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The Dog whelk mythos:

An investigation of the use of Nucella lapillus and other pigments in ancient Ireland

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Introduction

Purple refers in this text to the many hues possible to achieve with dyes from shellfish, lichen and plants. These range from red to blue and to what we now describe as purple. In many of the texts referenced the dyes are described as colours ranging from azure to the colour of congealed blood but also they use purple to refer to shellfish themselves .

Before the advent of modern synthetic colours, the pigments used in the dyeing of textiles, in painting and writing came from natural sources, plants and minerals and occasionally animals. One of the challenges of working with natural pigments is the varying quality of the materials and the fugitive nature of many of the pigments, that is to say the speed at which the colour fades over time. Lasting durable colours were highly sought after. These pigments were hard to produce, requiring specific materials and incredibly skilled master dyers to produce the most rich and saturated colours from them. The most infamous of these colours in antiquity was Tyrian purple, a colour derived from a particular ocean dwelling mollusc, *Bolinus brandaris*, that populated the Mediterranean. It was so hard to produce and the colour purple so rare in nature that it took on a legendary status reserved for emperors and the divine. In the hierarchy of colours it sat upon the highest rung alongside gold and ultramarine. In 2022 Kremer pigments were selling samples of a Tyrian pigment at 2823€ per gram and this value would have been equally reflected in antiquity with prices being often ten times greater than gold, due to the difficult and demanding labour of its production. The particular pigment that produces the purple hues of Tyrian purple - di bromo indigotin are not unique to *Bolinus brandaris* and along the coasts of Ireland and Britain there is another, the Dog whelk that too can produce long lasting and vivid purples.

What I present in the following essay is a speculative analysis of the use of the Dog Whelk in Ireland and a discussion of lack of artefacts showing this, and how this is reflective of the destruction of art and artefacts in Ireland from environmental and societal stressors. I will discuss a number of dyes and pigments known to be used in Ireland with a particular focus on what was used in the early christian period. The Artwork of this time demonstrates the wide variety of different pigment types used and available in Ireland many of which continued to be in use until the modern era and the introduction of coal tar synthetics. Using practical knowledge gained from working with natural materials and the making of plant based pigments and dyes to combine historically known and scientifically proven facts with theories on how the Whelk might have been used, on the use of other dyestuffs and the materials and techniques available to make particular pigments.

Discussing what little physical evidence remains alongside written sources that mention shellfish dyes in Ireland in relation to European sources examining Tyrian purple, I will outline three possible uses of the whelk in Ireland, in illuminated manuscripts, in fabric dyeing and in the painting of stone crosses and frescos using lime plaster and I will present the challenges to evidence confirming these uses in each case.

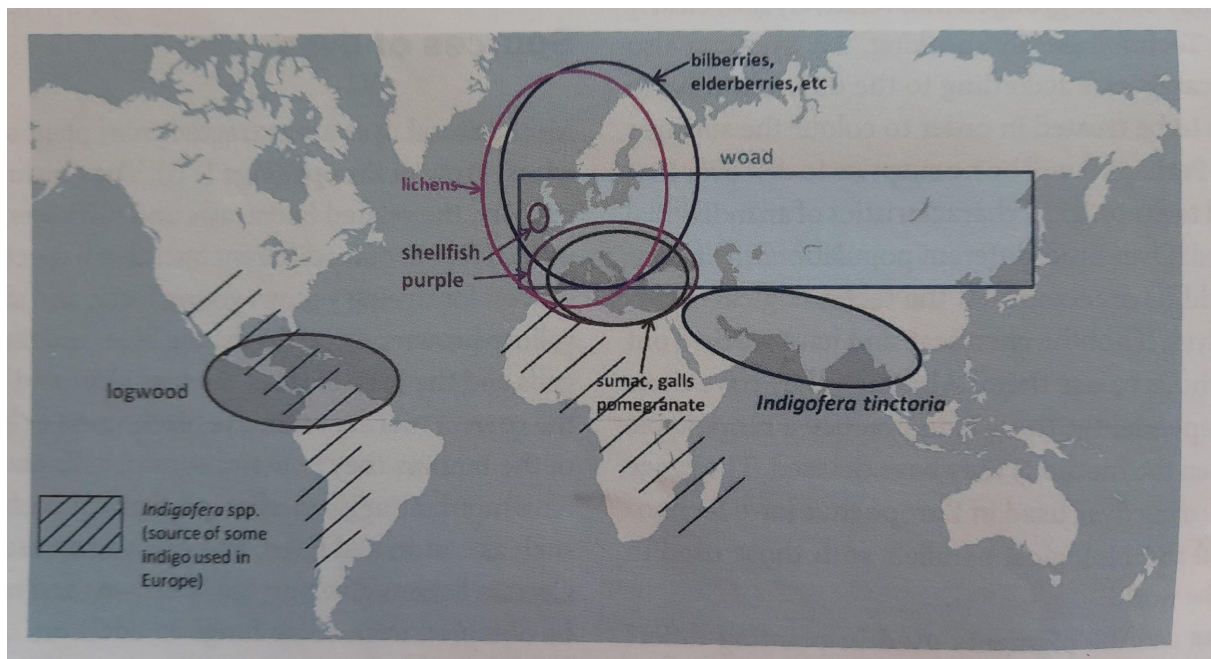


Figure 1. Map of the world showing the sources of blue, purple and black natural dyes that were used in a European context.

The Dog Whelk Mythos

The Atlantic Dog Whelk or *Nucella Lapillus* is a strange and fascinating Mollusc found on the Irish coast, it is a carnivorous gastropod that preys on other molluscs by means of a proboscis which it uses to bore holes in its victims shells thus gaining access to the flesh within. (Murray,2000, p.329.) It lives in the intertidal zone and can be harvested by hand in low waters or caught in baited pots. It is edible and in Ireland on the west coast evidence of its harvest is found in archaeological sites ranging from the Mesolithic 4500 Bc to the Early christian period, (Gibbons M.) The remains of the whelk shells piled in middens on these sites are likely not due to its use of its food source but because on another curious use for the snail, its use as a source of a true fast purple . “A particular feature of the dog whelk is the secretion in its hypobranchial gland of a cream coloured mucus which upon oxidation changes gradually in colour to a fast purple” (Murray, 2000, p.374)

Like blue, purple is a rare colour to appear naturally in its true form and there are very few examples of long lasting naturally occurring purples that don't come from a combination of red and blue pigments. The scarcity of purple meant it became a colour of exclusivity used only by the extraordinarily wealthy and powerful but also depictions of the divine. “Purple has always been associated with royalty .Of all the primary and secondary colours it has the most enduring singular meaning, its luxurious richness flows strongly through its history” (Coles, 2018, p.5.)

The history of purple is entwined with sea dwelling snails the term ‘purple’ comes from the Ancient Greek ‘*Porphyra*’ borrowed from the Phoenicians who in the city of Tyre produce a rich purple from the mollusc *Bolinus Brandaris*, this colour is now known as Tyrian purple and was used to dye the garments for nobility, the uber wealthy and popes. It gained a reputation as a colour exclusively for the emperor in Roman times and then became known as royal purple. Its significance also led to it being used in cloth on depictions of Jesus and in a religious context a variation of the dye is also suspected to be tekhelet, a blue-violet that was God's chosen colour for the Israelites.(ngo, 2022.) “For most of human history the rarity of pure purple gave rise to its symbolic nature” (Coles, 2018, p.6)

Along the Mediterranean and in Tyre knowledge of dying with maritime molluscs was kept within a small circle of dyers, who would be relegated to the furthest outskirts of cities due to the repulsive smells produced in the creation of the extraordinary Tyrian purple. Often the recipes were only passed down by word of mouth and only vague descriptions of the ancient methods that were made by observers exist in written forms, so there have been periods of time where the recipes have been lost, further adding to the mystery and rareness of purple . During the 13 century and the fall of Tyre the production slowed and by the late 1400s had disappeared from continental Europe.

"Whatever the situation in 1261,it is clear the Ottoman conquest in 1453 and the turkish settlement of the former byzantine territories resulted in the complete cessation of all purple dying as well as the loss of byzantine information of dying with the murex the secrets of obtaining fast lasting colours from the marine mollusc was lost in the fall of the byzantine empire” (Hezog, 1987 p.165 cited in Murray, 2000, p.)

In 1856 Henry Perkin accidentally invented the first synthetic dye which he initially called Tyrian Purple it was later renamed mauveine, however, to associate a cheaply produced artificial colour with the most expensive dye in all of history was a brilliant strategy for displacing the marine mollusc from its long association with the colour purple. With the advent of synthetic colour the snail becomes dissociated with the colour it had been tied to for most of human history, and the use of purple becomes more widespread. The replacing of a colour with a cheaper to produce synthetic version is a similar story to what we see later in 1889 with the first synthetic creation of an already known natural dye, Alizarin, a chemical component found in the root of Rubia Tinctorum plant that gives it its brilliant red colour, was synthesised from coal tar and thus began the decline of the natural dye industry (Chenciner, 2010.). We see examples of purple's rise in availability in the fashions of the time and in the arts, mauveine and another pigment made from chemical innovations with manganese became popular amongst the French impressionists frequently used in the shadows of paintings in place of black. Paul Friedlander a German scientist would using a complex method in 1909 extract 1.4g of pigment from approximately 12000 *Bolinus brandaris* he then identified the structure of the pigment to be a combination of bromine and indigo (Wolk, et al, 2010). A recipe more reminiscent to what would have been used historically and what was written about by Pliny wouldn't be rediscovered until later in the 1990s by John Edmonds who mixing a knowledge of dyeing and archeology worked out the appropriate materials and technology that would have been available at the time and using pieces of written descriptions of the process, combined with recipes for preserving shellfish in salt, he unravelled the mystery behind the legendary Tyrian purple (Chenciner), Mohamed Ghassen Nouria in recent years has made a notable revival of the art of making tyrian purple in Tunisia. There are over 300 varieties of molluscs that live across the globe that are dye producing, each one producing a different colour depending on species and the methods used in production of the dyestuff (Hendrick, 2013.).

The variety of colours ranging from reds and blues to purple (fig.2) make identification of sea snail dyes and pigment difficult. Identification of historical examples containing dyes coming from the *Nucella Lapillus* are basically non-existent even though we have piles of remains that were harvested in mass throughout Ireland, evidence of use for dyeing with the Dog whelk is circumstantial. Attempts to identify sites used to make dog whelk purple look to compare artefacts and sites from outside Europe with what we have remaining in Ireland.

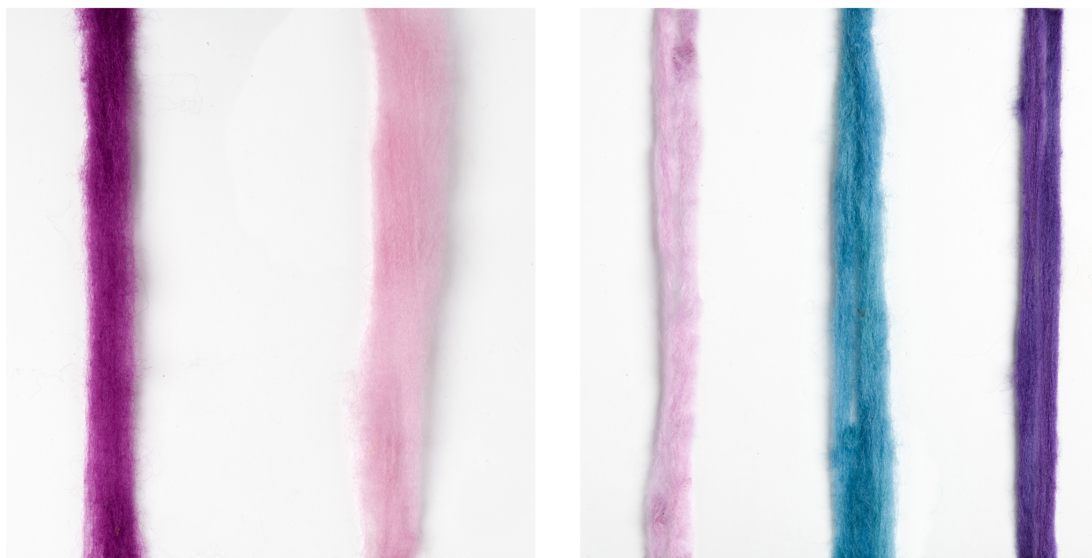


Figure 2. 1–2: *S. haemastoma*; 3. *B. brandaris*; 4–5: *H. trunculus*

Ireland has a long and rich legacy of arts that goes back thousands of years, due to our damp and humid climate and turbulent history much of which has been lost to time. However, what examples remain such as *The Book of Kells* exemplify the skills and knowledge possessed by the peoples of time particularly in their ability to produce colour. A variety of purple hues is seen across Irish manuscripts, many of these manuscripts were written at a time that coincides with the dates of the Whelk midden sites however while there has been much speculation that *Nucella Lapillus* was used in the production of manuscripts recent evidence has proven that the purple pigmentation in the *Book of Kells* comes from other sources and this is likely the case with other texts.

Looking to the other dye stuffs and colourants in use at the time we can build a picture of the colours and techniques in use by Irish artists up to the early Christian period when evidence of the middens seems to stop, from this we can find a possible niche in the arts which the dog whelk may have occupied. One of the primary uses for Tyrian purple in Europe was in the dyeing of textiles and in Ireland the use of bright colours was not limited to illuminated manuscripts but was commonly seen in the dyed garments. Wool and linen were the most common textiles at the time, having strong coloured cloth was a sign of wealth and status, the most common colours being the primaries; yellow, blue and red.

There are many sources for yellow but the most common was Weld (*Reseda Luteola*). Weld is often credited as one of the first dyes suspected to be used as far back as 1000 BC and is seen in ancient Egyptian tapestries to European tapestries until well after the 16th century where the opening of more trade routes between the East and the discovery of America led to an introduction of other vibrant and more exotic plant dyes to replace other less bold dyestuffs. Weld was also a favourite of the Vikings and grows natively in Ireland, its Irish name being *Buí Mor* referring directly to the dye it produces, used alongside another native plant to Ireland the blue indigo producing *Isatis Tinctoria* commonly called Woad it could dye cloth green, a practice that was continued right up until the 19th century but started much much earlier. The mixings of these primary dyes to produce secondary colours showed

a skill and intuition presence in ancient dyers and this knowledge would be critical in making other secondary colours including purple. . Reds and warm russets were the most popular colours to dye textiles and in Ireland and across Europe was often seen as the colour of common folk or in Military garments. Red in Ireland likely came from *Rubia Pergrenia* a native wild Madder variety that is closely related to *Rubia Tinctorum*, *Rubia Tinctorum* was the common Madder used for dyeing red cloth across the Eurasian continent and in 1562 Brubant a Dutch horticulturist would come to Ireland to collect *Rubia Pergreina* specimens to be cross bred with *Rubia Tinctorum* to produce an higher quality product that would grow more vigorously in the colder wetter climates of Europe as opposed to the Middle Eastern and Asian regions where the source plant of *Rubia Tinctoria* originated (Chenciner, 2000.).

Madder was a very significant plant and we see this in Ireland in accounts of the techniques of dyeing in Ireland with rimming the fabric being commonplace as a form of preparation of wool for dying that added warmth to the fibres and likely acted as a mordant to hold secondary colours too.

“There were two mainstages in the process of dyeing the first was imparting a ground or foundation of reddish brown from the twigs of ruam or alder this was called rimming The seconds was to to boil the cloth in the vat of the final colour” (Joyce, 1906, p.3)

The plant called rud or roid was also used for bright reds.

This Ruam referred to the Madder root and Roid referred to Raideaogh or Bog Myrtle. The Irish love of use of red is seen in its popularity as a colour dyed cloth and as one of the more frequented use colours in manuscripts.

This use of many of these dye plants is seen too in illuminated christian manuscripts. These books span a period of several hundred years and include several very important pieces such as the Book of Kells and the Book of Durrow The Book of Kells currently housed in Trinity College Dublin is one of the most significant pieces from this time written in the 9th century, on vellum parchment it is an illustrated document containing the four gospels written over 340 folios a tenth of which are full page ornate illustrations. The decorated pages are illustrated with a variety of colours, many of which are highly valuable; some of these are yellow orpiment, an arsenic containing rock, red lead pigment and blue indigo. The identification of the use of indigo coming from Woad in these manuscripts is significant because it means that the materials used to illuminate the manuscripts were able to be found and produced in Ireland. While we know that trade networks existed at the time and there is evidence of Irish monks travelling abroad the self contained production of material gives valuable insights into the industries that would have surrounded manuscript productions.

Francoise Henry writes in ‘a wooden hut on inishkea’ of how the findings of an apparent set up for whelk dying on the island would have been significant meaning that the pigments used in manuscript making would have all had Irish sources save the blue which at the time was suspected to be lapis lazulis but we now know to be Woad indigo. She mentions the presence of lead mines in Ireland and the unique tone of the yellow orpiment suggesting an Irish source, while the use of whelk in the Book of Kells has been disproven her claims of an almost entirely local industry still stand. From this and the beautiful metalworking of the time we know they were knowledgeable in the mining and refinement of metals . They had experience working with lead to know that through the heating of a white oxidised lead

powder you could produce red and yellow lead pigments, there is proof that there were mining chalk and producing organic pigments,

They had a very sophisticated knowledge of making colourants from a variety of natural materials. The extravagance of the Book of Kells shows that cost and labour is not an issue to the Irish monks. The ability for knowledge to spread to Ireland from across Europe is well documented and the already established harvesting of the Whelk predating the Christian period in Ireland, means there is seemingly little reason they wouldn't use the durable and desirable purple colour from the Whelk in their work unless of course either the colour was not desirable to the colour palette of the Irish at the time or they had another source of it and had another use for the whelk.

The Book of Kells contains several examples of pink and purple pigmentation and for many years this was suspected to be Tyrian purple or a purple made from *Nucella lapillus*. However, recent Raman spectroscopy has identified this pigment as orcein,

“Purple is found throughout all four volumes of the manuscript. Where it appears as a single layer, Raman spectra were difficult to obtain due to fluorescence effects. While the Raman spectra for these purple pigments do show some similarities with Tyrian purple, recent investigation of the purple areas on the Book of Kells by MOLAB (University of Perugia), using luminescence lifetime measurements, has indicated that the pigment is orcein $C_{28}H_{24}N_2O_7$, a dye produced from the lichen *Rocella tinctoria*.” (Bioletti, et al, 2009.)



Figure 3. (Left) and 3a (above) show the use of orcein purple in the Book of Kells, note also on this page the several different hues of blue and red pigments, and the blue tones seen alongside the purple in the colouration around the text.

Another manuscript significant for its use of colour is *The Book of Mulling*, a small pocket gospel from the 8th or 9th century that was likely for personal use; it is equally as beautiful and carefully illuminated as many of the other books from the time, just on a more miniature scale. Not only is it an important example for the variety of pigments used in the illustration of the book but also in the array of techniques that were applied.

“Up to nine different colours are apparent, and there is a greater use of translucent glossy pigments than in the other three manuscripts. The glossy quality of these pigments indicates a high medium content, with finely divided pigment particles and/or organic dyes used as colourants. This gives both a brightness to the colour and a slight effect of depth, as light is reflected from the shiny surface and the parchment underneath the pigment. The opaque pigments which by contrast are almost granular, are relatively thickly applied on top of the parchment and create a slightly embossed effect as raking light catches the surface.” (Trinity College Dublin, 2016.)

According to Susie Bioletti this variety of techniques used has presented difficulty in the identification of some of the pigments. However several of the pigments have been identified such as a red earth pigment and a chalk white as well as yellow orpiment and a blue indigo similar to what is seen in the *Book of Kells*

The portrait of St John is a full page illustration contained at the end of the book along with two other of the four evangelists. The figure legs standing apart, holds a large book and rests between two borders of zoomorphic interlace and is dressed in a purple robe. A similar pink/purple is seen throughout the book in border illustrations as well as a deeper purple in the robes of Matthew on another of the full page illustrations of the evangelists. Due to the same analytic equipment not being available for research on the book as was available with the *Book of Kells* the identity of purple in the book however remains unconfirmed, it is suspected to be organic and the same orcein purple that appears throughout the *Book of Kells*.

“In one of the pages of an ancient manuscript now in Turin is a passage written by Irish hand at the beginning of the ninth century which proves that the Irish were acquainted with the art of dyeing purple by the means of lichen.” (Joyce, 1906, p.3.)

Ireland's proximity to Scotland, similar geographies and biodiversity meant trade between the two is likely where the knowledge of lichen dying originated, with dyes known as criottall being widespread in the Scottish highlands and moors. There is evidence of criottal dyes emerging in Scotland around 400 CE and soon after they would reach Ireland coinciding with the arrival of Christianity to the island.

These lichen dyes while more fugitive than what would be made from the Dogwhelk where much easier to produce and the spread of criottal dyes at the time would have made them something the monks could have become more familiar with and be introduced to more readily compared to the Whelk. They were also and in many cases easier to use in the illumination of manuscripts.



Figure 4. Portrait of St John in the Book of Mulling

Looking to evidence of shellfish purple in manuscripts across Europe where there is a much larger volume of manuscripts still surviving although most of which are nowhere near as ornate as those found in Ireland, we see that the identification of the pigment continues to be difficult due to the delicate nature of the materials and the emission spectra of purple. There are however a few intact example of Tyrian purple in manuscripts. A dye made from *Murex brandaris* is used in the lettering of the “*Evangelicum lucae cum argumento et capitulus*” one illuminated manuscript identified by Cheryl Porter in 2002 and was the first scientifically identified use of Tyrian purple in a manuscript.. This particular manuscript was written between 700-800 CE a similar time to when the Book of Kells and the Book of Mulling where being written in Ireland.



Cheryl Porter argues the reason we do not see more frequent use of tyrian purple is because of its supposedly difficult nature to work with. With it being a hard pigment that does not spread evenly making it not as attractive as other reds might appear in the delicate illustrations of these books. An alternative form that purple pigmentation is seen in manuscripts is in the dyeing of whole pages of vellum which then are embellished with silver and gold lettering and details. Examples of this exist in later European texts and this method may be more suited to the properties of the material.

Figure 5. The page of the Evengelicum lucae containing the first identified use of Tyrian purple pigment in a manuscript.

The Whelk is much more suitable for dyeing textiles however in Ireland little textile artefacts remains none of which show evidence of whelk dying this leads us to the natural decomposition of material being one of the leading factors in why many of the artefacts containing evidence of the Whelk purple no longer exist or are in states of heavy distress that make identification impossible.

With these being natural materials they are much more vulnerable to rot and mould if not properly stored, and even then can undergo the process of decomposition. Sometimes even the materials used aided in this matter such as the tannic acid in the iron gall ink that was used to write many of the texts naturally eating through the vellum parchment over the centuries. Remaining evidence of Tyrian purple dyed cloth comes from countries like Israel with a more arid climate, with the exception of artefacts buried in the bogs, the geology and climate of Ireland makes it very difficult for the preservation of soft materials over time.

Many textiles were personal items and likely buried with the owner so there was little thought of future preservation of these goods. The illuminated religious texts were more precious and would have been passed down through religious orders over the centuries.

Ireland's turbulent past whether it be the Vikings or the societal changes introduced by the Normans and the colonisation of Ireland by English Protestants meant that many of these monasteries and religious institutions that produced and protected these artefacts were disbanded by the late 16th century, putting the artefacts into vulnerable positions.

The colonisation of Ireland also negatively impacted the traditional crafts of the Irish people with Henry VIII introducing acts in 1536 and 1539 that restricted the types of garments the Irish could wear and the colours their clothes could be (Shionnach, 2011.)

This led to many crafts only being kept alive in remote areas and the west of Ireland. Many of the skills and knowledge of dying cloth would have been passed down generationally and by word of mouth as we saw with the master dyers of Tyre. Ultimately this would mean much of that embedded cultural knowledge would over time fade to obscurity or disappear completely. Looking at dying in cottage craft we know that the specific colours would have been individual recipes passed down between the women of Ireland as dyeing then was women's work and it was even considered to be bad luck as to have men present when you were dying cloth, their continued to be some dye practices continuing using roots and bark. Browns, blacks and white were common with red being used for petticoats of women in the west of Ireland, curiously one passage in the archives of the national folklore collection reads "Magent - in various shades comes into vogue about the year 1880, when women wore magent colour woollen petticoats. It was much worn and appreciated, I am informed that magent colour was procured by adding Coprus to the boiling scarlet or rose madder dye" (Kathleen Hurley, 1940). This aligns with the rise in popularity of purple magenta with the introduction of mauve in Europe. Uniquely the fashion was to dye it yourself the mystery of what the coprus is unknown to me but it at the time seemingly converts madder red to magenta. Brid Mahon mentions how lichen dyes were the most popular in Ireland and can be used for a variety of colours. Work by Evelyn Lyndsy now housed at the National folklore collection UCD shows a documentation of 164 dye samples using a variety of plants and mordants including lichen purples and a series of other hues derived from other lichens. Her work shows natural dyes that were in practice in 1980 on the island and shows an expansive array of colours. Interestingly her crottle dyes are browns and yellows which differs from their normally associated reds and purples, she instead gets purple dye from *Rocella canariensis* and *Rocella tuberculata*.



Figure 6a. (Left) Purple lichen dyes .
 Figure 6b. (Bellow) ledger from the collection.
 Figure 6c. (Next page) full page display of lichen dyes.

93	Ribwort plantain	<i>Plantago lanceolata</i>	Flower heads	a	alum	6/85
				b	chrome + iron	6/85
94	<i>Rocella canariensis</i>	<i>Rocella canariensis</i>	Lichen	a	ammonia (2)	1/85, '85
(12)				b	ammonia + soda	1/85
95	<i>Rocella tuberculata</i>	<i>Rocella tuberculata</i>	Lichen	a	ammonia	3/85, '85
				b	ammonia + alum + soda	3/85
				c	ammonia + chrome	3/85
96	Rowan	<i>Sorbus aucuparia</i>	Berries	a	oxalic acid	10/84
97	Rush	<i>Juncus effusus</i>	Flowers	a	alum	6/85
				b	chrome	6/85
98	St. John's wort	<i>Hypericum inodorum</i>	Berries	a	oxalic acid	10/84
			Stalks	b	alum	8/84
						8/84



The persistence of lichen dyeing means there was also the possibility of the continuation of whelk dyeing. Physical evidence of whelk dyeing becomes scarce after the early christian period where there has not been whelk middens found dating after the fact. However several

written accounts give evidence to such practices in Ireland. William Cole writes of women in Ireland who produce a purple dye with shellfish in 1685 and Joyce further supports this; “The ancient Irish obtained a beautiful purple from small shellfish like cockles.. This method of obtaining purple dye continued to be practised in the eastern Irish counties as well as the opposite coast of Wales to the beginning of the last century.”

Suggesting the art continued until the 1800s although notably on the east coast which is in contrast to the locations of the pre mediaeval middens of the west

In the west of Ireland there are still a number of middens with a vast quantity of whelk shells that have been deliberately gathered and discarded together from a period spanning over a 1000 years; many of these middens were uncovered in the 1990s and have seen constant erosion since.

“In Doonloughan and False Bays most of this dune system was grass covered until about 30-40 years ago. Overstocking since then has led to the destruction of much of the sod cover which in return has made the whole system susceptible to wind erosion . This has exposed a large number of archaeological sites which in turn have been destroyed by further wind erosion, livestock and other factors. Most of the middens' archaeological surfaces are now exposed thus making them especially susceptible to damage. More than 50 % of the known middens have been destroyed and survive now only as talus.” (McCormick, et al, 1996, p.1.)

The scale of some of these middens even in a ruined state suggests the whelk had some significant place in the livelihood of individuals. There are other sites scattered throughout the Irish isle all of which are seeing significant erosion. Michael Gibbons identified several concentrations around Ballyconneely, and west Galway and in north Donegal.

There are also the sites on Inishkea described by Francoise Henry that are accompanied by a small settlement in which the whelks were processed; this site is dated to the 7th century.

The site seems to align with what was needed to extract shellfish dye as described by Pliny in the creation of a purple dye from the murex.;

“After it is taken, the vein is extracted, which we have previously spoken of, to which it is requisite to add salt, a sextarius about 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, and every hundred amphora 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 liquified 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 colour is found to satisfy the wishes of those preparing it, the liquor is still 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 colour.”(Pliny, Book IX, Chapter.62.)

The smaller scale of the Inishkea sites suggests only being used for dying of small cloth items and in no massive quantity, In Pliny's description of the making of the Purpurissm the type of

vessel used must be leaden or tin as iron saddens the colour while an iron pot was found on the Inishkea site there were also bronze artefacts found meaning tin was available.

A possible use for the shells remaining in the whelk middens and other shell middens was to be ground into calcium carbonate for the production of lime. The production of lime would have led to the reduction in size of the middens and that coupled with elemental exposure makes it hard to accurately gauge the size the middens would have been. Historically lime having numerous uses such as in the construction of buildings, as a fertiliser, in the production of glass and importantly in the painting of frescos.

Lime comes from the burning of calcium carbonate in a process known as calcining, there is two major sources of calcium carbonate used in the manufacturing of lime the first is ground mineral limestone or chalk and the second is in the calcium carbonate found in shells and bones .

Evidence use of lime in goes as far back as the early christian era but likely predates it; “Lime mortar technology was introduced to Ireland during the early mediaeval period (AD 500-1000), and was used for a wide variety of purposes in the mediaeval and post-medieval periods, including general building, internal plastering and external rendering, and for special purposes such as chimney flues and wicker-centred vaulting. A wide range of mortars are found in Irish mediaeval and post-medieval buildings, ranging from lime mortars used in tenth century churches and round towers to Roman cements and the often highly complex materials found in more recent times. These mortars were used for bedding and pointing masonry, for rendering external walls, and plastering the interior of these buildings, as well as more specialised applications”(Bolton, 2010, p.2)

The whelks shells could be used in the making of the lime used for these applications.

One potential usage of the whelk dye that goes in tandem to this theory is in pigmentation of the lime for painting of stone and on plaster. Evidence of this has been seen with *Bolinus brandaris* in the mediterranean where there have been excavations of sites that have murals painted with the purple. The hard nature of the pigment would be applicable to stone, this is particularly likely if the dye was solidified through a lakeing process with calcium carbonate. A lake pigment is a type of pigment made from an organic dye that is precipitated against an inorganic solid. The most common process for this is with the use of alum and soda ash salts however this method grew to prominence in the late 15th and 16th century and earlier methods would have used fine clays, chalks or calcium carbonate.

A lake pigment made in this way would be suitable in the use of plaster or tempera frescos The Aegean frescos contain a number of uses of a shellfish purple amongst the various wall paintings.

Examinations of three different bronze age Aegean sites have all produced individual evidence of the use of Tyrian purple including notably several small lumps of pure pigment that have survived . The hard nature of the pigment ment it stayed as a consistent solid piece and is in line with descriptions of the pigment being difficult to work with on soft material but would make it more appropriate for use on painting stone and frescos, the purple pieces were identified as a lake pigment made from the murex and significantly the source of the calcium carbonate in the pigment likely comes from shells;

“Examining a sample of the purple pigment from Trianda (TRI-PR13) under microscope, it was possible to observe the aragonite crystals with the characteristic needle shaped form and

clear appearance ... magnesium-rich calcite was also identified, which together with aragonite strengthened the assumption that the inorganic base of the pigment was possibly obtained from crushed and ground shells. The “recycling” of shells, of any species, either food residues or debris of purple production (Muricidae family), was a well-known practice not only for obtaining the base of the purple pigment but also for their use as coarse aggregate in the floor mortars or as raw material for the production of lime.” (Sotiropoulou, et al, 2021 p.10.)

In Ireland there are only a small number of frescos and wall paintings that remain, two of renown are Clare Island abbey and the the paintings in Cormac’s chapel, Tipperary although they both date later then the period in which the remaining middens were dated, analysis of the lime used in these frescoes for the source of the calcium carbonate may provide valuable knowledge into the painting of Irish wall murals and the use of shellfish matter in the mediaeval christian period. As stated previously there is evidence of lime plaster in use much earlier and their is a high likelihood of their being earlier paintings that have been lost,

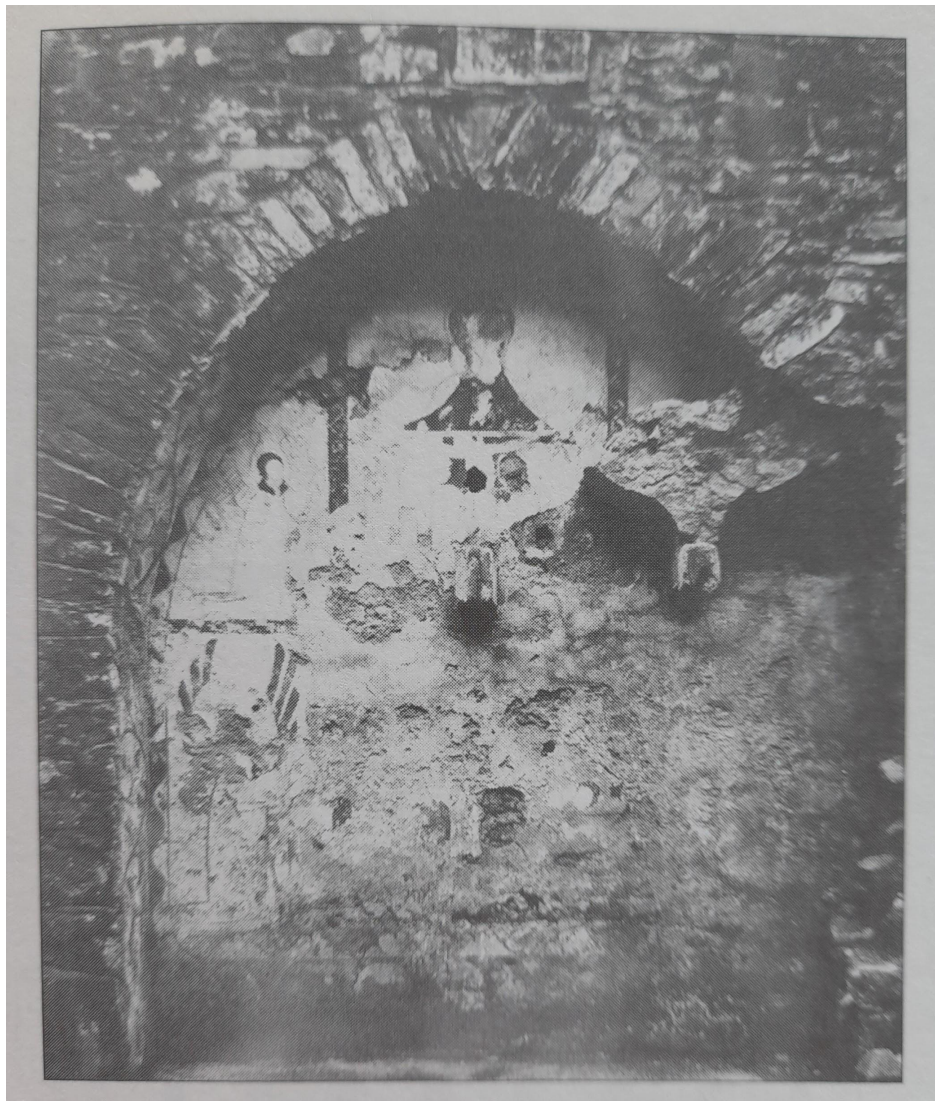


Figure 7.

Lime needs to be maintained regularly and like the situation with the preservation of textiles this becomes difficult and exposed lime eventually erodes. St. Audeon's church has

documented photographic evidence of a heavily damaged fresco (fig.7) in the nineteenth century however what remained then no longer exists showing how in a relatively short span of time these delicate pieces of art can be lost particularly when not adequately cared for (Moss et al, 2006, p.57.).

One of the major accepted ideas of painting on stone in Ireland is in the polychroming on Irish high crosses which now exposed to the elements bare no traces of any colouring matters, but given the penchant for colour at the time likely would have been brightly coloured. High crosses vary in ornamentation and exist across a broad span of time, the designs of the Irish crosses reflect the opus hibernia seen in Irish manuscripts several crosses from the 9th century share similar styles or may have had the same stone carver who travelled between the monasteries;

“ The Clonmacnoise figures are modelled in deep relief, with undulating forms and plenty of attractive detail. Round, cheerful faces add to the sense of life and spontaneity. The style is sufficiently close to that on the crosses at Durrow and Monasterboice to show that the workshop travelled extensively. The market cross at Kells, its surfaces decaying from long exposure to traffic pollution was almost certainly a product of the same ‘school’.” (Stalley, 1996, p.37.).

In these carvings we see overlap with designs in manuscripts from the same period, for example the motifs in figures 8.and 9. A set of men with their limbs intertwined is seen on a cross in Monasterboice and in the Book of Kells, show how there was a dialogue between the artisans producing these works.



Figure 8. (Left) and Figure 9.(Right)

With this we can surmise that in the painting of the crosses the makers of pigmentation for the illumination of manuscripts would have been consulted and the pigments may have shared similar origins in both types of art. High crosses bear significant erosion and with increasing threat of acidic rain and further abrasive damage from the elements it is without great innovations in archaeology impossible to identify pigmentation on these crosses. Perhaps however the solution for the preservation of the crosses is through a protective coat of lime based polychroming paint. Appropriate to what may have originally been used, using natural materials and with great consideration taken into the colours used. To do so negatively impacts the potential to discover evidence of the original paint on the sculptures and drastically changes the cultural aesthetics associated with the stone cross, but would aid in preserving some of the most important pieces of Irish heritage for generations to come.

One of the points previously unmentioned that ties a lot of what I've previously outlined together is that often when dying with Tyrian purple the cloth was often under dyed with another colour, typically indigo or madder dye, due to the shellfish colour being difficult to get smooth solid colours without multiple rounds of dyeing, with the cost of the pigment to do so was incredibly inefficient. Returning to the Book of Mulling with its use of highly transparent colours and layering of paints, it may be possible that the purple was first painted with indigo, madder or orcein and then glazed over with a whelk purple, the hard whelk pigment would also explain the granular surface appearance in the purple in the book. It also provides further difficulty in the identification of the individual purple pigments in the Book of Mulling and may also lead to the reexamination of the Book of Kells as we see in the spots identified as orcein variations in colour and orcein and the whelk dye may have been used in tandem in this case.

It is a known problem in Raman Spectroscopy that it readily identifies any organic materials present in samples (Kirby, et al. 2014 p.112), to successfully identify the possible whelk purple layer and orcein layer beneath it would have to be separated. I suspect that investigations into the base materials used in the making of pigments such as finding calcium carbonate that contains high levels of argonite that shows the use of the shells, like what is seen in the Aegean frescos or innovations in spectroscopy coupled with microscopic examinations of the crystalline structures of the pigments that are precise enough to differentiate between two different pigments of similar hue and form will confirm the presence of whelk purple in the Book of Mulling and will definitively prove whether or not the Atlantic Dog Whelk had historic use in the arts in Ireland.

In conclusion whether or not the whelk was actually used is perhaps not as interesting as the mystery around its usage and this already strange and unusual source of dye further takes on an almost mythological status. Going forward to concretely prove its use would be revolutionary in terms of Irish art and in greater European context. To do so preserved textiles with evidence of whelk dyeing would have to be found, or new scientific innovations that can examine the most microscopic quantities of pigments in manuscripts or frescos would be necessary.

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