

Historical Chilazon



Various colors, such as techelet, are mentioned throughout Tanach. Today, we are fortunate to have a variety of synthetic dyes in any color or shade. However, this was not the situation until recently. There were only a few known permanent natural dyes in antiquity. These dyes were rare and difficult to obtain.

We learn in the Torah that many parts of the Mishkan were made from sky-blue (“techelet”), purple (“argaman”), and crimson-worm (“tola’at shani”) dyed wool: “And this is the offering that you shall take from them: gold, silver, and copper; **sky-blue, purple, and crimson-worm wool**; linen and goat hair ...” (Shemot 25:3-4). B'nai Israel were also commanded to affix a thread of “techelet” wool on the fringe of each corner of their garments (Bamidbar 15:38).

We also learn from the Tanach that the garments dyed with these colors were associated with high social status and royalty:

“She fears not for her household for snow, for all her household are dressed in **crimson**. She makes beautiful bedspreads for herself; fine linen and **purple** wool are her raiment.” (Mishlei 31:21)

“The king shouted and said to the wise men of Babylon: Any man who shall read this writing and tell me its interpretation shall wear **purple** and have a golden chain on his neck and rule over a third of the kingdom.” (Daniel 5:7)

“And Mordecai left the king's presence with royal raiment, **sky-blue** and white and a huge golden crown and a wrap of linen and **purple**, and the city of Shushan shouted and rejoiced.” (Esther 8:15)

It was known that the ancient Tyrians were skilled in making sky-blue and purple dyes (2 Divrei Hayamim 2:6; Yechezkel 27:16), and that the snails from which they were made were found on the coast of northern Israel and Phoenicia (Shabbat 26a). Crimson dye was made from the Kermes insects.

The first part of this article will discuss the traditional, Jewish sources, while the second part will discuss the historical and archeological evidence related to this topic.

Talmudic Sources



The Talmud identifies the source of “techelet” dye as “Chilazon” – an aquatic or semi-aquatic creature:

1. Menachot 43b says that “techelet” was a permanent dye, which resembles the sea, which resembles the sky, that resembles Hashem’s Throne of Glory.
2. Bava Metzia 61b says that the color of the dye made from the “Chilazon” was practically identical to the color “indigo” (a plant-based dye native to India).
3. Megillah 6a states that the “Chilazon” can be found on the shores of the Mediterranean that were part of the portion of the Tribe of Zevulun in Eretz Yisrael, “from the cliffs of Tyre to Haifa.”
4. In Menachot 44a, we find the following description: “The ‘Chilazon’s’ body has the color of the sea, and its form is that of a fish. It appears only once in seventy years (In Masechet Tzitzit, the probable source of this information, ‘seventy’ is replaced by ‘seven’), and ‘techelet’ is made from its blood; therefore, it is very expensive.”
5. Shabbat 75a discusses the case of one who “smashes” a Chilazon on Shabbat in order to extract its dye, preferably while the animal is still alive. Use of the word “smashes” suggests that the “Chilazon” has some sort of hard shell.
6. In Ketuvot 5b, we find in Tosafot that the blood of the “Chilazon” pools in a sac, from which it can be easily extracted without killing the creature.

Halachic Research

Over the long years of the exile, the identity of the “Chilazon” was forgotten. But over the last several hundred years, Torah scholars have attempted to put together the various descriptive clues found in the classic Jewish sources to formulate theories as to the identity of that elusive creature.



1. **It is a type of squid.** At the end of the nineteenth century, Rabbi Gershom Henoch Leiner, ZT”L, the Radziner Rav, specified the type of squid as the “cuttlefish,” or “pouch fish,” a squid-like sea mollusk that has ten sucker-bearing arms and a hard internal shell. When endangered, some cuttlefish eject a black, ink-like fluid. It is this fluid, according to the Radziner, that is the source of “techelet.” Unfortunately, several problems are associated with this theory. The shade of blue does not quite match indigo and it can be removed from cloth rather easily. It is also uniformly abundant in the seas of the world. Nevertheless, the Radziner Chassidim maintain one of the two factories currently producing “techelet” from their version of the “Chilazon” in Eretz Yisrael.

2. **It is a *Janthina* snail.** The “Yad Ramah” on Sanhedrin 91a says that the word “Chilazon” refers to snails in general, and the “Chilazon” from which “techelet” was produced is a particular species within the family of snails. Rabbi Yitzchak HaLevi Herzog, ZT”L, did very extensive research into the subject and in fact wrote his doctoral thesis on the subject of identification of the “Chilazon,” in which he concluded that it was none other than the snail known in scientific circles as the “*Janthina Pallida Harvey*.” It lives in the Mediterranean, in colonies that experience population explosions approximately every seven years and inhabits a shell of a beautiful violet-blue color. This theory also has some problems, including the fact that the color it produces as a dye when applied to wool is also not quite indigo, and it washes out rather too easily to be considered “permanent.”

3. **It is the *Murex* snail.** Many dye-producing factories were found along the Mediterranean coastline, in the territory of Zevulun, with piles of shells of the species of snail known as the *Murex Trunculus*. Even though the dye made from the secretion of the *Murex Trunculus* is more purplish than blue, when it is exposed to direct sunlight, the color changes to a shade of blue that matches indigo, and indeed its chemical composition at that point in the processing is identical with indigo’s. Rav Herzog himself said that, even though he favored the *Janthina* snail, logic seemed to dictate that the identity of the “techelet Chilazon” was in fact the *Murex Trunculus*. There is also a factory in Eretz Yisrael that produces “techelet” from this species of snail.



History and Archeology

One of the most valuable commodities in antiquity was **Tyrian purple, also known as Phoenician red, Phoenician purple, royal purple, imperial purple, or imperial dye**, is a reddish-purple natural dye; the name Tyrian refers to Tyre, Lebanon. It is a secretion produced by several species of predatory sea snails in the family *Muricidae*, rock snails originally known by the name 'Murex'. In ancient times, extracting this dye involved tens of thousands of snails and substantial labor, and as a result, the dye was highly valued. The main chemical is 6,6'-dibromo-indigo: $C_{16}H_8Br_2N_2O_2$.

Background

Biological pigments were often difficult to acquire, and the details of their production were kept secret by the manufacturers. Tyrian purple is a pigment made from the mucus of several species of Murex snail. Production of Tyrian purple for use as a fabric dye began as early as 1200 BCE by the Phoenicians and was continued by the Greeks and Romans until 1453 CE, until the fall of Constantinople. **The pigment was expensive and complex to produce, and items colored with it became associated with power and wealth.**

Tyrian purple may first have been used by the ancient Phoenicians as early as 1570 BCE. It has been suggested that the name Phoenicia itself means 'land of purple'. The dye was greatly prized in antiquity because the color did not easily fade, but instead became brighter with weathering and sunlight. It came in various shades, the most prized being that of black-tinted clotted blood.

Because it was extremely difficult to make, Tyrian purple was expensive: the 4th century BCE historian Theopompus reported, "Purple for dyes fetched its weight in silver at Colophon" in Asia Minor. **The expense meant that purple-dyed textiles became status symbols, whose use was restricted by sumptuary laws.** The most senior Roman magistrates wore a *toga praetexta*, a white toga edged with a stripe of Tyrian purple. The even more sumptuous *toga picta*, solid Tyrian purple with a gold stripe, was worn by generals celebrating a Roman triumph.

By the fourth century CE, sumptuary laws in Rome had been tightened so much that only the Roman emperor was permitted to wear Tyrian purple. As a result, 'purple' is sometimes used as a metonym for the office (e.g., the phrase 'donned the purple' means 'became emperor'). The production of Tyrian purple was tightly controlled in the succeeding Byzantine Empire and subsidized by the imperial court, which restricted its use for the coloring of imperial silks. Later (9th century) a child born to a reigning emperor was said to be porphyrogenitus, "born in the purple".

Production

The dye substance is a mucous secretion from the hypobranchial gland of one of several species of medium-sized predatory sea snails that are found in the eastern Mediterranean Sea, and off the Atlantic coast of Morocco. These are the marine gastropods *Purple Dye Murex (Bolinus brandaris)* the spiny dye-murex, the banded dye-murex *Murex trunculus*, the *Rock-shell (Stramonita haemastoma)*, and less commonly several other species such as *Bolinus cornutus*. The dye is an organic compound of bromine (i.e., an organo-bromine compound), a class of compounds often found in algae and in some other sea life, but much more rarely found in the biology of land animals.

In nature, the snails use the secretion as part of their predatory behavior in order to sedate prey and as an antimicrobial lining on egg masses. The snail also secretes this substance when it is attacked by predators, or physically antagonized by humans (e.g., poked). **Therefore, the dye can be collected either by "milking" the snails** (see above Ketuvot 5b), **which is more labor-intensive but is a renewable resource, or by collecting and destructively crushing the snails** (see above Shabbat 75a). It is estimated that twelve thousand snails of *Purple Dye Murex* yield no more than 1.4 g of pure dye, enough to color only the trim of a single garment.

Royal Blue

The Phoenicians also made a deep, blue-colored dye, sometimes referred to as **Tyrian blue, royal blue or hyacinth purple**, which was made from a closely related species of marine snail *Murex Trunculus*. This second species of dye murex is found today on the Mediterranean and Atlantic coasts of Europe and Africa.

History



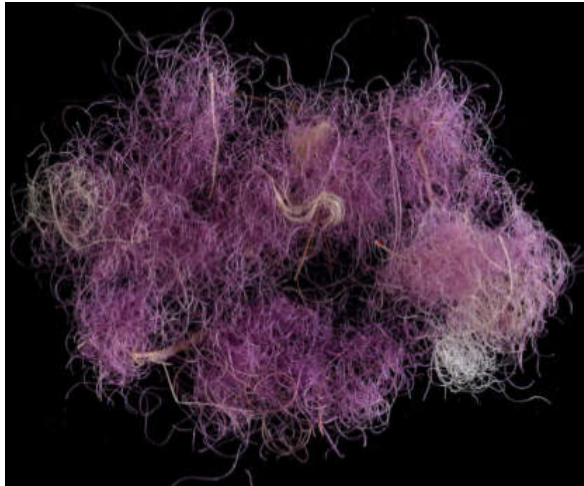
The color-fast (non-fading) dye was an item of luxury trade, prized by Romans, who used it to color ceremonial robes. Used as a dye, the color shifts from blue (peak absorption at 590 nm, which is yellow orange) to reddish-purple (peak absorption at 520 nm, which is green). It is believed that the intensity of the purple hue improved rather than faded as the dyed cloth aged. Vitruvius mentions the production of Tyrian purple from shellfish. In his *History of Animals*, Aristotle described the shellfish from which Tyrian purple was obtained and the process of extracting the tissue that produced the dye.

Pliny the Elder described the production of Tyrian purple in his *Natural History*:

“The most favorable season for taking these [shellfish] is after the rising of the Dog-star, or else before spring; for when they have once discharged their waxy secretion, their juices have no consistency: this, however, is a fact unknown in the dyers' workshops, although it is a point of primary importance. After it is taken, the vein [i.e.,

hypobranchial gland] is extracted, which we have previously spoken of, to which it is requisite to add salt, a sextarius [about 20 fl. oz.] to every hundred pounds of juice. It is sufficient to leave them to steep for a period of three days, and no more, for the fresher they are, the greater virtue there is in the liquor. It is then set to boil in vessels of tin [or lead], and every hundred amphorae ought to be boiled down to five hundred pounds of dye, by the application of a moderate heat; for which purpose the vessel is placed at the end of a long funnel, which communicates with the furnace; while thus boiling, the liquor is skimmed from time to time, and with it the flesh, which necessarily adheres to the veins. About the tenth day, generally, the whole contents of the cauldron are in a liquefied state, upon which a fleece, from which the grease has been cleansed, is plunged into it by way of making trial; but until such time as the color is found to satisfy the wishes of those preparing it, the liquor is kept on the boil. The tint that inclines to red is looked upon as inferior to that which is of a blackish hue. The wool is left to lie in soak for five hours, and then, after carding it, it is thrown in again, until it has fully imbibed the color.”

Archeology



Archeological data from Tyre indicate that the snails were collected in large vats and left to decompose. This produced a hideous stench that was mentioned by ancient authors. Not much is known about the subsequent steps, and the actual ancient method for mass-producing the two murex dyes has not yet been successfully reconstructed; this special "blackish clotted blood" color, which was prized above all others, is believed to be achieved by double-dipping the cloth, once in the indigo dye of *Murex Trunculus* and once in the purple-red dye of *Purple Dye Murex*.

In 2021, archeologists found surviving wool fibers dyed with royal purple in the Timna Valley in Israel.

The find, which was dated to c. 1000 BCE, constituted the first direct evidence of fabric dyed with the pigment from antiquity.

Dye chemistry

The main chemical constituent of the Tyrian dye was discovered by Paul Friedländer in 1909 to be 6,6'-dibromoindigo, derivative of indigo dye that had previously been synthesized in 1903. Unlike indigo, it has never been synthesized commercially. An efficient protocol for laboratory synthesis of dibromo-indigo was developed in 2010.

Variations in colors of "Tyrian purple" from different snails are related to indigo dye (blue) or 6-dibromoindigo (purple) being present in addition to the red 6,6'-dibromoindigo. Additional changes in color can be induced by debromination from light exposure (as is the case for techelet) or by heat processing.

In 1998, by means of a lengthy trial and error process, an English engineer named John Edmonds rediscovered a process for dyeing with Tyrian purple. He researched recipes and observations of dyers from the 15th century to the 18th century and explored the biotechnology process behind woad fermentation.

Woad is a yellow-flowered European plant of the cabbage family. It was formerly grown as a source of blue indigo dye, which was extracted from the leaves after they had been dried, powdered, and fermented.

After collaborating with a chemist, Edmonds hypothesized that an alkaline fermenting vat was necessary. He studied an incomplete ancient recipe for Tyrian purple recorded by Pliny the Elder. By altering the percentage of sea salt in the dye vat and adding potash, he was able to successfully dye wool a deep purple color.

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Recently, the archeological discovery of substantial numbers of Murex shells on Crete suggests that the Minoans may have pioneered the extraction of Imperial purple centuries before the Tyrians. Dating from collocated pottery suggests the dye may have been produced during the Middle Minoan period in the 20th–18th century BCE.

And finally, a really historical Chilazon: a seashell of the Murex snail bearing the name of Rimush, the second king of the Akkadian Empire in Mesopotamia, c. 2270 BCE. Rimush was the son of the legendary Sargon of Akkad. This historical Chilazon was traded from the Mediterranean coast where it was used by Canaanites to make a purple dye. This was a thousand years before the Exodus!



Conclusions

- 1) Based on the Torah description, traditional sources, history and archeology, it will be hard to avoid a conclusion that sky-blue and purple dyes, which were used to dye the wool donated to the construction of the Mishkan, as well as for the commandment of Tzitzit, were likely derived from several species of the Murex snails common to the eastern Mediterranean. The colored wool itself was likely brought from Egypt and then donated to the cause: “Take from yourselves an offering for Hashem; every generous hearted person shall bring it ... gold, silver, and copper; and sky-blue, purple, and crimson-worm wool; and linen and goat hair ...” (Shemot 35:6).
- 2) The prestigious “*techelet*” strings attached to the corners of one's garments were undoubtedly a status symbol in antiquity, giving their owners a sense of belonging to royalty. The disappearance of the “*techelet*” from the Jewish practise starting with 5th century CE, was linked to the sumptuary laws of the Roman and later Byzantine empires, which monopolized the dye production and its distribution (383 CE). This apparently drove the Jewish *techelet* industry underground. Later, with the Arab conquest of Eretz Yisrael in the 7th century, the secret of the *techelet* was essentially lost and the dyeing process forgotten.

Sources

This article was adopted from the following sources:

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2. <https://www.ou.org/judaism-101/glossary/chilazon/>
3. The Living Torah, Commentary on the Torah by Rabbi Aryeh Kaplan
4. https://www.chabad.org/library/bible_cdo/aid/63255/jewish/The-Bible-with-Rashi.htm