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An Exploration of the Variables Involved in Creating Mocha Diffusions

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Signed:

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Abstract

This technical report examines the history of creating mocha difussions and explores the possible variations involved. This came to fruition because of the scarcity of published documentation exploring this elusive decorating technique. The absence of information exists not only in its history, but in the creating itself.

There will be experimentation within the two most important variables in a mocha diffusion outcome, the acid and the stain. The accumulation of all of the historical and current information found will be applied into testing, and the results observed and recorded. This investigation will attempt to fill in the void of knowledge that exists in this field of decoration.

Contents

Introduction-

mocha diffusion is a form of slip decoration with fairly unknown origins. It is created by mixing a mild acid with stain and dripping it onto wet slip. When done correctly the stain/acid mix (mocha 'tea') fans out in a dendritic pattern. The earliest known use of this technique is a mug with M Clark 1799 written on the base. Pictured in Godden's British pottery, it resides in the Christchurch museum in Ipswich (Godden, 1990). The name mocha is believed to have originated from one of two towns in the middle east. Some believe it was the town of Mocha (al Mukha) in Yemen (Lewis, 1985)(Storr-Briz, 1997)(Bailey, 2009)(Rickard, 2006), and others believe it derived from the city Mecca in Saudi Arabia (Hopper, 2004). But all conclude that it was named after somewhere in this area due to the visual similarities between the pattern this decoration creates, and the moss agate stone that is mined and sold there (Clark, 1991)(Hopper, 2004)(Lewis, 1985)(Storr-Briz, 1997). There is also many references to mocha under different names such as 'mocoa' (Jewitt, 1878), 'moco' (Hutchinson, 2010)(McClinton, 1881), 'mocho' (Pomfret, 1988) and even a reference to a 'moshca' in Towner's The Leeds Pottery (Towner, 1965). This confusion also exists in what wares should be classed as mocha-ware. Some people believe it to be exclusively for dendritically decorated ware (Atlee-Barber, 1903), while others would label any dipped ware or slip banded wares to be mocha (Rickard, 2006). Rickard can 'document the misuse of the term for more than a hundred years' and believes that attempting to change this now would be confusing (Rickard, 2006). It would make sense that only dendritically decorated wares should fall under this category because of the origin of the name being so tied to the pattern. The questioning around where it began can most likely be attributed to the fact that its purpose was to be made easily en masse. It had very little value, so no one bothered to remark where or when it started. In a letter from Fleming to Teulon-Porter he described that 'it was so simple and so cheap that no one thought anything of it' (Teulon-Porter, 1953). When it was first being manufactured, a mug could be bought for less than five pence in todays currency (Lewis, 1985) and by 1870 'the pint ale mugs could be purchased for 10d a dozen' (Teulon-Porter, 1953). This is why all the antique mocha-ware on the market today is utilitarian wares, it was exclusively being made for a functional use.

It is believed by many that the first case of Mocha diffusion was done by accident. Both Hopper and Colbeck believe it to have started when potters were chewing tobacco while working and accidentally spat some on a wet pot (Hopper,2004)(Colbeck,1983). Tobacco being one of the mild acids people now use in mocha ‘tea’, it would have formed the dendritic pattern on the pot. However, Rickard believes mocha to have had a deliberate beginning. Stating that because of the moss agate stone was fashionable at the time, Lakin & Poole devised this decorating technique as way to replicated it (Rickard, 2006). A few believe it to have been created by William Adams of the Greengates Factory, Tunstall, England (Zamek, 2011)(Teulon-Porter, 1953) or at Colbridge in 1745-1805 (Lewis, 1969), but there is no conclusive proof of this. In a letter from Anne Robert's to Lady Howard in 1923 there is mention of a Jasper Collins or 'old joe the mocha' being the creator of the technique. Even though the mocha technique she describes is questionable, she did get these pieces from the Rockingham Works (Hughes & Pugh, 1990), which is where the notebook with the earliest written mention of mocha comes from (Brameld & Co, 1808).

The reason I chose to research and write about mocha-ware for my technical report was because of the shortage of knowledge. It seems to have never fully been explored, even during the height of its popularity. Teulon-Porter believes that mocha was not known to the public 'as anything else but tree, moss, seaweed, or fern pottery' (Teulon-Porter, 1953), and in 1923, when he enquired after it to the Victoria and Albert Museum in London they said 'they had never heard of it, and suggested that it was not English' (Teulon-Porter, 1953). Rickard describes the move from collecting cast iron mechanical banks to mocha-ware as a 'contrast' due to its unpopularity, and collectors of English Pottery had 'never considered it worthy of attention' (Rickard, 2006). He managed to find only three documents about mocha-ware. I may have found more documentation, but they all seem to reference from the same few sources. The reason for this lack of interest could very well have been due to the nature of its popularity. Mocha was a passing fad. It existed from 1799 to the last commercial production by T.G Green ceasing in 1931(Rickard, 2006). It replaced the pewter in public houses when it went out of fashion, and in turn was replaced by glass in the 1870's when people wanted to see what they were drinking (Teulon-Porter, 1953). Mocha-ware began during the early rise of industrial manufacturing in Britain. Mocha was a decoration used on creamware, which was created and mass produced by Josiah Wedgewood. This type of pottery was made for the rapidly growing middle class that wanted some status but couldn't afford the higher priced porcelain (Kirkpatrick, 2006). Mocha was a perfect decoration for this type of pottery. The dendritic diffusion can be made in a matter of seconds, but resembles and carefully hand painted tree or moss pattern. This element of individuality is one of the reasons I was drawn to experiment with mocha diffusion.

British Potteries before the 1700's were small and family run. Boys would learn to become master potters and take over from their fathers (Kirkpatrick, 2006). However Wedgewood, following Matthew Boulton's method, found that 'teaching unskilled labourers one task was much easier' and time efficient than employing skilled masters to perform all the tasks (Kirkpatrick, 2006). This was the beginnings of the move from individually crafted handmade to the uniform of mass produced work. The skilled masters were being left out of their field and being replaced by anonymous unskilled workers. Teulon- Porter describes mocha-ware as 'lacking the personal sincerity of the handmade object but not fully achieving the anonymous precision of the machine' (Telon-Porter, 1953). This highlights the recent absorption from one into the other and how mocha diffusion was straddling this newly drawn line. Mocha-ware in Britain from this era was rarely marked compared to its French and American counterparts (Rickard, 2006). In Teulon-Porter's collection of 160 specimens, there are only two that are marked. This lack of marking shows the difference between the personal pride in hand making and the apathy involved in mass producing. Teulon- Porter believes the only reason the early Ipswich mug had a mark was due to it being a personal gift to a family member (Teulon-Porter, 1953), which would instils the personal back into it. This idea of mass producing's effect on making is most apparent when there was a change of shipping regulation in the mid 18th century. It was changed from being 'transported by cubic measurement' to weight (Teulon-porter, 1953). This meant that to save money manufacturers started to produce lighter wares for overseas, which is why mocha-ware found in the US is often lighter than its British counterparts (Atlee Barber, 1903).

Mocha diffusions use today is almost the opposite of its origins. Being tested by people learning pottery or made by independent artist, of which commercially in Britain there are only three (Waller, 2013). There was an attempt to start commercially reproducing mocha-ware by the Rye Potteries, Sussex, but 'it was not satisfactory' (Teulon-Porter, 1953). The American potter Kevin Kowalski is probably the most prolific user of mocha diffusion today and goes into some detail on his website about his methods (Kowalski), but most of the experimentation in mocha today is personal and unpublished.

Introduction To My Testing-

I was aware going into this testing that my assessment of the results couldn't just be about the success or failure, but will also factor in a personal preference of colour or pattern. Most of the accessible writing done about mocha is found in decorating technique books. Giving various idea about what acids should be used for the mocha 'tea'. Hopper says that any mild acid would work (Hopper, 2004), but most give tobacco juice as the main suggestion and list vinegar, urine, turpentine, lemon juice, and wine as possibilities (Connell, 2002)(Hopper, 2004)(Barker and Crompton, 2007)(Bailey, 2009). However both Colbeck and Bailey only suggest vinegar as an the acid in their tutorials, even though Bailey believes that 'nearly all of the potters who have developed this technique use a tobacco-based mixture' (Bailey, 2009)(Colbeck, 1983). This inconsistency of information means that I should experiment with as many different acids as I can and see which outcome works best for me.

Both Colbeck and Hopper believe that finely ground stains will work the best, due to the acid not being able to 'adequately hold the colour in suspension' when heavy materials are used (Hopper, 2004)(Colbeck, 1983). The suggested stains to not use are black iron oxide, black cobalt oxide, and black copper oxide. I have both black copper oxide and black iron oxide and will test them to see if they really do not work.

Before starting my testing, I wanted to make sure that I knew I could control all of the variables that went into these experiments. Because, as Hopper agrees, the timing is so important in creating mocha diffusions (Hopper, 2004), I made sure that every batch I was testing was done all at once. Testing in one go means a decrease in the difference in variables between each test. If I had waited days between, the slip might be at a different consistency or the clay body tile a bit dryer. Each slight difference would skew the results and make the testing invalid.

If I want to test how one aspect affects the outcome every other aspect has to stay the same. This means that it was imperative that I measure out all of the ingredients and make them the same every time. For this I mixed a millilitre (a teaspoon) of whichever acid (Malt vinegar as the control for stain testing) with and a gram (quarter teaspoon) of the stain (Cobalt Oxide as the control for acid testing). To keep the slip the same I used Robin Hoppers recipe every time (Hopper, 2004).

Slip For Mocha Diffusion

cone 04-12
Feldspar………………………. 5%
Ball Clay…………………….. 75
Kaolin (china clay)…………. 10
Silica (quartz)………………. 10
(Hopper, 2004)

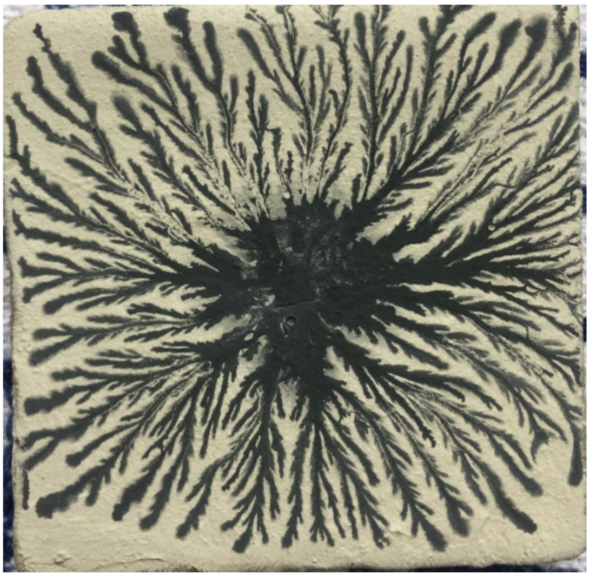
The importance of the slip in mocha diffusion is based on its alkaline nature. The creation of the dendritic pattern is believed to be a result of the contact point between the 'tea' and the slip becoming unstable. This is due to the surface tension of the 'tea' being less than that of the slip, coupled with the acid/base chemical reaction (Morris, 2018). Most technique books don’t give a specific recipe, using just regular or slightly coloured slip as a base (Connel, 2002)(Lewis, 1969). However, both Hopper and Bailey give a recipe specific for mocha diffusion. Bailey suggests that the slip be 'made from Hyplas 71 in the proportion of 1 kilo of ball clay to 1.5 litres of water' (Bailey, 2009), but Hopper gives a more specific recipe. Writing that 'The most important factor is a high percentage of ball clay or other plastic clay' and that porcelain slips will not work because of their low percentage of plastic clay, and high percentage of fluxes and fillers (Hopper, 2004). Storr- Britz's suggests engobe, which goes against Hopper suggestion as engobes have a higher content of flux and silica than regular slip (Storr- Britz, 1977). Colbeck suggest for slip to add 'a liberal squirt of washing up liquid' to 'provide an alkaline mixture'(Colbeck, 1983). This is an interesting suggestion, however most household washing up liquid is at pH 7-8 so I'm not certain how much difference this would make. This lead me to think about the water content of the slip. As it makes up a large part of a slip it seemed import to investigate the pH. I found that hard water was higher on the pH scale which makes it more alkaline that soft water which is lower (McDevitt, 2013). The water I use is hard water which should give me better results than if I were using soft (Water, 2017).

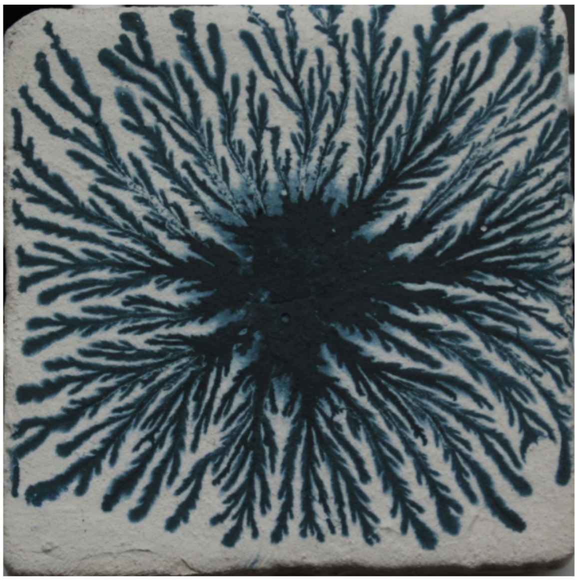
Changing the Stain

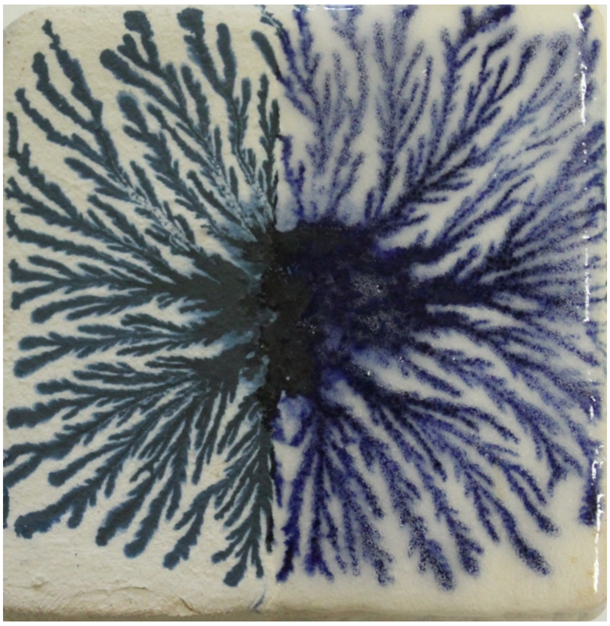
I started my mocha diffusion exploration with testing lots of different staining possibilities. This was to find out which stains cause what changes in the dendritic pattern. Each stain has varying sized particles and different resilience at certain temperatures. Due to what tutors, technicians, and the literature had told me I expected the stains with smaller particles to work better, this is because of the stain being able to carry it more easily (Colbeck, 1983) (Hopper, 2004). Hopper indicates that coating mocha with a glaze can lead the colour to 'bleed out or become absorbed into the glaze', especially in temperatures higher than cone 4 (Hopper, 2004). So I am coating half of every test tiles with glaze and leaving the other half empty to see the difference. However, I am testing all stains with and without glaze at both earthenware and stoneware temperatures. However, this means I cannot just use one tile for every temperature. A glaze made for earthenware would not survive at a stoneware temperature, and a tile fired to stoneware first would be pointless to then fire to earthenware. The colour would have already disappeared to the amount it would at its highest firing. This meant I had to make two separate tiles for testing the same stain, which could have slightly interfered with my ability to see exclusively temperature differences. I may have just been observing the difference in the initially created pattern. My way to combat this was to try and keep every variable the same, and to make sure that the two tiles were visually the same before any firing was done. For each temperature, I put the same earthenware transparent glaze and the same stoneware transparent glaze on each tile to test how the stain is absorbed by the glaze. I am going to report how the colour is carried by the mocha tea, the spacing of the tendrils, colour brightness at the beginning and between each firing, and how glazing affects the colour definition.

<u>Cobalt Oxide</u>- density [specific gravity] is 6.07 (Hansen, 2003)

Cobalt Oxide comes recommended by a few books (Colbeck, 1983)(Storr-Britz, 1977)(Teulon-Porter, 1953), despite it having a larger grain of 6.07 and being an oxide, which Hopper warned against (Hopper, 2004). Its earliest reference in relation to mocha is a journal from the Staffordshire Potteries 1796-1828 (Pomfret, 1988) where it is referred to as 'Zaffre' which 'is the oxyd or calx of cobalt' (Willich, 1802).

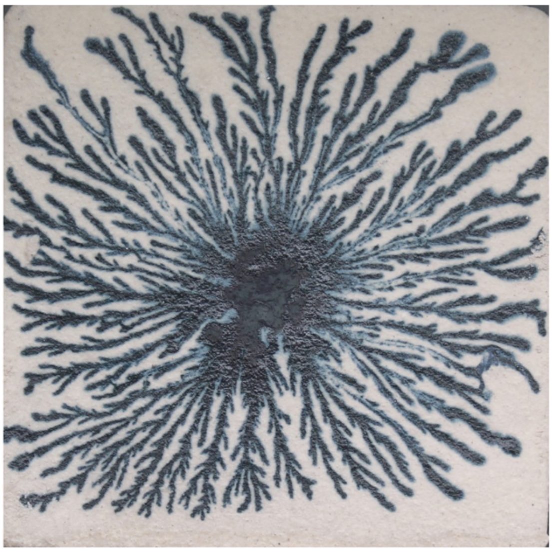






From left to right. Figure 1, Figure 2 & Figure 3

Cobalt Oxide works well as a colourant. It creates long and wide tendrils with colour throughout and defined edges. It has a small concentrated initial point of contact that fans into tendrils quickly. From unfired to bisque there is very little colour and definition loss, in fact first firing brings out some of the colouring. From bisque to 1100°c the blue colour becomes slightly lighter, but still no definition or colour loss. The glaze on top causes some definition loss but brings out the blue to a brighter colour.



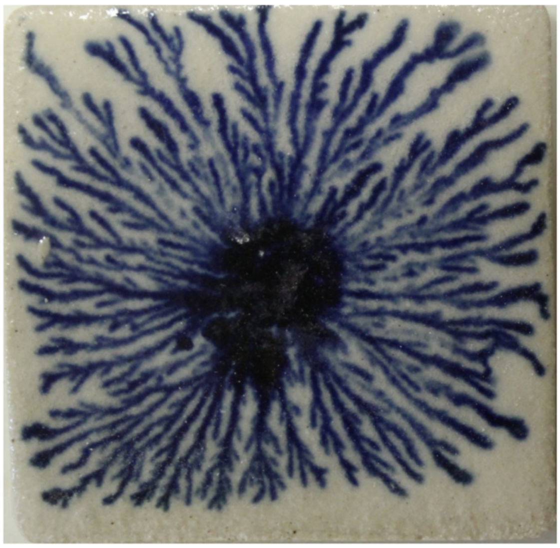


Figure 4 & Figure 5

At stoneware temperature there is also very little colour or definition loss. Colour stays the same between earthenware and stoneware temperature. However when the pattern is glaze there is a blurring and loss of definition. The colour is still just as brightened by the glaze as it is at earthenware.

Cobalt oxide is a good colourant for mocha diffusion. The grain is not particularly fine but I believe because of the potency of the stain it carries well with the acid. This also means that it stays throughout all temperatures.

Red Synthetic Iron- density [specific gravity] is 4.8 (User, 2016)

Iron is recommended for mocha by Fleming in a letter to Teulon- Porter. He recommends 'a mixture of iron for the salmon tints' or 'a strong concoction of iron ore for the brown'(Teulon-Porter, 1953). It is also mentioned in a recipe Fleming wrote for Mocha in 1923 as Iron scales but this appears to actually be for a slip not mocha tea (Fleming, 1923). Red Synthetic Iron has one of the lower densities at 4.8 and it should mix with the acid easily.

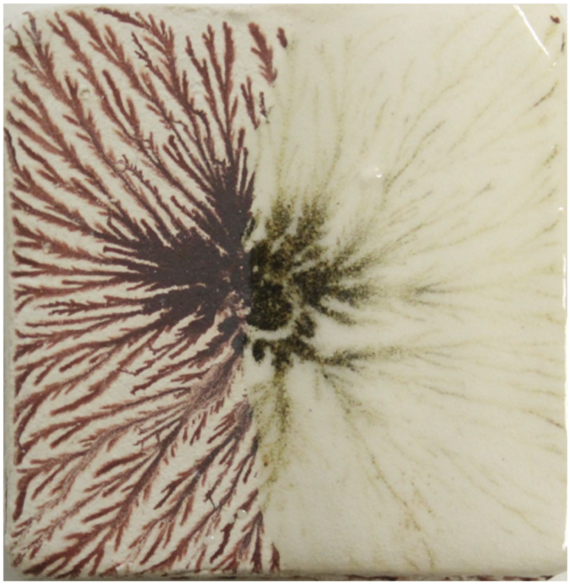



Figure 6 & Figure 7

Red Synthetic Iron works well as a colourant. The tendrils are long and wide, and have colour throughout with good definition. It has a small initial point of contact that fans into tendrils quickly. Between the 900°c bisque and the 1100°c firing there is little definition loss, and the colour goes from a dark brown to a deep red brown. However, on the half of the tile that is glazed the colour is almost completely gone. The glaze has absorbed most of the colour leaving faint brown lines where the tendrils were. Glazing this stain will lead to an unsatisfactory outcome.

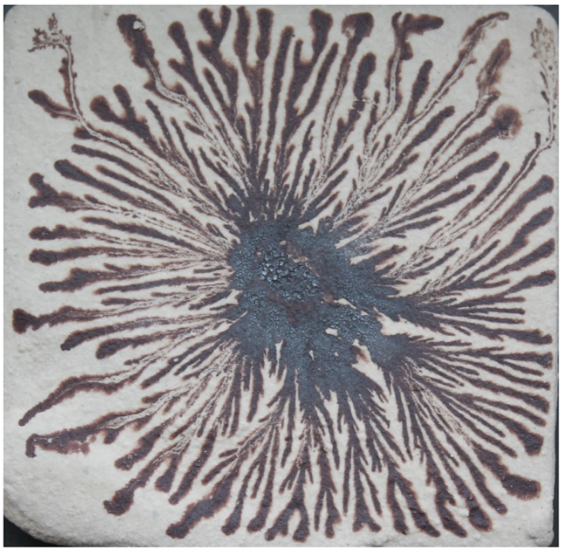
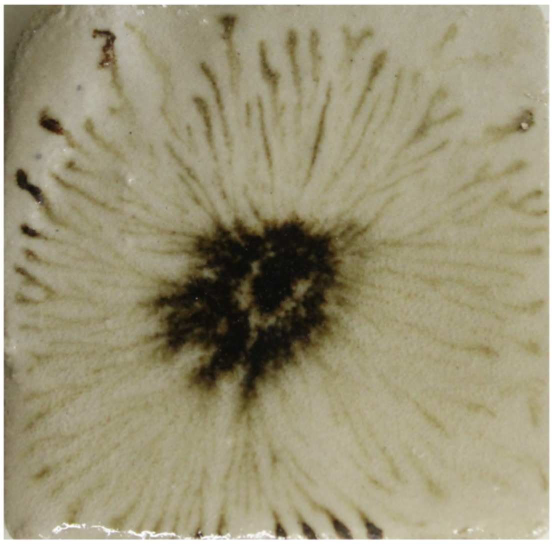



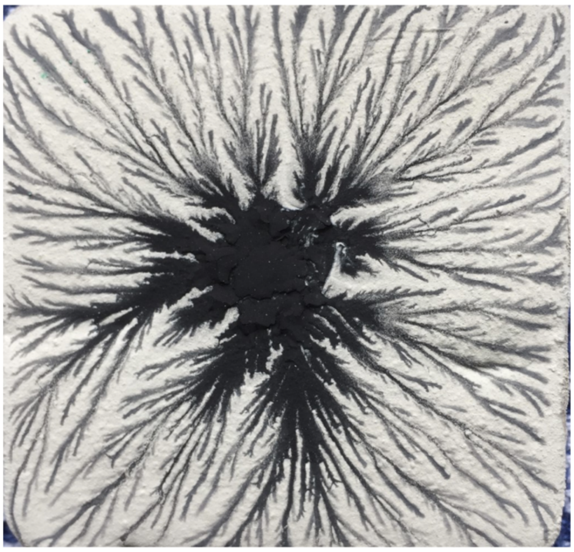
Figure 8 & Figure 9

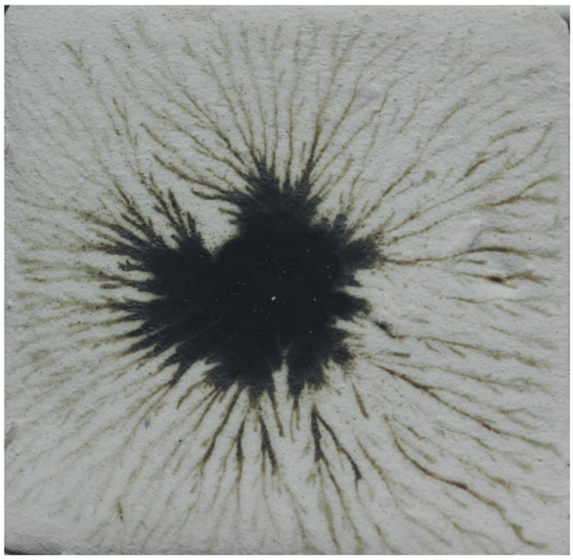
The colour from earthenware to stoneware keeps well and doesn't change colour. When glazed the same problem arises as the earthenware temperature. There is significant colour loss due to glaze absorption. What colour is left is brown.

Red synthetic Iron has a very fine grain and so carries well in the acid. It is a good colourant and stays in mocha that isn't going to be glazed. But for glazed work I would not suggest using this stain due to the loss of colour being to high.

<u>Black Copper Oxide</u>- density [specific gravity] is 6.45 (Hansen, 2003)

Black Copper Oxide is referenced as a stain not to use. Hopper says that 'the acid can't adequately hold the colour in suspension' due to its heaviness (Hopper, 2004) and its high 6.45 density would corroborate this.





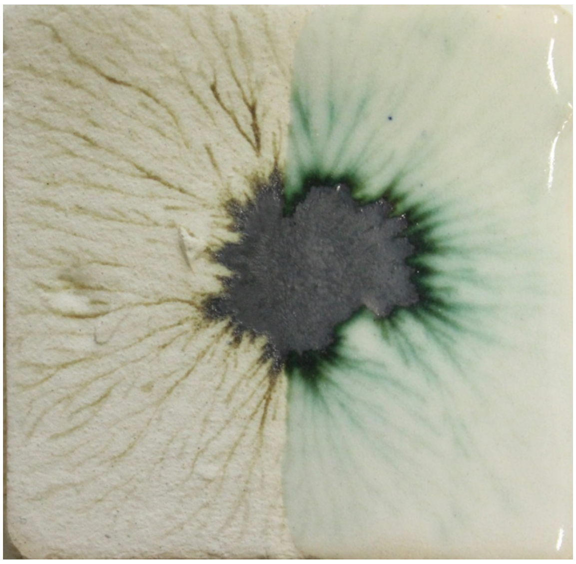


Figure 10, Figure 11 & Figure 12

Black Copper looks like it initially works well in the mocha ‘tea’, but after the first firing you can see the fading already. The tendrils are long and widely spread, but very faint in colour. it goes from main body to thin tendrils very suddenly. The Black Copper itself is very vibrant but it doesn’t travel with the acid down the tendrils well. The colour goes from black to green between the 900°c bisque and the 1100° earthenware. The glaze brings out the green more, but again absorbs quite a bit of the already faint colour. The initial point of contact is small and very concentrated with stain, which has made this area of glaze very matte over the top. This is because the Black Copper has not travelled with the acid down the tendrils, it has all stayed in the initial point of contact.

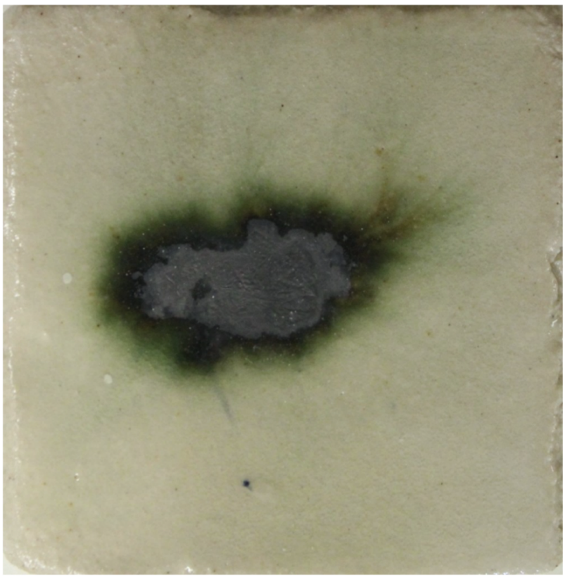


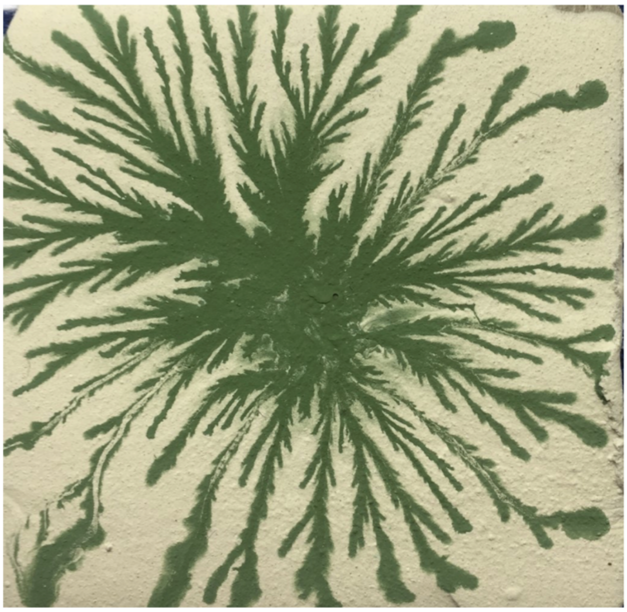
Figure 13 & Figure 14

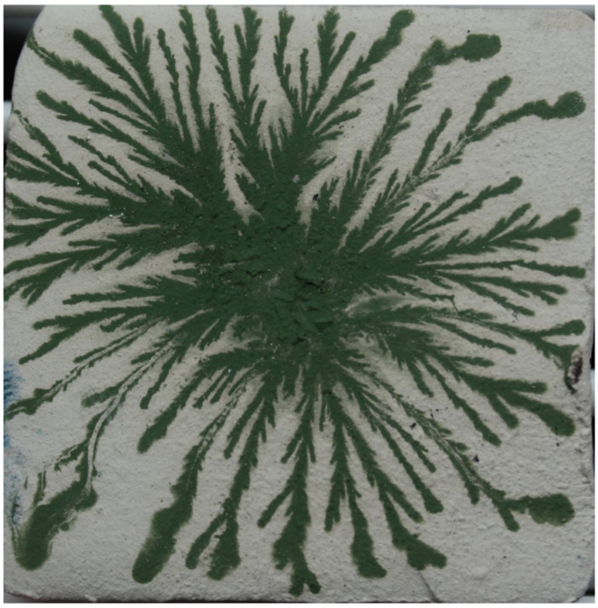
From earthenware to stoneware the colour gets a lot weaker, to the point where the colour is almost gone. Unglazed there as almost no green in the pattern and the only visible aspect is the initial point of contact. When glazed at stoneware the colour is much greener but has no colour in the tendrils. The glaze clearly blurs the definition around the edges, so the stain must be absorbed by glaze.

Black Copper is not a good colourant. The lack of staying colour definition in the tendrils makes it not look like mocha-ware pattern when properly fired. It would only ever really work when fired lower than 1100°c and even then, it's still very faint. This is not the problem I anticipated having read Hoppers advice. The colour actually spread quite well before firing, but the stain was too weak in the tendrils to hold through the temperatures.

Chrome Oxide- density [specific gravity] is 5.21 (Hansen, 2003)

There is no mention of Chrome Oxide in the research I have done. This could be due to its relative newness during the height of Mocha's popularity. In an email correspondence with Kevin Kowalski about mocha diffusion he mentions that he uses 'Chrome green Oxide the most' (Kowalski, kowalskipottery@gmail.com, 2018), which would back up this stain as only being used by more recent potters. Its density is a 5.21 which measures fairly high in comparison to my other stains. This means it should not work well in the initial diffusion.





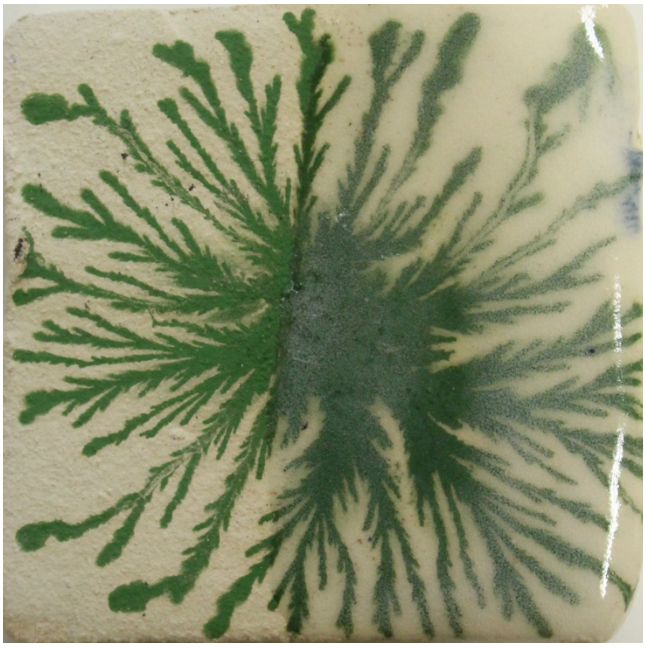


Figure 15, Figure 16 & Figure 17

Chrome Oxide works very well in the mocha tea. Tendrils are long and wide and there is colour throughout. There is no difference in colour between the initial point of contact and the tendrils. Initial start point is small and dense with the tendrils fanning out quickly and evenly. The colour from unfired to 1100°c earthenware stays exactly the same. With the glaze on top there is no colour loss. The glaze does not absorb any of the colour so there is no blurring of the edges. This is the only stain that is almost completely unaffected by the glaze.

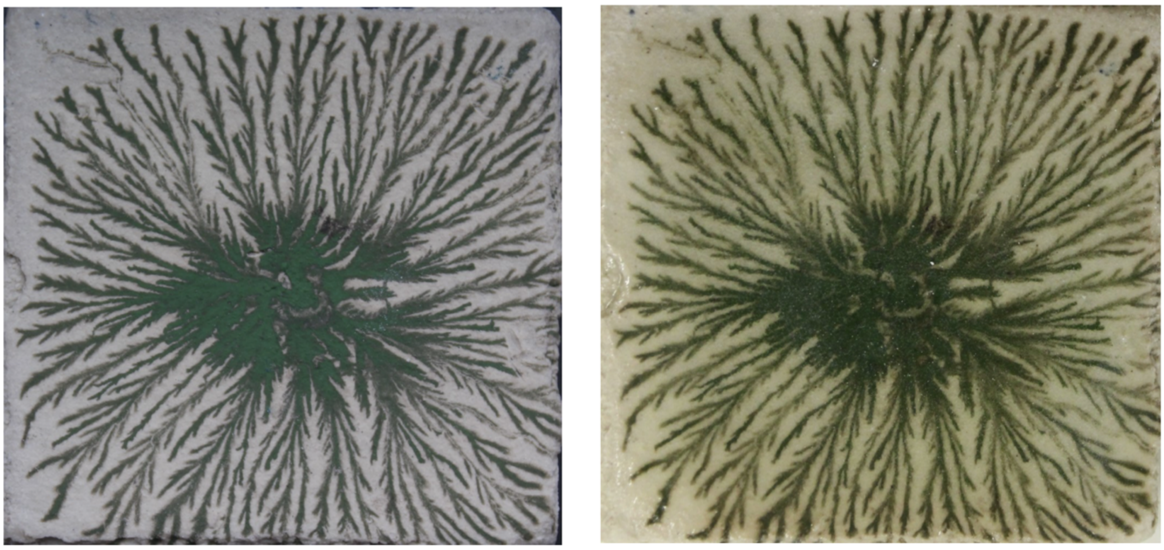


Figure 18 & Figure 19

At 1280°c stoneware temperature the colour stays just as vibrant as pre-firing. The colour is still unaffected by the glaze at this temperature but gets slightly darker underneath it.

Chrome Oxide works very well as a colourant for mocha 'tea'. The colour stays through all of the temperatures and is not lost when glazed. This could be due to its refractory nature. It is insoluble in alkaline and acids (Hansen, 2003) and this may be the reason it is so durable under glaze. For these reasons, it is one of the best mocha diffusion stains I have found.

<u>Manganese Oxide</u>- density [specific gravity] is 4.9-5.0 (Hansen, 2003)

Manganese is the stain mentioned the most in all of my recipe research. (Colbeck, 1983),(Connel, 2002)(Godden, 1990),(Storr- Britz, 1977), and Lewis in both 1969 and 1985 all mention or exclusively suggest the use of this material. It also exists in very early recipes such as John and Richard Riley's 'Mocho, or Tree Ware' recipe, written somewhere between 1796-1828 (Pomfret, 1988). In the earliest written mention of mocha in 1808 has 1 pt. Manganese written in as part of a recipe named 'Black for Mocha' in a notebook from the Rockingham Works Yorkshire (Brameld & Co, 1808). The continuous use of this stain means it must have its advantages, and with a density of 4.9 it should carry well with the tea.

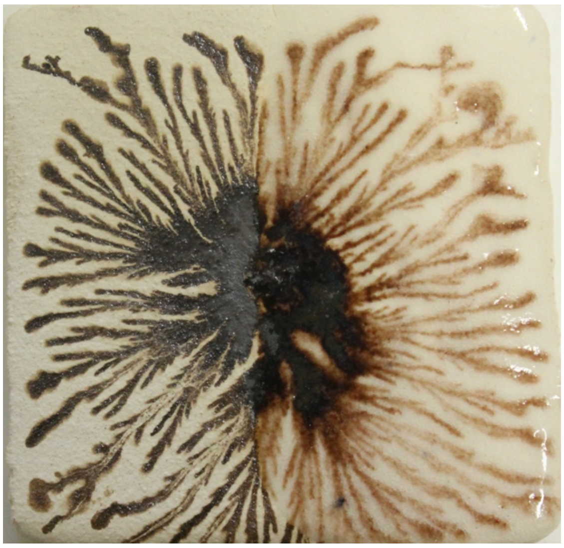
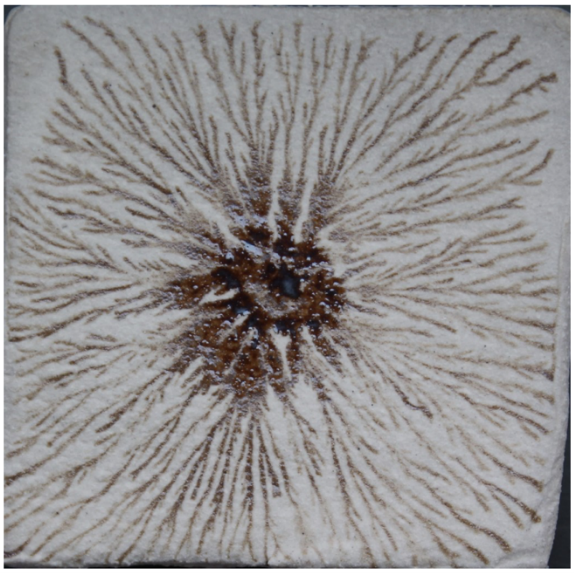


Figure 20, Figure 21 & Figure 22

Manganese Oxide works well in mocha tea. The colour spreads well and is consistent throughout the body and tendrils, as this stain has a fairly fine grain. The initial point of contact is small and tendrils fanning out quickly and evenly. Before firing the colour is a very deep brown but gets slightly lighter at each temperature stage. The stain gets a slight metallic shine after the first firing which stays until earthenware temperature. The glaze absorbs a little of the colour at this temperature and blurs some of the definition. It also turns the colour a slightly lighter browner, which gets even lighter further along the tendrils.



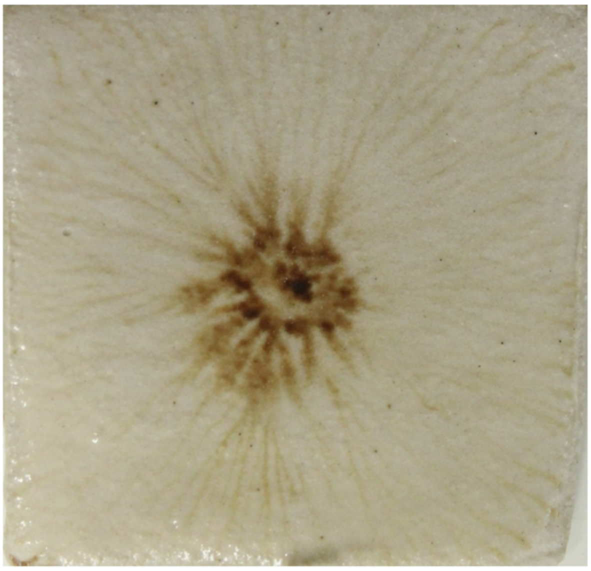


Figure 23 & Figure 24

At stoneware temperature there is colour loss in the tendrils. The main body has the same metallic brown as it has at the unglazed earthenware stage, but is slightly shinier. When glazed the colour is almost completely absorbed. Even on the main body the colour vibrancy decreases significantly. The tendrils become very faint lines.

Manganese Oxide works well initially as colourant for mocha diffusion, but I wouldn't suggest using it above earthenware temperature with glaze. The colour stays mostly consistent through firing temperatures but is absorbed too much by the glaze at higher temperatures.

<u>Cobalt Carbonate</u>- density [specific gravity] is 4.1 (Hansen, 2003)

Cobalt Carbonate has a fairly low density of 4.1. This means it should carry well and work better than its counterpart Cobalt Oxide, which has a higher density. There are few distinctions made between Cobalt Carbonate and Cobalt Oxide for mocha in the research I have done. Most that do mention it just say Cobalt (Bailey, 2009)(Teulon-Porter, 1953)(Storr-Britz, 1977), or mention Cobalt whilst writing about oxides (Colbeck, 1983)(Hopper, 2004).



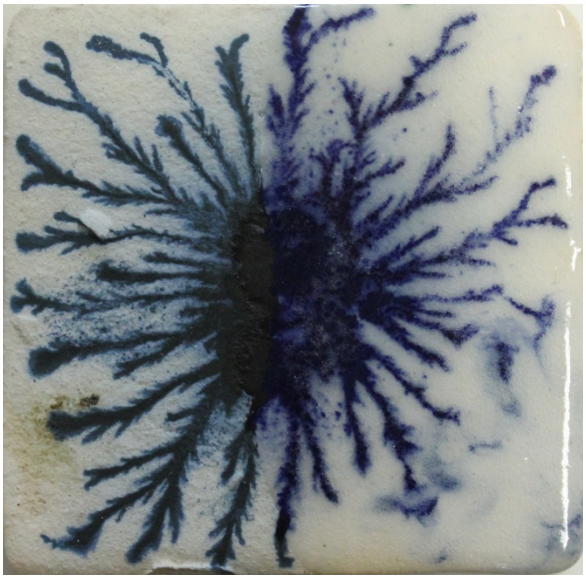


Figure 25, Figure 26, & Figure 27

Cobalt Carbonate works well in mocha tea. The colour spreads evenly and is consistent throughout the body and tendrils. Tendrils are long and wide, and the initial point of contact is average and dense. The tendrils branch out small and quite late. The colour pre-firing is a bright pink, but when fired turns a dark blue. This change in colour means that you cannot see how successful the diffusion was until fired. There is also a light blue aura around the body that shows up after firing. The glaze does absorb some of the stain and the colour gets slightly blurred, but despite its vibrancy, there is very little colour loss.

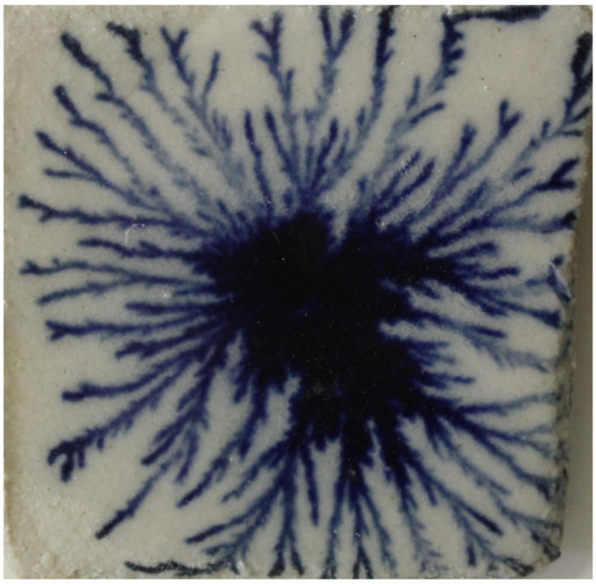
 

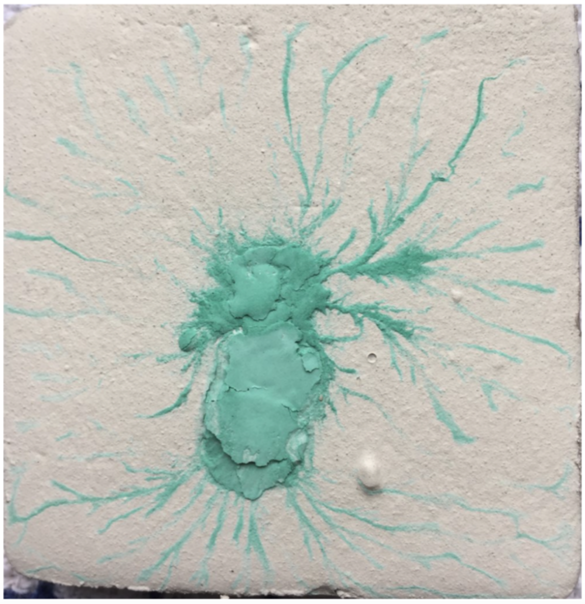
Figure 28 & Figure 29

At stoneware temperature there is a metallic/shiny texture in the main body that doesn't come out at earthenware. There is minimal colour loss throughout the pattern. However, when glazed there is colour loss in the tendrils, and more blurring at this higher temperature. The glaze brings out a similar vibrancy as it does is at earthenware.

Cobalt Carbonate works well as a colourant for mocha diffusion. It is consistent throughout the firings and isn't too absorbed or blurred by glazing. However, there is the issue of not seeing the diffusion properly because of its pre-firing light pink colour. With Cobalt Oxide you get the same after firing result but you can see more clearly pre-firing. You might use Cobalt Carbonate if you want a slightly cheaper alternative to Cobalt Oxide (Carbonate, 2017) (Oxide, 2017).

<u>Copper Carbonate</u>- density [specific gravity] is 3.7 (Hansen, 2003)

There are only two mentions of Copper in the research I have done. One in a list of metal oxides for mocha as an element symbol (Storr-Britz, 1977), and the other is as Black Copper Oxide in Hopper's list of stains not to use. However, neither of these are the Copper Carbonate that I used and with a density of 3.7 it should carry well.



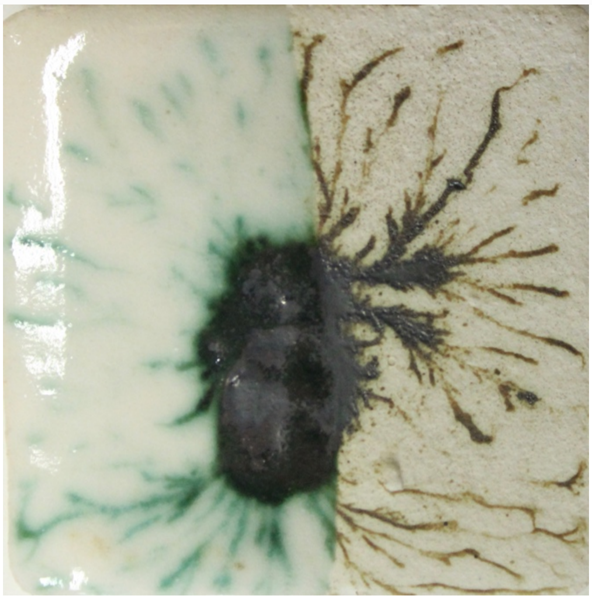


Figure 30, Figure 31, & Figure 32

Copper Carbonate does not work well in the mocha tea. Unfired it is a very pale green and you can see almost no tendrils. The main body is large and tendrils start suddenly and thinly. When first fire you can see slightly better how far the stain has gotten. But there is still breaks in the colour and faint patches in the pattern. From 900°c to 1100°c there is more colour loss in the tendrils, but the main body gets the metallic/shiny texture at this temperature. The glaze severely blurs and absorbs the colour and there is almost no colour in the outer tendrils.

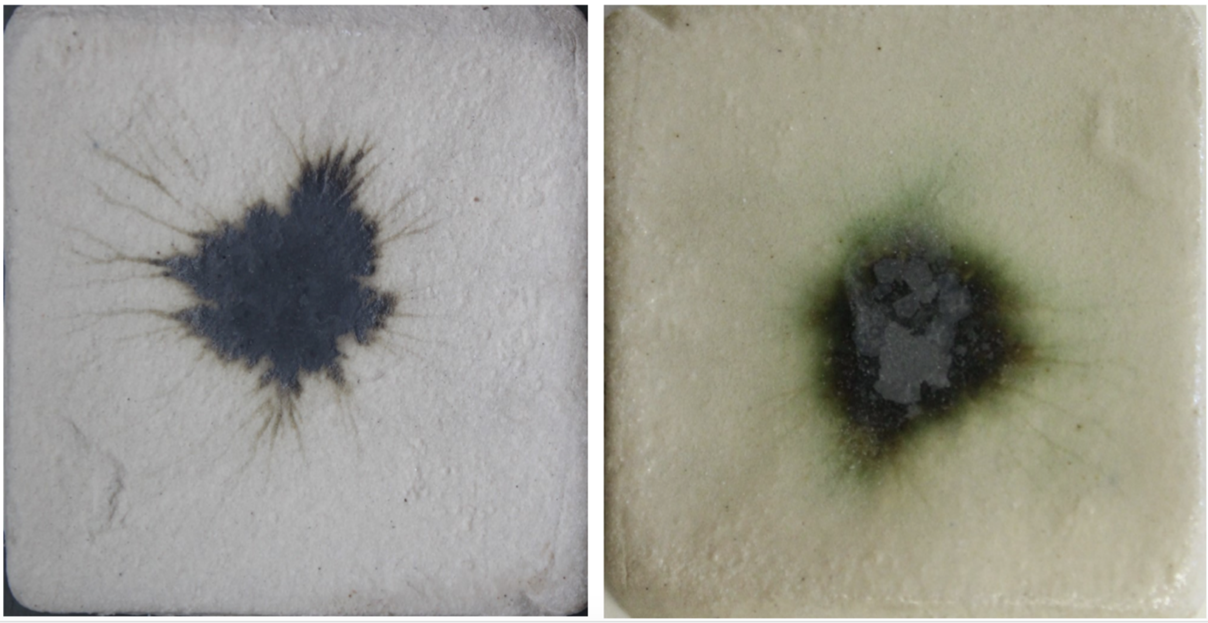


Figure 33 & Figure 34

At stoneware temperature there is even more colour loss. The colour in the tendrils is almost completely gone, but the main body stays dark and dense. The colour is mostly black with a greener border when glazed, which is a result of the glaze absorbing and blurring the colour. The glaze takes away the rest of the colours in the tendrils.

Copper Carbonate does not work well as a colourant for mocha diffusion. This is due the heavy grain of the stain not being carried down the tendrils. The murkiness of the colour at earthenware glazed is not satisfactory. However, at stoneware I think the colour is pleasant and, even though a lot of it is gone, it leaves creepy, faint, well defined outline that I think is aesthetically pleasing. Even if it doesn't fulfil the mocha diffusion intention.

<u>Black Iron Oxide</u>- density [gravity specific] is 5.2 (Hansen, 2003)

Black Iron Oxide is one of the stains that Hopper warned would not work (Hopper, 2004) and has a density of 5.2.

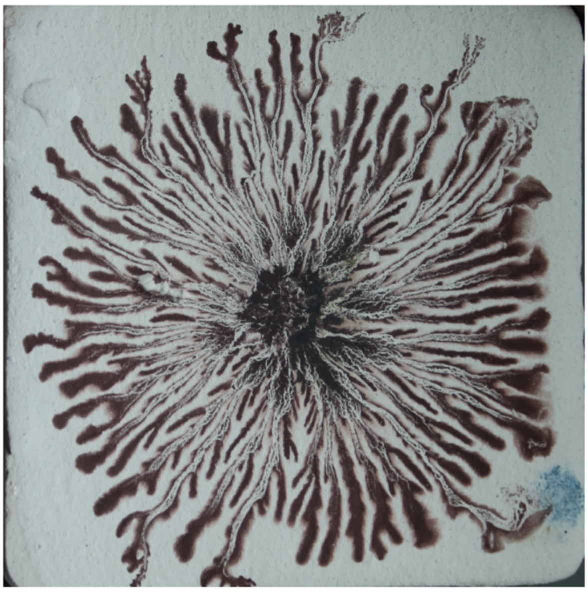
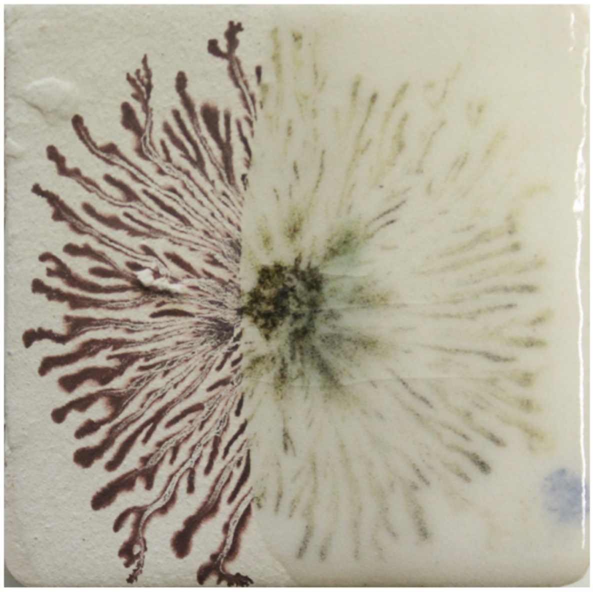



Figure 35 & Figure 36

Knowing that the grain, is large you can see where the acid doesn't carry it, there is tendrils hollow of colour. However, this is not what I was expecting to happen. I was expecting the colour to stay in the main body like it did with Black Copper. This is more effective than the Black Copper because the colour has gotten to the end of the tendrils and spreads pretty consistently. Although it doesn’t look like the classic mocha diffusion pattern it still is effective. At 1100°c the colour becomes slight lighter but there is no definition loss. The glaze at this temperature absorbs a lot of the colour and makes it murky through the glaze.

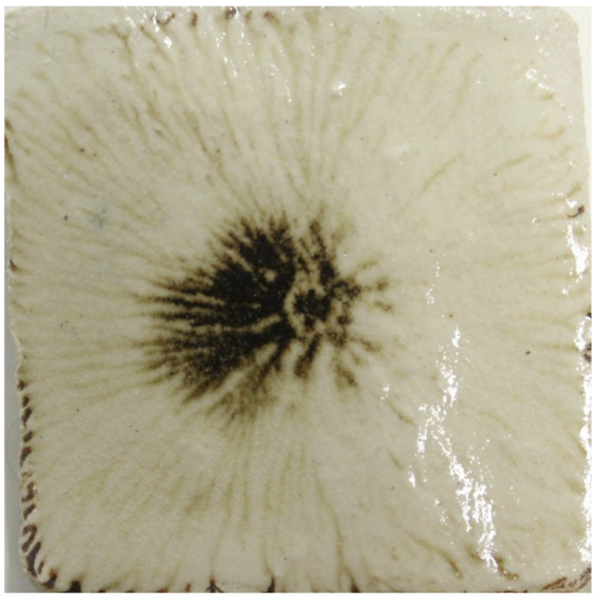



Figure 37 & Figure 38

Between earthenware and stoneware there is very little colour loss. The colour is still a dark brown/red which is absent along the middle of the tendrils. When glazed at this temperature the colour in the tendrils is very faint. This is the most drastic difference between glazed and unglazed that I have found in my testing so far. The colour in the body is still visible but slightly blurred. This stain reacts similarly with firing and glazing to Manganese Oxide.

Conclusion for Stains

I was expecting much less variation between the stains going into this, so seeing all of the different outcomes was surprising to me. In some cases, the research I had done was correct but in others it seems the books were wrong. Hopper suggest that carbonates and stains are better than oxide because they tend to be heavier (Hopper, 2004), but the two best reaction for me were Chrome and Cobalt Oxide. This is attests to why I wanted to do this technical research. That there is lack of experimentation into mocha-ware variables and people seems to go on assumptions. However, Hopper was right about how glazing and firing to high temperatures negatively affects the mocha diffusion pattern. Because this is such a volatile process you never know what the outcome is going to be. There is no black and white conclusion to these results. Some outcomes that I would say were a success others would consider a failure and vice versa. This process is so much about aesthetic opinions.

For me cobalt oxide is the most consistent and hardy stain to use for mocha-ware. Chrome oxide would be my second option but its complete lack of reaction to the glazing is a little unsatisfactory.

Changing the Acid-

The second round of testing I did was for different acids. I wanted to see how each acid affected the dispersion of stain and how the acid itself reacted to the slip. Mostly the use of which acid, or acids, is a personal preference to each potter (Lewis, 1985) some just using one whilst others mix them together to get the best results. Hopper suggest that 'any form of mild acid will work', so I tested the pH of all of the acid I used to see if milder acids actually did work better. I also thought it important to test different types of vinegar as most mentions of it were not specific as to what type (Colbeck, 1983) (Connel, 2002)(Brameld & Co, 1808). With these test I did not need to observe changes at different firing temperatures. The swapping of acid effects mocha only in the initial diffusion, any change after that is about the stains resilience. I mix a teaspoon of acid with a quarter teaspoon of Cobalt Oxide with each test to insure consistency throughout.

pH Scale-

acid						base							alkali
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Red Wine Vinegar- pH 3

Figure 39

Red wine vinegar has a quite high 6 percent acidity and does create a pattern on the slip. There is however very little fanning out of the tendrils. They stay together regardless of how far out they stretch. This could be due to its low pH which may cause to many tendrils to occur. The stain spread that it has is somewhat inconsistent, with inner circle keeping most of the stain while the rest is pushed to the outer edges. Red Wine Vinegar is not particularly affective as an acid for mocha 'tea'.

Apple Cider Vinegar- pH 3

Figure 40

Apple cider vinegar has a lower 5 percent acidity and does create a pattern on the slip. I was surprise by the low pH of this acid, as it is the only vinegar that is mentioned specifically (Storr-Britz, 1977)(Godden, 1990). I was expecting it to be a higher pH than the others to go along with Hopper's Mild acidity recommendation (Hopper, 2002). The stain spread using this vinegar is good, but there is no definition and the tendrils stay together all the way out. I was disappointed by the outcome of this acid as I was expecting it to perform better.

Sherry Vinegar- pH 2

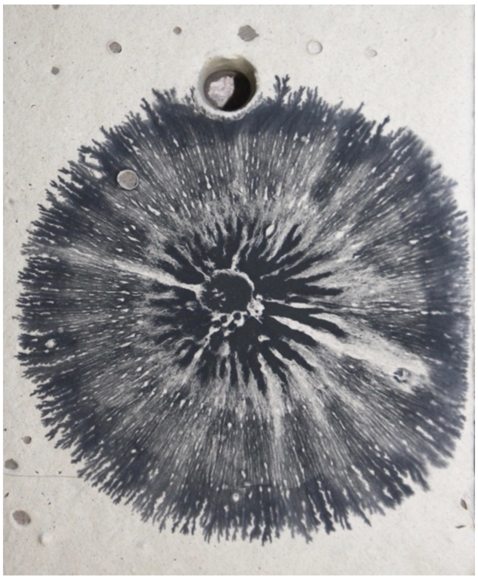


Figure 41

Sherry vinegar has a 7 percent acidity which is the highest of the vinegars I tested, and does create a pattern on the slip. This vinegar carries the stain fairly well but a there is a clear concentration of stain in the centre. The tendrils stay together the whole way out and only slightly define at the edges. Sherry Vinegar is not particularly affective.

Malt Vinegar- pH 3

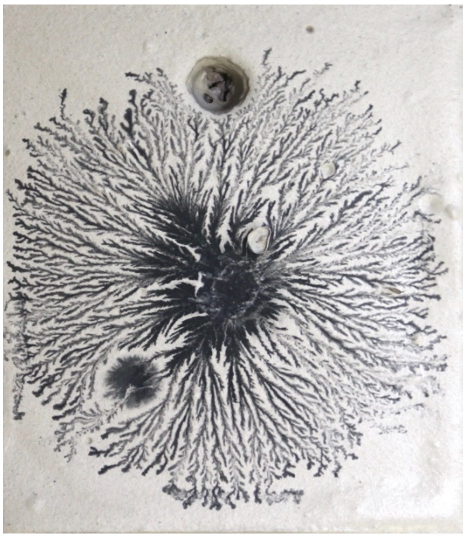


Figure 42

Malt vinegar has a lower percentage acidity of 5 and create a pattern well in the slip. It is not specifically mentioned in any literature for mocha diffusion. The stain carries well in this acid and fans out in and even and spaced way. There is a small increase of stain concentration in the centre and it does break off into obvious sections. There is definition in the outer tendrils. This is the acid I most like to use because of its reliability and consistent outcomes.

Tobacco Juice- pH 5

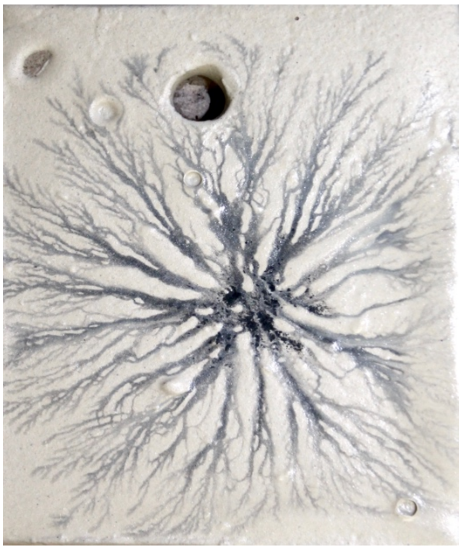


Figure 43

Tobacco juice has been used in mocha tea since the very beginning. Some believe it to be the very first acid to have been use in mocha diffusion (Hopper, 2004)(Colbeck, 1983) and almost every document written about mocha mentions it (Teulon-Porter, 1963)(Fleming, 1923)(Evans, 1970). Connel gives the recipe of 'one cigarette to 3 ½ fl oz (100ml) water' and to boil it for 10 minutes (Connel, 2002). This is the advice that I followed to create my tobacco juice and works very well as an acid for mocha diffusion. Its higher pH good results mean that it concurs Hopper's mild acid recommendation (Hopper, 2004). The stain carries with the acid with consistency and there are fewer tendrils than in malt vinegar, but they are much more evenly spreading out. These tendrils reach further, but are less dense.

Lemon Juice- pH 1

Figure 44

Lemon juice is highly acidic, with a pH of 1 I wasn't expecting any pattern to form. It was recommended by two people. One was Fleming in his letter to Teulon-Porter (Teulon-Porter, 1953), and the other was Connel in a list of tobacco replacements (Connel, 2002). However, no one has written that they use this as their main acid for mocha 'tea'. The stain does not carry well with this acid and has a gradual fading from the centre to the outer tendrils, but you can see a clear small dendritic pattern has formed.

Pure Gum Turpentine- pH 5

Figure 45

Turpentine in mentioned often in the literature about mocha. In the 1808 recipe it is suggested as a replacement for vinegar (Brameld & Co, 1808) but mostly it is listed as a small component in references to older recipes (Lewis, 1969)(Evans, 1970)(Flemming, 1923). This surprised me when I came to use it because it appeared to be hydrophobic, and would not mix with water or any of my other acids. During the diffusion, the 'tea' was clearly fizzing and pockets of stain were being brought together and push out. This created a ring of stain around the outside and caused the pattern to be inverted. The acidity is one of the mildest I have used, which means it should have had a more satisfactory outcome (Hopper, 2004). This dramatic reaction compels me to think that it was not the acidity that caused it, but some other component in the turpentine.

Citric Acid- pH 1

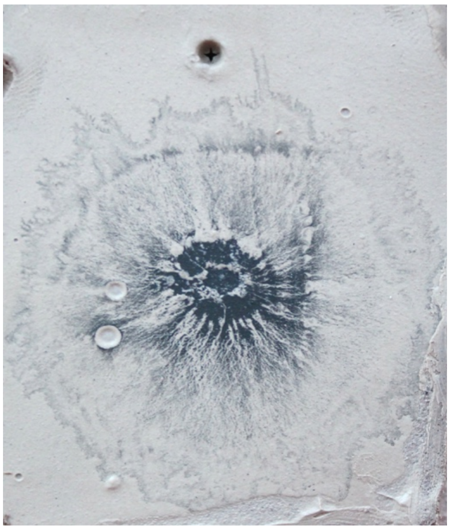


Figure 46

Citric acid is suggested in the letter from Fleming to Teulon-Porter (Teulon- Porter, 1953), but this is the only mention specifically. I wanted to try this as a more consistent way of getting the results of lemon or orange juice, as there would be less of a difference between batches of 'tea' due to it being pre-packaged. I was not expecting it to be so acidic and was therefore not particularly hopeful of the results. There was some kind of pattern formed but the stain did not carry well and the definition was minimal.

Conclusion for Acids

Which acid is used plays a large part of how a mocha diffusion will turn out. Each of the acids I tried had vastly different effects. However, it is clear that the acidity of these tests is not the only thing effecting the diffusion. Red wine vinegar, apple cider vinegar, sherry vinegar and turpentine all show signs of actually repelling the stain. This cannot be related to their acidity as they all have a different pH. Other substances were suggested for the mocha tea but for these reasons I could not test them. Tansy leaves were suggested 'to make the action of the acid more ornate' (Teulon-porter, 1953)(Lewis, 1985), but they were not available to me as it was the wrong time of year to pick them and I could not purchase them online. Urine was mentioned as a historical method (Lewis, 1969)(Evans, 1970)(Teulon-Porter, 1953) but I deemed it too unsanitary for this testing.

Due to mocha diffusion being so temperamental I found that using a more reliable substance is better. Acids where its properties can vary from batch to batch are to inconsistent. This problem occurs using tobacco juice, lemon juice and occasionally citric acid. If the diffusion went poorly with plain malt vinegar for example, I would know that the issue would be with the slip or amount of stain, not with the acid as it is bought and already made.

Conclusion

There are many factors involved in creating mocha diffusions and they are often difficult to predict. The main intention of this testing was to create a documentation of the outcomes, and to explore all the different possibilities for mocha diffusion. This has been very informative and the results were not always what I anticipated. Some of the more common suggestions for mocha tea were not the most satisfactory. The wide usage of manganese for instance, despite its lack of durability in firing. This I can attribute to the beginnings of mocha-ware. There was such a high demand for this one type of fashionable decoration, that the same kind of recipe was used every time to achieve the most similar outcomes. The purpose was not to create something new and experiment but to replicate the same in large quantities. This meant that when more recent potters came across these recipes they naturally began using it, assuming it was the best way. From my testing, I have concluded that for mocha 'tea' a combination of malt vinegar and Cobalt oxide give the best results. However, the interpretation of these results are weighted in personal preference and what effect one is wanting to achieve.

During the historical research, I began more and more to feel like mocha-ware was representational of the relationship between creativity and mass production. Mocha diffusion was happened upon by mistake which could never have occurred in a production line. The mistake would have been corrected and not valued. Yet this decoration technique was acquired by manufacturers and mass produced. That despite the ‘diminished role for the craftsman’(Johnson, 2015) at the time, there will always be a role for creativity in making. For me, mocha-ware highlights the importance of creative freedom and experimentation in making.

Glossary

Banded ware- A decorating technique using the spin of the wheel to create lines on a piece

Dendritic- A tree like pattern

Earthenware- The firing of a clay body at a temperature between 1000°c and 1200°c

Engobe- Slip with a lower clay content. Used mostly for bisque fired wares.

Glaze- A decorating technique for coating ceramic before firing to create a finish or a food safe piece

Marking- The writing of an artist or maker usually found on the bottom of functional ware sometimes refered to as a makers mark

Mocha diffusion- The ceramics decorating technique using acid and alkali to create dendritic patterns

Mocha ‘tea’ (juice)- The mix of acid and stain used for creating mocha diffusions.

Slip- Clay mix with water used for decoration and casting purposes.

Stoneware- The firing of a clay body at a temperature between 1200°c and 1300°c

Ware- refereeing to a state of pottery

Appendix

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