A head lies under van Gogh’s Patch of Grass

In February 1886, Vincent van Gogh (1853–1890) arrived in Paris. Until then, he had studied only Dutch painting and the work of French Realists, but in Paris, he began to see how the Impressionists handled light and color and treated themes from the town and the countryside. Inspired, van Gogh began to experiment. Because he was perennially low on cash, he often recycled canvases by painting over previous works.

In a recent *AC* paper (DOI 10.1021/ac800965g), Joris Dik of the Delft University of Technology (The Netherlands) and colleagues have teased out the details of a woman’s portrait under van Gogh’s Impressionist-inspired paintings, *Patch of Grass*.

Painting over previous works was not an eccentricity of van Gogh’s; many artists did so, including Pablo Picasso. “If you reveal those hidden layers, you’re looking into the history of that painting. It’s interesting from an art historical point of view, as well as for the conservations, to see what’s below the surface and the condition it is in,” explains Dik.

About one-third of van Gogh’s works have hidden images. Dik and colleagues focused on *Patch of Grass* because they knew from previous analysis that a painting of a woman’s head lay beneath the visible work. They recorded decimeter-scale X-ray fluorescence (XRF) intensity maps that showed the distribution of specific elements in the paint layers. From those data, they could visualize van Gogh’s brushstrokes and details of the woman’s face, such as her eyes, nose, mouth, and chin.

In conventional X-ray radiography—a formerly used analysis technique—absorption of primary X-rays is recorded, but in XRF mapping, the intensity of element-specific secondary radiation (energy emitted by atoms while an energetic X-ray beam scans over the surface) is measured. XRF mapping by Dik and colleagues showed several elemental distributions, most of which belonged to the surface painting. Lead showed a fairly homogeneous distribution, suggesting that van Gogh had placed a lead-based white priming layer over the earlier painting before embarking on *Patch of Grass*.

However, two elements were directly connected by XRF mapping to the painting of the woman—mercury and antimony. “The signals of antimony and mercury were totally obstructed in the regular conventional X-ray image. We didn’t see their distribution [before] because the X-ray absorption image was totally dominated by the lead signal,” explains Dik.

Mercury is associated with vermilion, a red pigment containing mercury sulfide. Not surprisingly, the investigators found the red pigment to be mostly on the lips and cheeks of the woman.

The origin of the antimony was a bit confusing. The investigators thought lead antimonate (Pb₂Sb₂O₇), also known as Naples yellow, was its source, because van Gogh used the pigment frequently during his Dutch years. However, the distribution of lead didn’t match that of antimony.

So the investigators carried out X-ray absorption near-edge structure (XANES), a type of absorption spectroscopy. But the XANES analysis, along with others, confirmed that the antimony did belong to Naples yellow. The researchers think that the pigment had been mixed with zinc white and lead white to produce lighter parts of the painting.

With portable XRF instruments, Dik and colleagues studied a series of women’s portraits van Gogh had painted in The Netherlands from October 1884 to May 1885. The faces of female peasants were all depicted in dark settings. “We saw that the palettes that he used for those paintings were more or less identical to the palette we visualized with XRF mapping on our hidden head,” says Dik.

The image hidden under *Patch of Grass* neatly fits in with the Dutch series of portraits. Letters between the siblings indicate that before his own arrival, van Gogh likely mailed the original painting from The Netherlands to his brother, Theo, in Paris. However, once he was excited by the Impressionists’ work, his older paintings may well have seemed dowdy and dull. With no money for new canvases and bursting with new inspiration, van Gogh one day picked up his tools and, over the dark, brooding head of a Dutch peasant, began to paint a vibrant, Impressionist-style landscape.

—Rajendrani Mukhopadhyay