין לה בדיקה.. ואם קנה טלית ועליה ציצית אם קנאה מישראל... ואם קנאה מגוי תגר יוצא... ועל זה אמרו הלוקח טלית... וכבר נתפרש במה שאמרנו למעלה בבאורנו שכונת דבורם מן ההדיוט כותי והוא שמרוני לפי שכבר אמרו מאן הדיוטות כותאי.

לימא מתניתין גלא כרבי דתניא וראיתם אותו מלמד שמעכבין זה את זה דברי רבי וחכמים אומרים אין העכבין מ ט 1 דרבי דכתיב חנף מין חנף וכתוב פתיל תכלת ואמר רחמנא עד דאיכא תרווייהו בחד ורבנן וראיתם אותו כל חד לחורא משמע לימא דלא כרבי אפילו תימא רבי לא נצרכא אלא לקדם דתניא מצוה להקדים לבן לתצלת ואם הקדים תכלת ללבן יצא אלא שחיסר מצוה מאי חיסר מצוה אילימא חיסר מצוה דלבן וקיים מצוה דתכלת לרבי עכובי מעכבי אהדדי א"ר יהודה א"ר שחיסר מצוה ועשה מצוה דלא עבד מצוה מן המובחר התינח לבן דאינו מעכב את התכלת תכלת דאינה (Menahot 35a b) מעכבת את הלבן מאי היא וכו"

Notes

רבי(לימא דלא כרבי) and משנה According to Samuel b. Hofni the division of opinion between the רבי, there would of course be limited to the second part of the Mishnaic statement "והלבן אינו מערב וכו" the question "לרבי עכובי מעכבי וכו" being agreement in the first part מעכבת. The question "לרבי עכובי מעכבי וכו" would fit in very well with the Gaon's גירסא in the Mishnah. There would, however, be a difficulty in the interpreting אוקימתא in a different sense

than *התכלת מעכבת את הלבן*, as a moment's reflection on the part of the reader will soon make clear. But similar instances occur here and there in the Talmud.

In the Jewish Encyclopaedia, s.v. Fringes, Maimonides is wrongly referred to as saying that the blood of the *hillazon* is red.

Num. 15, 37.

Compare 42 תוספות מנחות b, caption: וסממנים:

דבר תימא הוא איך מערב שום דבר בהדי תכלת ושמא עם הסממנים נקרא תכלת ובקונטרס פירש לשרות בהן בדרך הצובעין

ששורין אותו בצריף.

Cf. Rashi, *ibid.*: דרך הצובעין לשרות בגדים בצריף שקורץ בייצא.

Maimonides follows the gaonic tradition as here handed down by Samuel. See *הל' ציצית פרקב*.

This characteristic is not satisfied by any at least Mediterranean species of the genera *murex* and *Purpura* which alone are known to have been anciently employed in purple dyeing. Lewysohn {*Zoologie des Talmuds*, P 366), identifying the *חלזון של תכלת* with *Purpura* or *pelagia* (Pliny, 9, 36, 61 ; Voigt, 3, p.459) proposes the emendation *גופו* for *גוונו*. The correction, besides lacking the support of any authority whatever, would really not be helpful in the least, for if in the text *גוונו* would be the exact equivalent of *גופו* in this connection, meaning nothing but 'its colour', i.e. the colour of the animal or of its shell; the dyesecretion is termed *דם* in this very passage. Khout's attempted solution ascribes to *גופו* a meaning which is simply cannot be made to bear. *גופו כלומר* (*חלזון*..ז. v. *plci um*. Aruch C '01) מראה גופו היינו הראה מיין שסוחטין מגוף החלזון הוא תכלת. Khout here really betrays complete ignorance of the nature of the dye secretion in the *muricidae* and *purpundae*. The Talmudic description probably applies to *Janthina* (*Janthina Pallida* Harvey. *Janthina Prclongata* Blainville, not to *Helix Janthina* as some supposed, Lewysohn, loc. cit.)\ the latter species does not really live in the Mediterranean. No serious difficulty is offered by the fact that the colour of the dye furnished by *Janthina* partakes of the violet, while *תכלת*, according to tradition, was an intense blue. Some other materials besides the 'blood of the *hillazon* probably entered into the manufacture, having the effect of deadening the element of red. Compare Note 2, *מע אכלאטאכר*. I hope to publish shortly a work dealing with this among kindred matters,

embodying my own researches together with the illuminating remarks of my learned friend Dr. L. Germain, Dr. és Sciences, of the Museum national d'Histoire naturelle.

Better than דמיון of the edition.

Professor Barthélemy of the École des Hautes Études to whom I forwarded a copy of the text has suggested יעאינה.

The editions צבעיתו.

The editions ורמינן.

Cf. editions.

I I. Cf. editions.

I 2. Cf. editions.

1 3. Professor → → אלמרסוס corrected.

Cf. editions, and cf. 42, פסחים, קולן של סופרים.

Doubtless a copyist's mistake for אחא. See דקדוקי סופרי, Menahot 43a.

ישראל.

1 7. The remark that הדיוט here means Samaritan is as astounding as it is unparalleled, the reference to 21 b סנהדרין being altogether irrelevant. One almost feels inclined to doubt that the statement emanates from the Gaon. It would be interesting to compare the passage in the כתאב referred to as containing the grounds for this curious interpretation, but unfortunately I have only the last two chapters at my disposal. Compare for instance 51 בבא (ממציעא) כשם שאונאה להדיוט כר אונאה לתגר.

APPENDIX B

PROCEEDINGS OF THE BELFAST NATURAL HISTORY AND PHILOSOPHICAL
SOCIETY, 1919-20.

11th December, 1919

PROFESSOR GREGG WILSON, President of the Society, in the Chair.

THE DYEING OF PURPLE IN ANCIENT ISRAEL

By REV. ISAAC HERZOG, M.A., D. Lit., Chief Rabbi of Dublin

(ABSTRACT)

Varied as are the meanings of the term purple in modern usage, to the student of antiquity the word denotes a cloth dyed with a colouring matter furnished by certain marine snails. And, the tinting of cloth by means of marine animal pigment is still practised, albeit in a crude, primitive form, by the natives of certain coasts of Central America.

Our principal authorities as to the species of marine snail anciently employed in purple-dyeing are Aristotle and Pliny, but their statements leave much to be desired. Aristotle in the fifth book of his History of Animals (chap. 15), states that it is the genus *πορφύρα* (*Porphyra*) which furnishes the pigment for the dyeing of purple. In close association with the *Purpurae* Aristotle also gives some account of a genus called *κήρυξ* (*Keryx*) without, however, distinctly referring to its employment in the dyeing of purple. Pliny, on the other hand, speaks of two genera utilized for the manufacture of purple, namely, *Purpura* and *Buccinum*. It is assumed by all writers on the subject, at least as far as my research has extended, that the *Keryx* of Aristotle and the *Buccinum* of Pliny are identical; but in my work on *Tekhelet*, still awaiting publication, I have shown that there is very serious ground for questioning the identification.

Modern research on this subject began with the identification by Guillaume Rondelet (d. 1556), Professor at Montpellier, of the *Purpura* of Pliny with the species now termed *Murex brandaris*; and the chain of inquiries has been practically continuous down to the present day. To William Cole, an Englishman, belongs the credit of having for the first time after the total extinction of purple-dyeing, rediscovered (1681) the remarkable properties of susceptibility to light, and of colour-progression under its action, possessed by the fluids secreted by certain molluscs. W.R. Wilde, an Irishman, made a substantial contribution towards the solution of our problem by his

discovery of huge deposits of shells of *Murex trunculus* on the shore of ancient Tyre, the home of purple-dyeing. Special mention must also be made of the striking researches of Lacaze-Duthiers. His "Memoirs sur la Pourpre" (1857), narrates his experiments on the secretions of *Murex trunculus*, *M. Brandaris*, *M. erinaceus*, *Purpura haemastoma* and *Purpura lapillus*, and sheds a flood of light on the statements contained in Aristotle and Pliny.

The net result of the study of the classical texts, combined with archaeological discoveries and scientific experiments, has been the establishing, beyond a shadow of doubt, that at least the following species were anciently employed in the manufacture of purple: *Murex brandaris*, *M. trunculus*, and *Purpura haemastoma*.

Purple in the Bible and in Talmudic literature is mentioned under two designations, *Tekhelet* and *Argaman*. While *Argaman* is generally explained as red or violet-red purple, there is less consensus among translators with regard to *Tekhelet*, but the prevailing view is that, contrary to the traditional interpretation, it denotes not a dark pure blue, but rather a dark violet, inclining to blue. In my work on *Tekhelet*, however, I have shown, I believe conclusively, that if not actually so in the strictly scientific sense, the *Tekhelet*-colour did not, at all events, *appreciably* differ from a dark pure blue, the nuance assigned to it by tradition. It is generally assumed that both *Tekhelet* and *Argaman* are varieties of purple, or in other words, of stuff dyed with sea-snail pigment. That *Argaman* was of this nature is attested by the Septuagint, the oldest translation of the Bible. Wherever *Argaman* occurs in the Bible it is rendered by πορφύρα or one of its derivatives; and πορφύρα without a qualifying epithet means, of course, purple dyed with the pigment of sea-snails. *Tekhelet* is rendered in the Septuagint by ὑακινθός, a designation which does not necessarily imply that the dye is of molluscan origin. Philo and Josephus, moreover, while expressly mentioning the conchylian origin of the dyestuff used for *Argaman*, are silent in regard to the source of the pigment producing *Tekhelet*. Talmudic tradition, however, fills the gap. A Talmudic text, going back in all probability to a time when the Second Temple was still in existence, dispels all doubt on the matter by declaring that *Tekhelet* used for ritual purposes must be of conchylian origin. The Talmud, moreover, contains a description of the species used for dyeing *Tekhelet*, and also an account of the actual process of dyeing *Tekhelet* for the "fringes" (Num. XV).

The exact determination of the species used in ancient Israel for the dyeing of *Tekhelet* and *Argaman*, and particularly the former, is a task fraught with almost insuperable difficulties.

Various suggestions have been made, but it has fallen to the lot of Dr. Alexander Dedekind, keeper of the Museum of Egyptian Antiquities in Vienna, to press Lacaze-Duthiers' far-reaching results into the service of Semitic archaeology. He maintains that Lacaze-Duthiers' researches have once for all furnished the clue to the identification of *Tekhelet* and *Argaman* respectively. In the fourth book of his *Beitraege zur Purpurkunde* (p. 226) he gives the following classification:-

- Purpura lapillus* → belong to the *Tekhelet* variety
Murex erinaceus → of purple, i.e., violet or blue
Murex trunculus → purple.
Murex brandaris → belong to the *Argaman* variety of purple, i.e.,
Purpura haemastoma → red or scarlet purple.

He regards *Murex trunculus* as the *Tekhelet* species, but also names *M. erinaceus* as a possible identification, though in view of the minuteness of the dye-secretion in that species its employment for dyeing was unlikely. His omission of *Purpura lapillus* is probably due to the fact that this species is not found in the Mediterranean.

The identification adopted by Dedekind, be it carefully noted, is based solely on the tradition of the *Tekhelet* nuance: it does not take into account the description of the *Tekhelet* species as given in the Talmud, and as reproduced by Maimonides, the greatest authority of Post-Talmudic Judaism. And if we are to choose between the three species known to have been employed in Phoenician purple-dyeing (*M. trunculus*, *M. brandaris*, and *P. haemastoma*) there can be little hesitation so far as *Tekhelet* is concerned. *Murex trunculus* is the likeliest of the three; but there is the possibility that *Tekhelet* was produced from an altogether different species.

The description given in the Talmud of the *Tekhelet* species runs as follows:-

"(a) Its body (i.e., the colour of its body or shell) is like unto the sea; (b) its shape is like unto a fish; and (c) it comes up once in seventy years, and with its blood *Tekhelet* is dyed, and therefore it is very dear" (Menahot, 44a). Another ancient text (Baraita a'Tzitzit) offers a variant reading: "What is Hilazon (Hilazon in general means a shell-snail. In this instance it means the particular species furnishing the *Tekhelet* dye) like unto? Its shape is like unto that of a fish, and its body

(i.e., the colour of body or shell) is like unto the sky, and it only comes up once in seven years; therefore it is very dear."

Which species of marine snail satisfies the description thus recorded in the Talmud and the Baraita a'Tzitzit?

Before we attempt to answer the question it is essential to ascertain the import of the three elements constituting the description in the Talmud.

(a) This presents no difficulty. It refers to a deep blue or deep violet blue resembling the colour of the Mediterranean or of the clear cloudless Palestinian sky in bright sunshine.

(b) The second element offers considerable difficulty. From the sporadic allusions to the nature and characteristics of fishes it is exceedingly difficult to evolve a clear idea of the type "dag" (fish) in the Talmudic conception, though one gains the impression that it does not materially differ from the modern conception of the term fish. Seeing, however, that on the one hand the *Gastropoda* and *Cephalopoda* are probably included in the term "dag" as used by Maimonides, and that the *Tekhelet* species is described by him as "dag," we are led to think that the characteristic (b) in the Talmud description does not exclude these classes of marine snails.

(c) The last point in the description also offers certain difficulties. Science knows nothing of a comet-like septuagenarian appearance of any of the denizens of the sea. In reality, however, "once in seventy years" is a hyperbolic expression. It amounts to saying that the species is caught at long intervals of time.

Murex trunculus fails to satisfy characteristics (a) and (c) of the Talmud. A serious difficulty in the way of the identification with *Murex trunculus* is also offered by the fact that the dye furnished by the latter is of a fugitive nature, while *Tekhelet*, as we know from the Talmud, was exceedingly fast. This difficulty can partly be met by the consideration that the *Tekhelet* dye used to be mixed with certain drugs, not specified in the Talmud. They may have served as stiptics for the purpose of endowing the colour with the quality of durability and fastness, but I do not think this very probable.

If for the present all hope is to be abandoned of rediscovering the *Tekhelet* species among the members of the genera *Murex* and *Purpura*, it might not be amiss to look for the same within the confines of the genus *Janthina*. The two species of this genus that live in the Mediterranean are *J.*

pallida, Harvey and *J. prolongata*, Blainville. These furnish a blue colouring fluid playing into violet. They live in the high seas, at the surface, and their colour is of a beautiful violet blue, which might easily be confounded with the colour of the sea. Lastly they, like a great many pelagic animals, abound for some years to an enormous extent, whereas in the preceding period they had been rare or even extremely rare.

Mention may also be made of the fact that the dye secretion of *Janthina* is fairly abundant in quantity: in *J. prolongata* the secretion, in fact, amounts to an ounce. This tends to corroborate the identification with the *Tekhelet* species; for while in the classical authors the extreme expensiveness of purple is attributed to the minuteness of the purpurigenic matter in the animal, in the Talmud the preciousness of *Tekhelet* is ascribed solely to the rare appearance of the species.

Pending further research which, let us hope, will one day be undertaken along the Palestinian and Syrian coasts by specialists from the future Hebrew University of Jerusalem, the suggested identification with *Janthina pallida* and *J. prolongata* is, I venture to say, deserving of serious examination.

* * *

THE PROCESS OF DYEING

No other material but wool was admissible for *Tekhelet*, *Argaman*, and *tolat shani* (scarlet) of a sacerdotal and ritual character, and for the *Tekhelet* of the fringes.

In Greek and Latin authors, *πορφύρα*, *Purpura* and their derivatives stand for woollen or silken stuff dyed with purple pigment. Silk purple was probably not unknown in Phoenicia and Palestine, but in the Temple its use was excluded by tradition. There can be but little doubt that purple dyeing in its early stages was confined to wool. Silk purple being a later extension of the industry naturally failed to gain admission into the sanctuary or the ritual.

The wool was dyed in its raw state, the spinning, weaving, etc., forming subsequent processes. This is apparent from certain stray allusions in the Talmud, and is also corroborated by classical authority in regard to the manufacture of purple. (Compare also Exodus XXXV, 23 with v. 25.) No account of the mode of dyeing has been preserved by Jewish tradition in connection with *Argaman*. *Tekhelet*, however, has fared better, though the account given in the Talmud by R. Samuel bar Judah leaves much to be desired. "Abayi" records the Talmud, said to R. Samuel bar Judah, - "Now about this *Tekhelet* - how do you dye it?" He said to him, "we take the blood of the

hilazon (i.e., the dye secretion of the *Tekhelet* species) and drugs (*Sanmanim*), put them into a kettle, boil the mixture, and then take out something of the liquid in an egg-shell, and test the sample with a bit of soft wool (Cf. Pliny, IX, 38). We then throw away that egg-shell and burn that sample of wool." No particulars are given of the "drugs" employed together with the dye-secretion of the *Tekhelet* species. Commentators differ. The Tosaphists, the French school of Talmudial exegesis, remark that "it is very strange that extraneous matter should have been mixed with the *Tekhelet* dye," "but perhaps," they add, "it was the combination of the *Tekhelet* pigment with these drugs that constituted the *Tekhelet* dye." Rashi, the foremost commentator of the Talmud, would seem to hold that the drugs in question were simply mordants used for fixing the colour in the fibre, and had nothing to do with the production of the colour itself. An earlier authority, Samuel ben Hofni, principal of the Academy at Sura, Babylonia (d. 1034) would seem to be of a contrary opinion. In a treatise extant as a unique manuscript at the library of Petrograd he asserts:- "the information has been handed down to us that *Tekhelet* was dyed with blood of an aquine (marine) animal called hilazon mixed with another (substance)." This rather gives the impression that the *sanmanim* or drugs formed an essential part of the dye, assisting in the production of the requisite colour. Appearances in the Talmud, I feel, point in the opposite direction. The absence of all specification of the *drugs* in question, tends to indicate that the latter stuffs were not essential to the production of the colour.

This is really the opinion of Maimonides, the greatest codifier of Jewish law and ritual. In reproducing the Talmudic account of the dyeing of *Tekhelet*, he states: "The wool is soaked in chalk and washed until it is clean, and then boiled with *ahla* and the like, as is the practice of the dyers, in order to prepare the wool for absorbing the colour. The blood of the hilazon is then put into the vat (kettle) together with drugs such as kimonia (cimolia) (Cimolia is a cleaning substance, a reference to which is often made in Pliny (XX, 81, etc.)), as is usual in dyeing; the liquid having been raised to a boiling heat, the wool is immersed therein, remaining in that condition until it has the colour of the sky, and this is the *Tekhelet* used for the fringes."

TESTS FOR DETECTING FRAUDULENT IMITATIONS OF *Tekhelet*

Imitations of purple with vegetable dye-stuff are referred to in Pliny, Vitruvius and other non-Jewish sources. I cannot, however, recall any reference to tests in Greek and Latin authors.

For *Tekhelet* the Talmud records two testing processes: one due to R. Isaac V.R. Jehudah, the other to R. Avira in whose name it was reported by R. Ada. In the first case a sample of the wool

in question was allowed to soak overnight in a mixture of alumine, fenugrec juice and urine forty days old (or according to a variant reading urine of a forty days' old child). If the colour remained unimpaired, the *Tekhelet* was proved genuine. The other test consisted in putting some of the wool into an overfermented dough made of barley flour, and baking the dough. If after the baking operation was over, the sample on being taken out showed a change for the better in the quality of the colour, the wool would be pronounced genuine *Tekhelet*; if for the worse, it would be rejected.

The *Tekhelet* imitations were usually made with indigo, which being fast to light and washing, could not be easily detected as a fraud.

In test (1) we miss an indication of the proportions in which the several constituents are to be mixed. What is the value of these tests from the chemical point of view?

Professor Green, Professor of Tinctorial Chemistry at the University of Leeds, in reply to this and other questions (Dated July 29, 1913) states:- "It would seem clear from the quotation given that the tests prescribed have the object of ascertaining whether the dye is easily reduced (hydrogenated). Indigo is more readily hydrogenated and removed from the fibre in the form of its leuco compound than is the brominated indigo (of which the purple probably chiefly consists). In both cases the action probably depends on the evolution of the hydrogen by the fermenting organic matter. 2°. It seems likely that *Tekhelet* was faster than indigo. 3°. Indigo like all vat dyes is very fast to soap. In pale and medium shades it is not very fast to light, in which respect it is surpassed by brominated indigos. 4°. Brominated indigos are all brighter in shade than indigo itself. 5°. All vat dyes are fixed on the fibre by oxydation. In the bath the dye is not present as such but as a soluble leuco or hydro compound. If the oxydation on the fibre is not complete, the dye will be easily removed by washing."

THE USES OF PURPLE IN ANCIENT ISRAEL

Allusions to the secular uses of *Tekhelet* and *Argaman* are very few. Neither ever appears in connection with the royal apparel of Jewish Kings in Biblical times. In Canticles the seat of Solomon's palanquin is spoken of as being made of *Argaman*. The virtuous woman is depicted as clothing herself in *shesh* and *Argaman*. *Tekhelet* is conspicuous by its absence.

The ritual uses of *Tekhelet* are two-fold, (I) for sacerdotal and cultural purposes, (II) for the *tzitzit* or fringes. (See Exodus XXV, etc., etc., and Numbers XV.) *Tekhelet* appears as occupying a somewhat higher position than *Argaman* in the ladder of sanctity.

The account of the First Temple in I Kings, 5-7, which of course is very far from complete, omits all mention of textiles. The parallel passages in Chronicles refer to *Tekhelet* and *Argaman*, but in very general terms.

Ezekiel's sketch of the Future Temple contains no allusion to *Tekhelet* and *Argaman*.

In the Second Temple *Tekhelet* and *Argaman* were, we know, used not only for the High Priest's garments, in accordance with Pentateuchal prescriptions, but also for the thirteen veils hung at the gates.

The ritual use of *Tekhelet* for the *tzitzit* or the fringes survived the Temple by several centuries.

The law of *tzitzit* (the fringes) occurs twice in the Pentateuch Numbers XV, 37-41, and Deuteronomy XXII, 12.

The symbolic significance of *Tekhelet* is, I think, quite clear from the text of the Pentateuch itself. The *Tekhelet* resembling the sky-colour is to remind one of heaven, and so raise his feelings and thoughts to higher planes. This is, in fact, the traditional view of the significance of *Tekhelet*.

Though the rite of *tzitzit* is still observed, to some extent, by professedly orthodox Jews, and in a small measure even by reformers, *Tekhelet* has long ceased to form part of the *tzitzit*.

THE TOTAL EXTINCTION OF TEKHELET

Tradition singles out the territory of Zebulun, which, as we know, adjoined Phoenicia, as the centre of purple manufacture in Palestine.

This is significant in view of what we otherwise know of Phoenicia as a principal centre of the purple industry. A Talmudic tradition states in connection with Jeremiah, LII, 16 that Nebuzradan left some of the poorest people of the land to engage in the fishing of the purple-snails on the coast extending from the ladder of Tyre to Haifa. This would point to that stretch of territory as the home of Jewish purple-manufacture in ancient Palestine. The Hittite City Luz (Judges 1, 26) is referred to in the Talmud as pre-eminent in the manufacture of *Tekhelet*. The reference may

well be to a city in the vicinity of the Syrian coast belonging to the great Hittite Empire in Northern Syria.

In view of the tradition crediting Phoenicia with the invention of purple-dyeing, and of the high esteem in which Tyrian purple was universally held in antiquity, (Cf. for instance, Strabo, XVI, 11) it is rather startling to find Ezekiel (XXVII, 7) referring to the Isles (or coast lands) of Elisha as furnishing Tyre with *Tekhelet* and *Argaman*. This sounds like bringing coals to Newcastle. Where are those isles or coast lands of Elisha?

I am inclined to agree with Professor Sayce (Hasting's Dictionary of the Bible, s.v. Elisha) that Elisha adjoined the Mediterranean coast land. It may very well have been a Phoenician settlement, which would seem to have excelled about the time of Ezekiel, in the manufacture of purple. It would thus appear that the universally renowned Tyrian pre-eminence in purple production is subsequent to Ezekiel (died about 571 B.C.).

A classical source (Geog. Gr. Minores, II 5-13, 29) names Sarepta, Caesarea, Neapolis and Lydda as cities supplying purple, thus indicating that the industry covered an area comprising the coasts of Syro-Phoenicia, Galileo, Samaria and Judaea. Migdal-Sabaja in the neighbourhood of Lydda (Lud) would seem to have contained an important purple market.

The question in how far the manufacture of *Tekhelet* in particular may have been affected by the imperial edicts issued from time to time concerning the fabrication of purple, its sale and use, is discussed at considerable length in my work on *Tekhelet*. For centuries after the destruction of the Second Temple extra-Palestinian Jewry was wont to procure *Tekhelet* for the "fringes" from the Jewish dye-houses in the Holy Land. There is a record of the importation of ritual *Tekhelet* into Babylonia about 506 C.E. It may safely be asserted that at the time of the completion of the Babylonian Talmud (C.E. 570) *Tekhelet* still continued in practice for the *tzitzit* or fringes. On the other hand in the Sheltot D'Rabbi-Ahai, a ritual work composed in Palestine about 760 C.E. all mention of *Tekhelet* is omitted. The disappearance of *Tekhelet* from the Jewish ritual thus falls between the final redaction of the Talmud (C.E. 570) and the composition of the Sheltot (C.E. 760).

The Arab conquest of Palestine about the year 638 entailed the total destruction of the purple dye-houses administered by the imperial officials (See Amati. De Restitution Purposes). The final extinction of *Tekhelet* would also seem to have been one of the effects of the Arab conquest.

The great Jewish traveller, Benjamin of Tudela (c. 1160), makes mention of the dyeing of red-purple on the Tyrian Coast. It would thus appear that the industry revived some time after the Arab occupation. The interval must have been a fairly long one, seeing that the Jews who in Benjamin's time played an important part in the industrial life of Tyre (See Benjamin of Tudela's Itinerary, ed. Asher, pp. 29-30) had made no attempt to resuscitate the dyeing of *Tekhelet* for ritual purposes; the chain of tradition must have been too long broken.

The art of purple-dyeing in general, which, dating from hoary antiquity - the mention of *Tekhelet* and *Argaman* in the Cuneiform texts occurs already about 1600 B.C. - passed through a long and checkered career, finally becoming extinct, at least in the Old World, on the fall of Constantinople, May 29th, 1453.

It is worthy of note that the remarkable researches carried out by Gentile inquirers from William Cole to Lacaze-Duthiers found no echo in Jewish circles.

It was not until 1887, some 28 years after Lacaze-Duthiers' famous experiments that an attempt was made by a certain Rabbi, Gershon Enoch Leiner, of Radzin, Poland, to restore ritual *Tekhelet* in Israel.

He carried out investigations along the Adriatic coast, and eventually arrived at the conclusion that the *Tekhelet* species was identical with *Sepia officinalis*. In 1888 he established a factory for ritual *Tekhelet* in Radzin, dying a few years afterwards. The dye-house founded by him was still in existence about the time of the outbreak of the Great War. The *Tekhelet* of Radzin has failed to obtain general acceptance, and its use is confined to a small circle of a few thousand families, consisting of admirers of the late Rabbi Leiner and of his son and successor.

That his identification of the *Tekhelet* species is entirely erroneous is conclusively shown in my work on *Tekhelet*.

At the conclusion of the lecture the sincere thanks of the audience was conveyed to Dr. Herzog by the Chairman.