PAINTS AND THEIR HISTORY

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Why old buildings need "breathable" paints

The way older dwellings are built affects the best way to repair and decorate them. In the South West, most old buildings are of solid wall construction, rendered with breathable lime mortars and limewashed. These "breathable" materials reduced the effects of condensation and allowed the moisture in the walls to evaporate to the outside. Newer building techniques however, rely on cavity walls and barriers for protection against damp penetration. Misguidedly trying to seal the weather out of traditional structures can lead to dampness, rot and condensation problems, causing decay in structural timbers and damage to the cob and stone walls themselves.

Paints are used to protect and decorate wall surfaces. Up until relatively recently they were normally made on site of simple, locally available materials such as crushed and slaked limestone (limewash), skimmed milk (casein paint), gelatine and chalk ("distempers"), wheat or rye starches and linseed oil. They could be coloured with pigments made from the iron oxides founds in the earth and would therefore harmonize with the colour of the soil locally. Other easily obtainable colourings such as soot, blood and animal urine were also commonly used.

These paints were not only sympathetic to the construction and local colour of traditional dwellings, their production did not cause significant pollution and they were easily renewable. Some had other positive benefits – limewash for instance is very alkaline and therefore makes a good antibacterial agent, which is why it is widely used to paint farm buildings, and was used in the combat against foot & mouth disease.

Although the terms "limewash" and "distemper" have a bygone sound about them, these paints were very much in evidence up until the middle of the twentieth century. A great deal of work would go into the mixing of pigments and preparation of paint on site and house decorators would have had as many tried and tested paint recipes as celebrity chefs.

With the development of modern petroleum-derived paints in the middle of the century, DIY home decorating has become a massive industry. But with their convenience and colour-consistency comes a cocktail of synthetic chemicals and concern over growing problems of allergies and asthma. Moreover, figures from West Germany in 1989 showed that the manufacture and use of synthetic paints and solvents puts nearly as much pollution into the atmosphere as the fumes from motor vehicle exhausts. Nowadays, there's a growing awareness of the benefits of more traditional and natural paints. The benefits of breathability apply not just to these paints but also to the environment.

Limewash

Limewash is one of the oldest paints known to man. The Pharaohs used it in ancient Egypt and it is still widely used throughout the world today. Recipes for making it vary - animal fat, linseed oil, skimmed milk, salt are often added for durability, and earth or synthetic pigments, soot, animal blood, etc, for colour.

On the right surface, limewash has many benefits, being very breathable, long lasting and easily renewable. Being alkaline, it's anti-bacterial and an insecticide (woodworm and death-watch beetle hate it) - hence its wide usage on farm buildings. It also has fireproofing qualities. After a disastrous fire in 1212, King John ordered that all the houses on the Thames should be lime plastered and whitewashed within eight days to prevent another such catastrophe.

It was common practice in this country from medieval times onwards to limewash stone buildings (and later brick ones) in order to preserve them, and in cases where the stone was crumbling, to heal them. It was argued that the limewash was absorbed into stone, hardened it and filled crevices, which would otherwise allow water to penetrate and attack the stone.

Limewash tends to rub off organic substances like wood. Since the introduction of oil paints and egg tempera paints in the 17th Century limewash hasn't traditionally been used woodwork and furniture in this country. However it was still used to treat infected oak tables – and 'limed' effects on wood furniture and floorboards have become very popular again today.

Unlike modern barrier paints, limewash works by sinking into the surface and becoming part of the protective render or plaster. Limewash is naturally white and forms a complex crystalline matrix which has a matt, slightly chalky appearance. It can be used internally and externally. Limewash does have some limitations – as it's a water-based paint, it can't be absorbed into non-porous surfaces such as newer cement renders, or hard gypsum plasters and therefore it won't wear nearly as well.

To make limewash, water is added to lime putty. Limestone is burnt in a kiln, driving off carbon dioxide and leaving "quicklime". Old lime-burning kilns can be found throughout Devon. The quicklime is traditionally in the form of lumps and these were added to water, a dangerous occupation as the heat generated boiled the water. This process is called "slaking". The resultant liquid was hoed and left to mature in pits or tanks for several months. It becomes lime putty, which is like thick cream cheese in consistency. It can be combined with sand to form soft, breathable mortars and plasters, or, if diluted with water it will produce limewash.

Although considered a "technologically primitive" paint, limewash is making a welcome comeback as more and more people appreciate its natural appearance and qualities.

Painting with casein ~ a milk paint

Most of us have become used to buying paints ready made off the shelf – it's hard to imagine that up until the twentieth century we could have been raiding our larders to concoct our own paints from a variety of household ingredients including milk, eggs, beer, flour, vinegar and wine. Some of these paints lasted 30 years or more, others didn't last long at all. Most had the advantage that they wore away rather than flaking, making it easy to clean and repaint the walls. This would have been important for coping with the soot generated by open fires and candlelight before the advent of central heating and electric light bulbs.

The important constituents of any paint are a 'sticky' medium to bind the pigments to the surface being painted, and a solvent, which thins the binder, allowing it to spread and dry into a surface film. The binder in milk paint is casein, a milk protein, and the solvent is water. A traditional recipe for casein paint is to add the curds from soured skimmed milk to water and pigment with an alkaline substance such as lime putty, soda or ammonia to dissolve the casein. Some modern "paint experts" omit to mention the alkaline ingredient in which case you get a sludge which is difficult to paint with! Nowadays you can buy ready made casein paint in powdered form, to which you need only add water and pigments. Casein paint is applied with a brush or roller just as you would a modern paint.

The advantages of using casein paint are that it's breathable, it will readily cover most surfaces , it takes pigments well and it has an attractive soft matt chalky finish.
It doesn't cover gloss paints or distempers easily and may become moldy in a damp environment such as a bathroom or kitchen. Although casein paint shouldn't be used externally on its own, a small quantity of casein added to limewash will thicken and strengthen it considerably for external use.

Casein paint can be used on wooden furniture and either buffed up to polished surface or waxed and glazed to give the same effect. The Shakers in mid nineteenth century America often used casein to paint their furniture, as did the Scandinavians. Attractive hard stucco wall finishes can also be achieved with this paint proving it to be a versatile and attractive option.

Casein can also be made into a very strong glue and it is thought that it was used in ancient Egypt, Greece, Rome and China by joiners and cabinet makers as well as by painters and decorators. Another traditional paint involving glue is distemper, which is the subject of the next article in this series.

Distemper

While some paints have vanished without trace – worn away, destroyed and painted over, others have survived from the earliest civilizations. Distemper has been used since ancient Egyptian times for wall painting, house decoration, the painting of theatrical scenery and occasionally for easel painting. In this country it was still being used by local authorities to paint council houses in the 1970s. Its name derives from the Italian word "tempera", a term which originally probably encompassed all paint but later came to mean just egg-based paint.

Distemper (also known as calcimine, size paint and whitewash) is a water-based paint composed of pigments held together by glue. It has the advantage of being very cheap to make. There is no definitive formula and craftsmen would have had their own preferred list of ingredients, usually made up on site and kept a trade secret. In its most basic form a "soft" distemper is made from whiting, glue and water, resulting in a soft, water-soluble paint. The whiting is crushed chalk, which gives distemper its characteristic matt white appearance. It can be coloured with pigments such as ochre, sienna or ultramarine. The glue, or clairecolle as it is known from the French for "clear glue", was commonly made from gelatin obtained by boiling animal bones, hooves or skin, particularly rabbit skin. However other binders such as casein, a milk protein, and gum Arabic were also used. The ratio of whiting to glue is important - too much whiting and the paint will powder, too much glue and it cracks. Linseed oil can be added to make the paint more durable. Distemper was considered particularly suitable as a cheap option for painting ceilings and especially good for plaster moldings as it could be washed off before repainting, avoiding a build up of paint.

Distemper is only really suitable for painting onto new plaster, which has to be sized with a weak solution of the glue to control suction, or for repainting onto existing distemper. Ideally only one coat of the paint should be painted over the clairecolle, as a second coat may dissolve the first! The glue base and the water-solubility means that it is difficult, if not impossible to paint over distemper with a different type of paint, and people have been known to take the plaster off their walls to remove it. A clue to whether you have soft distemper on your walls is if the coating is easily removed by running a wetted finger over it. However an oil-bound distemper isn't so easy to identify.

For those who admire the soft chalky appearance of distemper but don't want to make a life-long commitment to repainting their walls with it, similar effects can be achieved using limewash, casein paint or a natural emulsion.

The ins and outs of painting your house walls

Many people would like to use sympathetic traditional paints to decorate their homes, but find that the previous occupiers have coated the internal walls with acrylic emulsions or vinyl wallpaper. Worse still, external repairs are often carried out in sand and cement render, and sealed with synthetic masonry paint, which looks immaculate but traps moisture in the wall causing damp problems in the longer term.

The manufacture of emulsions, which have superceded traditional paints like limewash and distemper, used to be based on raw materials such as chalk and powdered marble, with water as a solvent. Ingredients were skillfully chosen for a specific function and their production involved only relatively simple processes. Unwanted waste products were biodegradable i.e. solid matter could be composted.

Nowadays these emulsions have evolved into a complex cocktail of synthetic chemicals and can include detergents, fungicides, preservatives, carcinogenic solvents and sometimes toxic metals. While these paints can be very effective, their manufacture produces a mountain of waste and excessive atmospheric pollution. Worst of all they can be bad for your health, giving rise to irritations, migraine and allergies. This is despite the claims often made that they are 'user-friendly'.

Happily we are seeing a revival of conventional paint manufacture. Natural emulsions look and behave much like their synthetic counterparts but are flexible, breathable and pleasant to use. Their appearance is soft and matt, not unlike limewash and casein. They can be used anywhere throughout the house

internally and on furniture.

Externally silicate masonry paint is a good alternative to limewash when painting over impervious renders. Silica is a hard glassy material found in quartz, sand and opal. Silicate paints were first patented in Germany in the late Nineteenth Century. King Ludwig I of Bavaria, who was a great lover of the arts, wanted to copy Italian frescos in his own castles but found that the lime plaster couldn't withstand the harsh climate north of the Alps. He asked his scientists to develop a paint that looked like lime, but was much more durable. Like limewash, silicate paint works by soaking into the underlying material The silica binds chemically with the mineral building material, whether it is cob, brick, stone or cement, forming an insoluble crystalline bond. This is likely to be a far more compatible treatment than painting walls with a surface film of synthetic masonry paint.

Apart from being very durable, Silicate masonry paint is relatively breathable, unaffected by ultraviolet light, resistant to acid rain, mould-growth and fire. In some regions where fire is a threat such as earthquake zones, sodium silicate is sprayed onto wooden buildings as a cheap method of fireproofing them. This paint can also be used inside on areas where limewash or emulsion might not work well, for instance on damp internal stone walls or basements.

Traditional Oil Paint

It is fascinating looking back over the history of paints to learn how inventive our forebears were at exploiting natural materials to make protective and decorative coatings for our walls and woodwork. It is hardly surprising given the complexity and range of materials used, that a painter and decorator's apprenticeship could last as long as doctor or lawyer's training.

Traditional oil paint, by which I mean the combination of oil and finely ground pigment, was first documented in this country in the accounts for the upkeep of royal palaces dating back to the Twelfth Century, although there is evidence that oil was used to coat surfaces a long time before that.

Not all oils are suitable for painting because they don't all dry into a hard film in normal temperatures. Those that do are known as "drying oils" and include linseed, walnut, soyabean, sunflower and poppy. These absorb oxygen and form a solid elastic, non-soluble film. Of these linseed oil from the flax plant is probably the most commonly used oil in paint, because it's durable, flows well, and has a good sheen. However, it has a tendency to go yellow over time and nut oil was often used in white paint to avoid discolouration.

Plant oil is not the only option - fish oil was found to be particularly effective as a binder in rust preventative paints. The Forth Bridge was painted with two coats of hot whale oil before the topcoat of red-oxide pigment and linseed oil paint.

Because a thin layer of oil can take a month to completely harden, other substances, normally lead, were added to hasten the drying time. This is why traditional oil paints are often referred to as "lead" paints. The manufacture and use of white and grey lead paint is now restricted as they are poisonous if inhaled or swallowed.

Lead not only helps oil paint to dry more quickly, but also makes it more opaque and gives it colour – for instance white or red lead gives you a white or red paint. Some pigments also had drying properties. These include verdigris, obtained from copper rust, and umber, which contains manganese. Another additive was turpentine which had several functions – it could dilute the paint, help it dry and reduce the sheen. Resins were combined with oil to make varnishes and were sometimes painted over oil paints to give additional gloss.

Oil paints were generally used on wood, internally or externally, and on walls where a durable, hardwearing paint was needed. It was common practice in some regions to oil paint brickwork as soon as it was built to preserve it.

Unlike synthetic modern gloss paints, which tend to disintegrate under ultraviolet light, traditional oil

paints wear thin with age. They tend to move with the underlying structure rather than crack and are relatively breathable.

Pigments

Some pigments are literally as old as the hills, having their origins in the earth and rocks. The pigments that were used in the cave paintings of Lascaux and elsewhere are still every much in evidence, not only in paints but also in cosmetics. Pigments have their own well-documented histories and characteristics and it is only possible to give the briefest of thumbnail sketches here.

A pigment is a substance which gives its colour to another material either when mixed with it, or when applied over its surface in a thin layer, as in fresco painting. When ground pigment is mixed with a "binder" such as oil, lime or casein to form paint, it doesn't dissolve but remains suspended in the liquid, unlike dyes, which become absorbed by the material they colour.

Organic pigments are relatively easily obtained from flowers, seeds, berries, nuts, bark, wood and roots. Although most of these tend to fade in sunlight, some plants and insects do provide very durable pigments, for instance the Woad and Indigo plants, the Madder root and the Lac insect. Another easily obtainable pigment is Carbon Black or Lamp Black, which is simply carbon obtained from charcoal, soot and even charred bones.

More common, and commercially available are the natural earth pigments, such as red and yellow Ochre, raw and burnt Umber, Sienna and Green Earth, also known as Terra Verde. As their name implies these pigments are natural earth consisting of clay and silica coloured by iron oxides and other minerals. They are mined all over the world but some take their names from their primary locations – Sienna, and Umber from Umbria, for instance. It is relatively simple to make your own earth pigment by a process of "levigation" or soaking and filtering earth to remove impurities.

Other more exotic and brightly coloured mineral pigments were obtained from the heavy metals. The colour ultramarine was originally obtained from the semi-precious stone Lapis Lazuli mined in Afghanistan. Orpiment, also known as King's Yellow, and Realgar, an orange red, were both sulphides of arsenic. Vermilion or Cinnabar was a combination of sulphur and mercury - more poetically, brimstone and quicksilver. Malachite, a basic copper carbonate produced a bright green pigment and Azurite, bright blue. These legendary pigments are no longer used either because they're too expensive to extract, or because of their highly poisonous nature.

Mankind is always trying to improve on nature. Synthetic pigments were made from the time of the Pharoahs, and the early 18th Century saw a growing momentum to create cheaper, more reliable and refined pigments. These were manufactured using a variety of metals, notably copper, lead, chrome, manganese, cadmium, aluminum and cobalt – from the German "Kobold" meaning "goblin of the mines". These are commercially available, but great care should be taken handling them in powder form.

Oils, waxes and varnishes

There is something deeply satisfying about applying a coat of oil to a parched and greying piece of stripped wooden furniture and buffing it back to life with a soft sheen.

Oil is easy to apply, it fills the open pores in wood and stops anything else getting in; it reduces splitting and drying out. It hardens into a durable skin that is heat, alcohol and water resistant, and it is easy to reapply. Despite its tendency to yellow over time, linseed is probably the most popular oil, because it's easily absorbed, it's durable and it has a good sheen. It can be combined with Tung oil, which is highly resistant to water. Oil is often used as a deep penetrating primer for other surface treatments. It can also be used on stone, terracotta, cork and even concrete to give added protection and a slight sheen.

Wax is another traditional treatment for wood, often used as a finishing coat on top of oil. It's not as durable or resistant to heat and water as oil, but it's just as easy to apply and renew. Wax in solution can be used to clean waxed surfaces. There are a surprising variety of waxes from unexpected sources but

traditionally the commonest treatment for wood was beeswax. Beeswax is very soft and inclined to smear, and is often strengthened with Carnauba wax from Brazilian palm fronds, which is hard and brittle. Beeswax thinned with turpentine is a well tried recipe with the added advantage that wood-boring beetle dislike them both

Oiled and waxed surfaces are only suitable for internal use. A more durable surface treatment, suitable for both indoor and external use, is natural varnish which contains resin and hardens to a glossy finish. Most natural resins come from the secretions of plants, both living and fossilized. Amber is a fossil tree resin used mainly for jewelry, which can make a very dark varnish. Copal is the name given to a large variety of hard resins, which are dissolved with a drying oil to form durable, water resistant, oil varnishes. Softer resins such as Danmar, Mastic and Sandarac are dissolved in turpentine or alcohol to form weaker spirit varnishes, normally used to protect easel paintings. However, the most commonly used natural wood varnish doesn't come from a plant, but from a living creature, the Lac insect, which secretes resin. Shellac dissolved in alcohol gives us French polish with its smooth hard finish and high sheen.

With a huge choice of wood finishing products on the market today, many of which are synthetic or contain unpleasant solvents, it is well worth considering the tried and tested natural treatments. They have the benefit of being breathable, relatively safe, effective and, most importantly, they enrich wood in a way that a coat of polyurethane can't hope to do.

I hope you've enjoyed this series of articles on traditional paints, oils and waxes, and feel inspired to try the natural alternatives to the modern chemical cocktails.

Gill Tesh runs the paint side of Mike Wye & Associates who specialise in supplying natural building and decorating materials for the repair and conservation of traditional buildings. They also undertake conservation & repair work, and run practical courses on renovation and decoration. They are situated in the heart of the Devon countryside, operating from three warehouses on the site of the old Buckland Filleigh sawmills. They can be contacted on 01409 281 644, or visit their web-site www.mikewye.co.uk for a wealth of information.