Jewish Ritual Ink:

A Study in Jewish Law and the Scientific, Historical Realities of the Times

In centuries of exile, Jews have traveled to a myriad places and to countless climates, and have faced different cultures, technologies, and religions at the various stages of their travels. Yet, despite the many travels, Jews have generally used the same ritual items wherever they may be residing, faithfully committed to the assumption that the same ram's horn used today is the exact same ram's horn at the time of the Bible; that the Torah is written on cow's hide, much as it was centuries ago.

One notable exception to this rule is in the case of the ink used to write the Torah scroll. Though black ink was used, and continues to be used, for centuries - the exact recipe for that ink has changes through time, as we will see. Halakhacists have looked to the science of ink production in their own times, and allowed it to influence their thinking about the most proper ink for Torah writing, and so we can safely say that the Torah scroll written today, even if it uses the same quills or parchment as years past, is still not made in exactly the same way as it once was.

At the onset, we should also note that Halakhacists need to contend with two types of changes: technological *improvements* where an old recipe is rendered obsolete, and issues of *raw material* accessibility where the change is predicated on different materials found in different locations. Our discussion will focus primarily on the question of the materials used to create the black features of the ink (soot, wood, or other chemicals), but will touch in passing on some of the other ingredients that serve to help the ink bond to itself or to the paper (metals and saps).

Talmudic Ink

The Talmud never gives an explicit recipe for how to create ink for use in a Torah scroll. Instead, the ink used for Torah scrolls and other religious articles is usually referred to with the generic Hebrew term "*dyo*," without further explanation. Still, some characteristics of the Talmud's ink can be deduced from the various discussions; later authorities used these characteristics to try to determine the recipe for Talmudic ink.

First, the ink must last for a significant period of time. The Mishnah rules (Shabbat 12:4, 104b) that only writing that makes a lasting impression[1] is prohibited on Shabbat, and includes *dyo* on the list of inks that cannot be used on Shabbat. Thus, one can deduce that the ink can make a lasting impression, unlike the fruit juices mentioned later in that Mishnah. This ruling is also confirmed by Mishnah Gittin 2:3 (19a), which also requires a lasting ink for the writing of a bill of divorce, but considers *dyo* as an acceptable ink for the process.

At the same time, Sota 2:4 (17b) rules that *dyo* must also be erasable. Since the scroll of the Sota is erased, the ink used must retain the ability to be erased. Metallic inks, such as Kankantom[2]are prohibited for use for a Sota because they sink into the paper and cannot be erased. Most other inks sit on the surface of the paper, or bond with the outer layer of the paper,

[1] Different texts of the Mishnah have minor variants for the formulation of this requirement of the ink, but all versions indicate that the ink referred to as *dyo* is lasting, despite the nuances in description.

[2] The Kaufman codex consistently reads *kala*-kantom, closer to the Greek khal-kanthon, but most authorities assimilate the first and second syllable of this ink and instead speak of *kan*-kantom
Rashi (Sota 17b) identifies this metallic ink with Vitriol and Ardement. Vitriol is the ancient trivial name for metallic sulfates, with the most common types being "Green Vitriol" [today called Iron Sulfate ($FeSO_4$)] and "Blue Vitriol" [Copper Sulfate ($CuSO_4$)]. Copper Sulfate is known as Blue Vitriol because the typical hydrate of Copper Sulfate ($CuSO_45H_2O$) is blue in color. Iron Sulfate hydrates are green in color. "Adrement" is an ink made with Copper Sulfate.
Maimonides also notes this ink is metallic in his responsum (136), discussed below. See David Diringer, *The Hand-Produced Book* (New York: Philosophical Library, 1953), 550, and Pliny N*atural History* Trans. H Rackham (Cambridge Harvard University Press, 1955), 34.32.

but metallic inks seep in so thoroughly that they cannot be removed from the paper without perforating the paper, itself.

A third source may also be relevant to this discussion, but is not conclusive. A final Mishnah (Megilah 2:2, 17a), permits the use of *dyo*, but prohibits the use of four other inks that were used at the time: *sam, sikra, kumus,* and *kanhantom*.[3] Here, the Mishnah does not specify what characteristic of ink is lacking in these four other writing materials. It is possible that the writing of the Megilah also requires "lastingness" or "erase-ability" and this is the reason for the exclusion of these other inks – ie, this Mishnah merely restates earlier known criteria. Yet, it is also possible that this Mishnah is communicating an entirely different principle, that there is one specific brand of ink, the *dyo*-ink that must be used, and thus invalidates all other ink types. Alternatively, it may also be that a third characteristic beyond lastingness and erase-ability, unspecified in the Mishnah, is lacking in all of these other inks. In sum, the corpus of the Mishnah provides two clear criteria for ink – erase-ability and lastingness; and may add a third.

The Babylonian Talmud adds a fourth characteristic of ink, but the context is narrative and not normative in tone. Nidda 20a explains that the black color deemed impure in the Mishnah is the color of ink. This identification suggests the Talmud's ink was historically black, but it is not stated in a legislative way to disqualify unusual, colored inks. The Talmud continues that the known dyo-ink had two states, a liquid state, and a drier state wherein the ink seems to have had a slightly darker hue.

The Babylonian Talmud has one brief discussion of the possible recipe for the *dyo*-ink. The recipe is incomplete, and would be taken and understood differently by different later authorities. The Talmud rules (Shabbat 23a):

[3] Rashi generally translates "Sam" as orpiment (literally a contraction of "aurum pigmentum" or gold colored), an orange ink made from Arsenic Sulfide (As_2S_3).

> Rabbi Yehoshua ben Levi said: all oils can be used for ink, but olive oil is the best choice. They asked – is the oil meant to be mixed with the other ink ingredients, or to be burned to make smoke? Answer: Rav Shmuel ben Zutra taught, that all oils can be used for ink, but olive oil is the best choice, both to be mixed with the other ink ingredients, and to be burned to make smoke. Rav Shmuel ben Zutra also taught that all smokes can be used for ink, but olive oil's ink is the best choice. Rav Huna said all saps can be used for ink, but the sap of *Ketaf* is the best of them all.

The main component of Talmudic ink appears to be lamp black residue, made by burning oil (preferable olive oil) into soot,[4] which is scraped off a glass receptacle and then mixed in turn with liquid olive oil, a second ingredient, and possibly other ingredients. This recipe is a very rudimentary one; most contemporary cultures at the time of the Talmud had already moved on to more advanced recopies by the third century.

The original recipe is provided by Rebbi Yehoshua ben Levi, an early Amora living in Israel. A later Amora from Babylonia, Rav Huna, adds a critical line at the end of the discussion. Rav Huna adds the ingredient of sap, probably meaning that the sap was a third ingredient that would be mixed with the olive-oil/lamp-black mixture. It is unclear from the text whether Rav Huna meant to add an ingredient that was used in his day but not in earlier centuries, or whether he meant to reveal the name of the third ingredient that had been used even in the days of Mishnaic ink. Most ancient inks of the period – including Egyptian and Greek ones that could have influenced the population in Israel – were made by mixing lamp-black or other soot with the gum or sap of the arabic tree,[5] so it is likely that all the Talmudic and Mishnaic inks followed

[4] If so, the chemical composition of the ink would be Carbon-based.

[5] Avrin, Leila *Scribes, Scripts and Books: the Book Arts from Antiquity to the Renaissance* (Chicago: American Library Association, 1991), 89, 146; Diringer, 547-550; Nirel "Mekoro shal ha-Zivon Bedyo Shehora Bektivat Sefarim, Teffilin, U-Mezzuzot" *Sinai 114*(1994), 261. See also Pliny, 13.19-20 and 35.25, writing in first century Rome of the Common Era.

a similar recipe even before the time of Rav Huna. David Diringer also cites a similar recipe for Persian Ink presented in the earlier Arab period that also uses soot, ink, and gum arabic.[6]

The Palestinian Talmud discusses a different recipe for ink, although the context does not relate to ritual writing. The Talmud in Gittin 2:3 (repeated in Shabbat 12:4) speaks of a practice of certain wise men:

> Rabbi Hiya bar Ava said: those men of the east (*some – the country*) are very wise, and when one of them wishes to send a secret missive to his friend, he writes the letter with only gallnut juice, and the one that receives the letter pours *dyo* without gallnuts in it onto it, and it is absorbed into the place of the writing.

The implication of this passage is that regular ink uses gallnut juice as an ingredient, and that secret writing is revealed by mixing gallnut juice with the rest of the ink, creating a standard ink in the paper.[7] Later authorities read this passage as confirming that gallnuts were ingredients in standard ink,[8] although it is hard to make the deduction definitively from the above text, as perhaps galls were only used in this one unusual case. There is limited evidence that nut-galls were used in conventional inks at the time,[9] so the best assumption is probably that the regular use of galls in ink was a later, post-Talmudic development.

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[6] Diringer,550.

[7] For a discussion of gallnuts and others uses for nut-galls in the process of preparing a Torah Scroll, see Yaakov Hoffman, "Is Parchment Klaf" *Hakira* 21 (2016), 197-205.

[8] See Nahmanides to Gittin 19b.

[9] David N. Carvalho, *Forty Centuries of Ink* (New York: Lennox Hill Publishers, 1904), 42, 83. Diringer (551) notes that the development of this ink is often dated in the seventh or eighth century at the earliest. Some conventional early inks had iron as an additive, but none had an iron-gall mixture. Menahem Haran "Scribal work in the Biblical Period" *Tarbiz 50* (1981), 80 and Ta-Shma, 293and Nirel, 262 in his wake, challenge the earlier prevailing scholarly consensus and instead argue that nut-gall ink was developed in the second century of the common era and was common in Talmudic times. Were Haran right, we would have to accept an odd reality that a superior ink and an inferior ink were used side-by-side across the globe for roughly one thousand years (Haran, 77), a less likely possibility.

Rashi

By Rashi's time, the olive-oil/lampblack mixture was no longer the recipe used in the preparation of scribal ink. Thus, it is unsurprising that Rashi was unable to determine how ink would be made until:

> I found in the response of the Geonim[10] that they collect smoke from olive oil on a glass vessel, until it becomes black, and then he scrapes the black and places in a little oil, and mixes them, and dries them in the sun, and dilute them into the ink (Shabbat 23a).

Clearly, ink production in Rashi's day differed from Talmudic ink-production, and so Rashi only suggests the interpretation that he found in the writing of the Geonim, without instinctively knowing it to be true. The Talmud's ink was used and recorded in an earlier period, but it was no longer used. It seems Rashi is comfortable with the fact that the ink of Talmudic times was different from his own since the Talmud only indicated that the use of olive oil was a *preference* without saying that it was a requirement. Olive oil was hard to come-by in colder, Northern Europe, so other materials were used as replacements for olive oil in ink production. The lamp black may have been made from a cheaper type of oil or from pitch instead of olive oil; the lamp black would be mixed with water, instead of olive oil.[11]

What ink would Rashi use for his Torah scroll? Rashi never addresses this question explicitly, although his practice can be deduced from a surprising and cryptic comment made to the continuation of the discussion in Shabbat. Rav Huna had added that sap of Ketaf was to be used in the ink recipe. Elsewhere in his commentaries, Rashi identifies the "Ketaf" as a tree

[10] I have been thus far unable to find this responsum. The word "Geonim" in Rashi does not necessarily need to refer to the Geonim of Babylonia, however, and can refer to any earlier sage.
[11] Nathan ben Jehiel of Rome, *Sefer Ha-Aruch* (גבל) also notes that water was used instead of oil in his days.

which only produces sap and no fruit (Nidda 8a), or as the "*theriake"* (Exodus 30:34).[12] The word in the Talmud and the Targum is generally taken to mean a more common sap tree (like balsam),[13] or to reference the generic term "sap tree."

Surprisingly, in our context Rashi offers a non-typical translation "*Ketaf* - forest plumbs;[14] *Like we use*,[15] from sap." Rashi offers a unique translation which he did not give in the other context, and which seems to be anachronistic for the passage at hand. The best explanation why Rashi assumed the *Ketaf* was the plum sap in this context and no other would be that Rashi used it in the production of his own ink, and assumed that to some extent the realia of his days must have matched the realia of the days of the Talmud.

Rashi's description of an ink made with olive-oil lampblack mixed with plum sap matches the recipe for early medieval ink, prevalent in Europe through the eighth century, but gradually phased out after that point (ostensibly still remaining in use in some smaller communities where the advanced technologies had not yet taken hold). This early ink was easily erased, and involved only three ingredients, paralleling the same three ingredients alluded to in the Talmud, according to Rashi: Water, gum arabic (in this time usually from a plum or almond tree), and some sort of soot (from beeswax, tallow, olive oil, pitch, or almond oil).[16]

Rashi demonstrates an interesting position vis a vis change. On the one hand, Rashi attempted to read the ink recipe of his day back into Rav Huna, when he was able to do so. On

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[12] See also Rashi to Avoda Zara 35b.

[13] Michael Sokoloff *A Dictionary of Jewish Palestinian Aramaic of the Byzantine Period* 2nd Ed. (Ramat-Gan: Bar Ilan University Press, 2002), "קטף" translates the word with the generic "balsam" or "resin." This translation is also offered by the medieval dictionary *Arukh*. See also Richard N. Jones, "Balm," *The Anchor Bible Dictionary* Ed. David Noel Freedman (Nedw York: Doubleday, 1992) who questions if the balsam sap could really be the correct translations of the Biblical passages in which "*kataf*" is used.

[14] Rashi's *prunelier* is easily identified as the plumb tree. The word has this meaning both in Latin, spoken before Rashi, and modern French, spoken afterwards. See Moshe Catane, *Otsar Ha-Loazim* (Jeruselm: Gittler Brothers, 1988), Charlton Lewis and Charles Short *A Latin Dictionary* (Oxford, 1975), "prunum" (the source of the modern scientific name of the tree), and J.E. Mansion *Heath's standard French and English Dictionary* (Boston: DC Health, 1965) "prune."

[15] Rashi uses similar language in his commentary to Sota 17b (s.v. Ela), "But with ink – that is (like) ours, from sap.

[16] Arvin, 214.

the other hand, Rashi recognizes that on the raw material level, olive oil had been replaced in Northern Europe. Thus, Rashi is a paragon of two different approaches to change and development of realia: first: there is a recognition that things can change, but second: there is a drive and commitment to try to minimize the change and read as much as possible of the past back into the Talmud.

Tree Galls in Europe

The simple European recipe was nearly completely phased out by the eleventh century. By that time, the most common ink had two new ingredients that replaced the plumb sap. First, various metals were included (for example, iron sulfate was used to make green vitriol ink), as were tree galls.[17] This new ink lasted longer than the earlier kind, and quickly took the place of simpler, earlier inks. Rashi makes no mention of the use of either ingredient in his own ink recipe, which strongly suggests that he used neither tree galls nor metallic additives. It is difficult to make any argument from silence, but Rashi's silence on galls and metals imply he used neither one.[18]

Though the Talmud had rejected the use of metal substances in the production of ink - Sota 20a ruled that metal additives or Kankantom caused ink to violate the erase-ability criteria - the Talmud never addressed the ink made with oak galls, gum Arabic, and lamp black. As early as elevent century Hananel ben Hushiel, Jewish authorities ruled that the permitted ink can be based either on lamp-black, or galls.[19] Just a few decades after Rashi's death, *Sefer Hasidim*

[17] Ibid. See also Bernhard Bischoff, *Latin Palaeography* trans. David Ganz (New York: Cambridge University Press, 1979), 16.
[18] It is also unclear whether Rashi was acquainted with this recipe but did not use it (perhaps because it violated the criteria of being erase-able), or if he was not even aware it existed.
[19] This position of Rabbeinu Hananel is only found in a single, second-hand source, Ramban to Gittin 19b. If it is truly the position of Rabbeinu Hananel, it could reflect how the two inks were still both in use in eleventh century Italy and/or Tunisia, and that the gall ink had not totally outflanked the lampblack ink as yet.

speaks matter-of-factly about a "pot that has in it galls for ink" indicating that by his days, galls were used as a regular ingredient in the production of ritual ink.[20]

Early German authorities even shockingly maintain that the true ink of the Mishnah was the gall ink. Eliezer ben Natan, living shortly after Rashi writes that though the Talmud invalidates the use of gallnut fluid without any additional additives as ink, the Mishnah's ideal ink was a mixture of the gallnut fluid and tree sap.[21] Later German authorities continue to maintain the permissibility of using this new gall ink: even if it was not the ink of the Mishnah, the realia of the time had become the Halakha of the day. Writing a century after Rashi's death, the German Yizhak of Veinna contrasts between the gallnut ink, ostensibly of Germany, and the non-gallnut ink "which they use in France," and cites two opinions, one which permits gallnut ink and one which invalidates it. Asher ben Yehiel (Sefer Torah, 6) also writes that gall ink is permissible in all cases.[22]

It should not surprise us that the new development of the use of galls was supported by the German authorities. After all, earlier developments in ink production (such as the use of tree saps or the shift from olive oil soot to other blackening agents) had been accepted as valid improvements on ritual ink. So long as erase-ability and lastingness were maintained, all ritual observances could be achieved even with different types of ink.

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[20] Jedusa Wistinetzki, *Sefer Hasidim*, (Frankfurt: Wahrman, 1924), 187 (No. 729). The passage is part of a larger section that deals with the laws of writing Torah scrolls, and is also found in the Bologna manuscript, No. 894.

[21] Ra'avan is cited by Mordekhai ben Hillel 339 and Hagos Ashri Gittin 2:10 from Mordekhai, and alluded to in Tosafot to Megilah 19a ("And the Germans replied to him"). The middle source, which refers to him as Rivan, is probably a copyist's error. The Mordekhai's account adds Ra'avan's agreement that thorn-ink is also valid (in order to explain a difficult passage in Nidda 20a), although that line is missing in Hagos Ashri and Tosafot to Megilah 19a, and may be Mordekhai's own interpretation of Ra'van in any event. Thirteenth century Rabbeinu Yeruham (Sefer Toldot Adam V'Chava 2:2:17b, 24:2:203d) does rule that both are acceptable, though he used the gall ink. No treatment is made on the topic in the Laws of Sefer Torah of Ravya, grandson of Ra'avan (1,149)

[22] Rosh adds an argument that one is even permitted to use gall-soot ink on parchment that had been treated with gall-water, and there is no disqualification for using ink that resembles the writing surface. Rosh reprises this argument in his Tosafot to Gittin (19a).

Whereas Rashi confronted a raw material change, these rabbis confronted a technological improvement. Despite the more radical difference, they still permit the ink that was in use at the time. A small number argue that it was indeed the ink of the Mishnah, but the majority perspective argued that the Talmud never had intended to establish a set recipe, only criteria, and any new ink that matched those criteria could be deemed acceptable.[23]

Maimonides

Maimonides had an entirely different point of departure. He believed that the Talmud only provided general characteristics that the ink needed to have, but that any ink that met these criteria could be used (Laws of Tefillin 1:4-5):

> This ink is the best one for Torah scrolls, Tefillin, and Mezuzah… What is excluded by the tradition that one must write with ink? It means to exclude other colors like red and green and the like, that if Torah scrolls, Tefillin, or Mezuzah have even one letter written in another color or in gold,[24] they are invalid.

Any ink is permissible, so long as it maintains the crucial Talmudic characteristic of color (from Nidda 20a), [25] even if it lacks the criterion of erase-ability, and ostensibly lastingness. And so, it might be of historical interest to know the type of die used in the times of the Talmud (Shabbat

[23] There is less discussion of the permissibility of adding metals to the inks. We have noted that adding metals decrease the erase-ability of the ink, but (a) we are unconvinced if this requirement applies to Sefer Torah beyond Sota, and (b) the Talmud never categorically disapproves of metallic inks only lists some specific ones as being disqualified – but they may be disqualified on the basis of color (such as in the case of orpiment). Rashi seems to invalidate both Adrement (Copper Sulfate ink) and Vitriol (Iron Sulfate ink), but Rabbeinu Tam permits the former despite the addition of metal, thinking that the Talmud only discounted the significantly more lasting Green Vitriol ink and not the more temporary Copper Sulfate ink. However, the adjustment of one metal to the other would be a much less dramatic change and the German authorities do not seem to criticize this position of Rabbeinu Tam. Rashi seemed to use no metals in his ink, but it remains unclear if Rabbeinu Tam used metallic inks, or just permitted them to others. See Tosafot Gittin 19b (Kankantom) which is less clear, and Tosafot to Megilah 18b (Kankantom) which implies that it was used regularly.
Ramban Gittin 19b notes that Rabbeinu Tam's view is challenging, since the difference in lastingness between Blue Vitriol and Green Vitriol is minimal, and if the latter is invalid the former should as well.

[24] This clause takes its inspiration from the Borayta of Shabbat 103b.

[25] Maimonides identification of *dyo* with blackness is echoed in the Laws of Tzitzit 2:2, and the laws of Shechita 7:17.

23a), but that information carried no legal relevance.[26] Still, though Maimonides was thus unencumbered by legal reasons that would force him to equate his ink with the ink of the Talmud, he did so anyway.[27] His position allowing all black inks is merely a halakhic-legal position, not an outgrowth of a realization that the conventional ink used in his day differed from the one of the Talmud.

The ink recipe found in Maimonides's code (Tefilin 1:4-5) generally resembles the one of the Talmud, although there are differences that leave Maimonides unperturbed. Lampblack and sap are the two primary ingredients, although the lamp black could be from pitch, oil, or wax. Honey is also added, although the Talmud never mentions honey in its discussions of ink. Gallnut juice is added at the time of writing.

Where did Maimonides find this recipe? It seems that these ingredients were a prevalent ink recipe in the times. A contemporary treatise on book production by Ibn Badis[28] makes use of the same ingredients as Maimonides, in a variety of recipes for ink, though Maimonides's exact recipe is not found among the hundreds of ones in the treatise. Be that as it may, Maimonides follows the model of the French authorities, and considered a contemporary ink to be the Talmudic ink.

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[26] See the discussion in Ta-Shma, 289.

[27] In the Commentary to the Mishnah Shabbat 1:4 and 12:4, and Gittin 2:3 Maimonides translates the Hebrew *dyo* with the contemporary Judeo-Arabic literal equivalent *al-madar*. It is unclear whether Maimonides meant merely to translate the word, "ink," or if he meant to identify the substance called ink in Talmudic times, with the substance called ink in his day. The treatment in the responsum tends towards the latter interpretation.
Maimonides identifies ink with the gallnut ink discussed in the Code in his responsum. Ta-Shmma (291) indentifies it with lampblack ink that lacks gallnuts, but it is clear from the responsum that the ink of Shabbat 12:4 needed gallnut additive or else there would be no violation of Shabbat in the case discussed. Hadassa Shy, *The Lexicon of Tanhum ben Yosef Hayerushalmi to Mishne Tora of Maimonides* (Jerusalem: The Israel Academy of Sciences and Humanities, 2005), 123, also identifies Maimonides' ink from Tefillin 1:4 with the Arabic *madar*.

[28] Al-Mu`izz ibn Badis, *Staff of the Scribes and Implements of the Discerning with a Description of the Line, the Pens, Soot Inks, Liq, Gall Inks, Dyeing and Details of Bookbinding (1025)* trans Martin Levy, "Mediaeval Arabic Bookmaking and its Relation to early Chemistry and Pharmacology" *Transactions of the American Philosophical Society* 52.4 (1962)

In the words of his responsum (No. 136):[29]

> This is proof that "*dyo*" mentioned throughout is something that produces a lasting mark… Were that not true, one who writes using this ink would not be liable on Shabbat, for it would be analogous to writing with fruit juices which is not liable for they do not last! But if the ink is erased well, it can be erased, and no mark will be left; and thus it is permissible for the scroll of a Sota.
> With this introduction, I say that ink is the soot from burning oil and the like (such as oils, pitch, pine sap,[30]or ammoniac gum) beneath an upside-down vessel. When the soot is gathered and mixed with sap and honey[31] until it can flow…
> And it is – to me – a great error if this ink is taken, and soaked in water, and used to write a Sefer Torah, for it is analogous to writing with fruit juices, for it will not last at all; and if the scroll is rolled start to finish a few times the whole writing will be erased – or most of it… What should be done is to soak this ink in gallnut juice[32] and then write with it, and to dry it after it has been written so the writing is nice and lasting. Through this process it will last and not smudge or be erased, but it could still be eased if one wishes to erase it. And so we did when writing the scroll that we wrote, that we made sure it conformed to the Halakha.[33]

In sum, the ink of the Talmud – and in his mind the ink of Maimonides' day – was a mixture of lampblack, sap, and honey later added to gallnut water. It was both the erasable דיו of

[29] Joshua Blau, *Teshuvot Ha-Maimonides* (Jerusalem: Rubin Mass Ltd., 1986), G. Margolioth "Responses of Maimonides in the Original Arabic", *JQR 11* (1899), 549-550. This responsum was sent to the sages of Tyre in 1177. [See Herbert Davidson, *Moses Maimonides: The Man and His Works,* (New York: Oxford University Press, 2005), 203-204.]

[30] This translation for the Judeo-Arabic *kalponia* is given in Joshua Blau *A Dictionary of Mediaeval Judeo-Arabic Texts* (Jerusalem: The Academy of the Hebrew Language, 2006), 563.

[31] The text of the recipe found in Blau essentially matches the recipe in Mishneh Torah. The text of the parallel responsum in the Pe'er Ha-dor edition [David Yosef, *Responsa of Maimonides "Pe'er Hador,"* (Jerusalem: Machon Or Hamizrach, 1984), No. 45] reads: "to take from the soot of vines, to crush it, and to take the smoak of oils like olive oil, tar, *kalponia*, and mix it with that dust"adding the ingredient of charcoal, not found in Maimonides' Code. D. Simonsen, "Arabic Responses of Maimonides" *JQR* 12 (1900), 134-138 notes that this line is an addition not found in the original text.

[32] Ta-Shma, 291, understands Maimonides that besides Gallnuts, some Al-Chiber must be added – he fails to cite how he reads this in the responsum, though.

[33] According to this responsum, vitriol is not added to the ink, only gallnuts, and as a result, the writing can be totally erased. Pe'er Ha-dor adds the ingredient of *kankantomand* rules that the ink can only be removed by scraping, as a result. The presentation in Blau's edition is in consonance with the other presentations of Maimonides' position, though, and reads better with the earlier half of the responsum. See the later ruling aforementioned in Yad Ha-Hazakah, and the earlier explanation of Maimonides, *Commentary on the Mishnah* trans. Yosef Kapach, (Jerusalem: Mossad Harav Kook, 1974) to Sota 2:4 and note 17. See also Simonsen, Responses, 137.

the discussion in Sota, and the lasting דיו of the discussion in Shabbat. An ink lacking gallnuts would not last long enough, and should not be used for the writing of a Torah scroll.[34]

What about a metallic ink that was lasting but not erasable? Maimondies ends his responsum by saying that non-erasable ink was subject to a Talmudic dispute; uncomfortable with adopting either position, Maimonides rule that ideally one should be stringent, using an erasable ink; but if one did not, one had fulfilled the obligation ex post facto – for the requirement of color was the real essential one for ink production. This position is also reflected in Maimonides' Code and also in the commentary to the Mishnah.

By the fourteenth century, Yom Tov ben Avraham Asevilli could say about Jacob Tam (Shabbat 104b): "and he is correct. For the custom has already spread in all of Israel to write Torah Scrolls, Phylacteries, and Mezzuzot with gallnut ink; and the custom of Israel is the Torah."[35]

In the end, all the inks under discussion met the criteria that we would require legally today: they are all black, and are all lasting and non-temporary. And they all (with the exception of one post facto situation in Maimonides) could be erased with relative ease, if needed. In the end, the Talmudic criteria would be met in all places and all times. It was just the process of producing what was needed and used that changed over time and place.

[34] Ta-Shma, 291, writes that the addition of gallnuts facilitates erasure, and that Maimonides had meant to advocate adding Alhiber to the regular ink to facilitate lastingness, although this does not seem to be the sense of Maimonides' responsum.

[35] The widespread use of Gallnut ink is also alluded to by a gloss added by a later hand to one manuscript of the Mahzor Vitri's commentary on the incense prayer [Simcha of Vitri *Mahzor Vitri*, Ed. Aryeh Goldshmit Vol. 1 (Jerusalem: Ozar Ha-poskim, 2004), 157] "And it is used to write throughout Spain, Narbonne, and Provence" and in *Beit Yosef* at the start of #32.