The Actual Secrets of the Old Masters, part IV

Chalk and Other Minerals – Tad Spurgeon

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Older painting practice contains many interesting technical surprises. Next to the craft of the oil, the use of stone dust as an extender, brightener, stabilizer, and varied surface creator is at once both the most prosaic and the most profound. Different minerals have been used in the past to make pigments more translucent or to raise the value of a colour without making it markedly cooler in the manner of white. Painters tend to think of extenders as part of lower grade paint, therefore as something to avoid, but their use in older painting was functional both optically and technically. Early examples are Raphael's use of manganese-bearing ground glass in the imprimatura layer and the paint (National Gallery Technical Bulletin 25), the recent discovery of ground silica (quartzite) used for making glass in Venice as an extender in the work of Lotto, and the ground glass itself in various colours in the work of Tintoretto. In the 17^{th} century, ground chalk is found in the work of Rembrandt, and to a lesser extent, Vermeer, and ground calcite is found in the work of Velásquez. The various materials do have different intrinsic behaviors, but are all also adaptable through shifts in proportion, or by incorporating other ingredients. While this territory is fascinating, exploration of it has yet to yield the penultimate philosopher's stone dust. As with other aspects of the craft, much depends on the scale and style involved, and the painter's intentions. The materials are different, but since Velásquez used ground calcite, Rembrandt used ground chalk, and the Venetians used ground glass or silica pebbles, the difference isn't one of quality, but of personal working preference, or perhaps simply availability, coupled with a given material's working character. While variety exists, this area is equally about developing greater awareness of the materials through experience.

Chalk is a natural calcium carbonate made up of the discarded shells – coccoliths – of ancient microscopic marine creatures. Natural chalks behave slightly differently in use depending on their composition, degree of compression, and how finely they are ground. Chalks tend to have a slight colour in oil from grey to beige, this is not typically an issue in working. (Note that the material called Bologna chalk is not calcium carbonate, but calcium sulphate, and is best avoided as a paint additive.) If the purest colour is necessary, say for emphasis on more pure midtone colour in translucent applications, the lightest chalk becomes more critical, the lightest natural chalk in oil is the Kremer Stone Chalk, 58162. Alternatively, a fine calcium carbonate made from marble or limestone is almost pure white and a bit more opaque in oil, while also being less sticky. However, all natural forms of calcium carbonate tend to inhibit yellowing in the oil. Chalk is absorbent, and translucent. Unless the oil is aged, it gives the putty a significant glutinous body and the ability to make impastoed or broken surfaces readily. Most chalk is quite fine, and the finer chalks, such as the Champagne chalk used for pastels, have a long, stringy, and more adhesive quality in new, the behavior becoming more gelatinous as the oil is aged in the light. Chalk is associated with the late, broader style of Rembrandt, but is also found in the work of Chardin, and in several of the paint samples from *Girl With A Pearl Earring* (c. 1665) analyzed in *Vermeer Studies* (1998), and in the work of Cezanne. While the active, broken surface potential of a putty-type medium is obvious, chalk can easily be incorporated into a smooth surface style as a way to create slightly more body and adhesion with a technically reliable oil medium.

Ground **calcite** is not made from optical calcite crystals, but is the name given to a crystalline, non-absorbent, and relatively large particle (approx. 20µ for the Kremer 58720) calcium carbonate that exhibits a much different working behavior than chalk. If made with thin oil, a calcite putty is translucent, tends to slump and level, and benefits from being mulled to give the mixture more cohesion. The rheology of this medium can also be altered by using heat-bodied linseed oil, as detected consistently in the analysis of Velásquez paint samples (NGTB 19). An oil heated for four hours to 150°C has enough body to effectively float the calcite particles, but this can also be engineered with sun oil or studio oil added to thinner oil. This increases the thickness of the paint and relative elasticity or *boing*. Of the putty family, this medium has a unique rheology, sliding in a slightly granular manner as though on miniature ball-bearings, but also stopping abruptly. It exhibits little of the adhesive or glutinous quality of a chalk putty. As such, a calcite putty tends towards lower, more even relief and edges which break cleanly but raggedly. This behavior is easily seen in close-ups of Velásquez paintings. Although consummately skilled, the painter is also capitalizing on the medium's natural way of working. An energetic style of brushwork with repeated edge attenuation is the calcite putty's strength; this medium is not as conducive to fine work at a small scale unless mulled. In a mixture, calcite provides a way to balance chalk with more mobility. It is also useful for the underpainting of finer work to provide a slight internal grip for future layers, and need not, in this case, be mulled.

Marble dust is semi-crystalline and the Fredrix brand is widely available as a gesso additive, making it an easy material with which to begin. Typically pure white and quite fine, it is more glutinous than calcite, not as adhesive as chalk, and more opaque than either. Even coarse marble dust is more adhesive than fine calcite.

There are many forms of natural **calcium carbonate** available as well, often made from limestone, the geological precursor to marble, sometimes also called **whiting**. (Limestone is sometimes marketed as chalk, since both are calcium carbonates, but they are quite different materials in use.) Used for the building trades, or for pottery, these tend to be quite white, relatively fine, and less adhesive but more opaque than chalk. They are available in large bags at low prices. Man-made **precipitated chalk** is also available. This is very light, and makes an adhesive white putty with little body and a very fine working character, but may yellow – testing is advised.

More gritty forms of **silica** such as fine aquarium sand can be used in a lean underpainting putty to help maintain subsequent adhesion. Kremer also has many grades of pure quartz sand. In the NGTB research there are many examples of coarser materials used in underlayers. Silica from pottery supply sources is typically 200 to 400 mesh and makes a beige putty similar in working character to marble dust. Very fine **glass beads** are also available, at 0-50µ these make a short mid-gray putty otherwise similar to calcite. An underpainting putty can also incorporate **ground leaded glass** when available. An interesting material in this family is very fine **cristobalite**, a high-temperature variety of quartz. At 7µ it makes a translucent white putty with a long but gelatinous or mobile quality. This is a step towards the behavior of **fumed silica**, which essentially dissolves into the oil, forming a gel of any consistency that produces a lubricating effect in a putty even in small amounts. While the calcium carbonates tend to accelerate drying, silica tends to be neutral or retard drying slightly. Using hand-refined organic linseed oil, this is not an issue. Any ground silica in dry form presents a long-term respiratory hazard and should always be handled wearing a serious particle mask.

Another interesting traditional additive is **bone ash,** an organic complex that is principally calcium phosphate, and often mentioned as a drier in the oldest texts. A small amount acts as a thickener, making it potentially the original material used in this way, and its mildly alkaline nature helps the paint film remain less acidic over time. It also tends to make a putty formula relax or slide, making it more mobile unless a separate thickening agent is added. This can be helpful when fine tuning a putty formula, or for diminishing the adhesiveness of a thicker oil.

Colloidal Clay is often used as an additive in commercial paint, a minute amount of a colloidal clay such as attapulgite or bentonite creates a more thixotropic putty. These clays are not ever that light in colour, however, and darken the putty even in small amounts. The lightest bentonite is marketed as Bentonlite in the pottery trade.

The early 20th century system of extenders is covered in *Paint Making and Colour Grinding* (1913) by Charles Uebele. It is important to note, though, that barium sulphate, commonly used in cadmium pigments in the 20th century, does cause the oil to yellow in tests and is therefore not a general purpose extender. Similarly, magnesium carbonate, while more gelatinous and translucent than chalk, also causes yellowing in an unpigmented test. Kaolin has also been reported to darken significantly.