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REMBRANDT'S INKS  
(Synopsis of presentation)

The literature on Rembrandt's brown ink drawings traditionally has described them as being executed in bistre, a carbonaceous substance made from chimney soot. As other early inks prepared by rule-of-thumb formulations, bistre displays a broad range of color and textural properties, most of which can be easily found among the many drawings by this artist. To determine the identity of these inks, non-destructive analysis of twenty-two Rembrandt drawings in the collection of the Metropolitan Museum of Art was undertaken using x-ray fluorescence. Almost all the inks examined proved to be iron gall. Three white pigments were also found. Testing was carried out by Gary Carriveau, now at the Detroit Institute of Art.

Results of the analysis were based on the relative concentration of the inorganic elements. Variations in the concentration of iron and sulfur, predominant elements in the iron gall ink samples, were used as a means of determining different formulations of this ink within the same drawing. These two elements reflect the inorganic portion of gallotannate ink which was made from a mixture of gall nuts or any gallic and tannic acid producing vegetable matter, and ferrous sulfate. Ferrous sulfate, or vitriol, functioned as the colorant in recipes for gallotannate ink before the use of logwood additives in the late 18th century. Tannins used alone or with an inadequate amount of vitriol produced a pale colored ink that quickly faded. Depending upon the relative proportion of the constituents, the color and depth of tone of the ink could vary from pale grey or brown to a deep brownish black.

Among the samples analyzed, ink chemically resembling the bistre controls contained a greater amount of calcium than found in iron gall. Only one of the 22 drawings, Potiphar's wife Accusing Joseph, was executed entirely in this ink. In another composition, Cottage At Wood's Edge, the presence of this type ink was detected in a few wash passages. Almost all the other ink sites were pure iron gall, or iron ink containing elements suggesting the admixture of pigments such as burnt umber. Comparison of them showed a correlation between the relative concentration of iron to sulfur and the color and intensity of the ink. Where the ratio of iron to sulfur was very high, the color of the ink was very dark, perhaps close to its original appearance. Where a lighter and darker ink had the same relative concentration of iron to sulfur, the lighter one was assumed to be a dilution with water of a more concentrated ink. Dark inks with a low ratio of iron to sulfur appeared to be enhanced by the addition of carbon ink such as lamp black (which is not detected by XRF), a practice noted in literary sources of that period and earlier. The difference between the relative concentration of iron to sulfur was lower in the medium color brown inks, and approximately equal in the palest inks.

This chemical, hence color variation in Rembrandt's palette contributes technical support to the division of his drawing oeuvre into three general groupings: sketches, preparatory drawings and presentation pieces. For example, some of the drawings which showed evidence of reworked lines, as Two Studies of a Woman Reading, proved to be executed in only one formulation of iron gall ink, indicating rapid, sketchy handling and immediate correction, rather than having been reworked at a later time with an ink whose composition would have been different. In Cottage Among Trees, a narrow strip of paper was pasted to the larger sheet and the drawing continued as if uninterrupted. Analysis, however, revealed that each section was drawn with a different ink. This reorganization of the composition, as Rembrandt was known to do in preparation for his etchings, must have occurred after a measureable time period when the original ink was no longer available. Rembrandt also used white pigment to reorganize and edit his compositions. Two white pigments used for this purpose were detected:

lead white, as in Cottage at the Wood's Edge, intended to obscure those lines Rembrandt was dissatisfied with, but which now appear as grey wash, and a calcium white (the specific pigment cannot be determined by XRF). Calcium white, often appeared to be a blackened lead sulfate correction, as in Landscape with Farm Buildings, the dark color resulting from the optical mixing of this pigment with the iron gall ink it partially covered. Rembrandt also used these whites for washes. In Beheading of Prisoners, lead white was intentionally used to produce a grey wash, and in Man Seated at a Doorstep, traces of a calcium white wash, not readily visible to the unaided eye, were detected by XRF. Undocumented restoration was detected in Nathan Admonishing David by the presence of titanium white. In Cottage At the Wood's Edge, one of Rembrandt's few presentation drawings, and in Self-Portrait (1636), a great diversity of brown inks and washes were found, emphasizing the elaborate and carefully worked draughtsmanship in these monochromatic drawings.

The determination of the original color of these drawings, and the mechanism of fading and color alteration of iron gall ink need further examination. The historical misidentification of muted brown inks as bistre must in part be attributed to the confusion associated with this substance. It, as sepia, became not so much a reference to a specific pigment, but rather a designation for materials similar in color. Contributing to this is the lack of understanding surrounding the properties of iron gall, including its color, corrosiveness and of its use.

Undoubtedly, the brown glow of many old master drawings is the product of time more so than intention. Yet, the iron gall ink the artist selected for his work was not necessarily a deep brown-black to begin with. Although we do not know to what extent Rembrandt's inks have altered, this analysis has shown that the inks he employed had varying chemical compositions. Not only does this permit us a glimpse into his working procedure, but it also reveals his use of different inks within a composition for the color and tonal gradations they offered.