

New study shows people used natural dyes to color their clothing thousands of years ago

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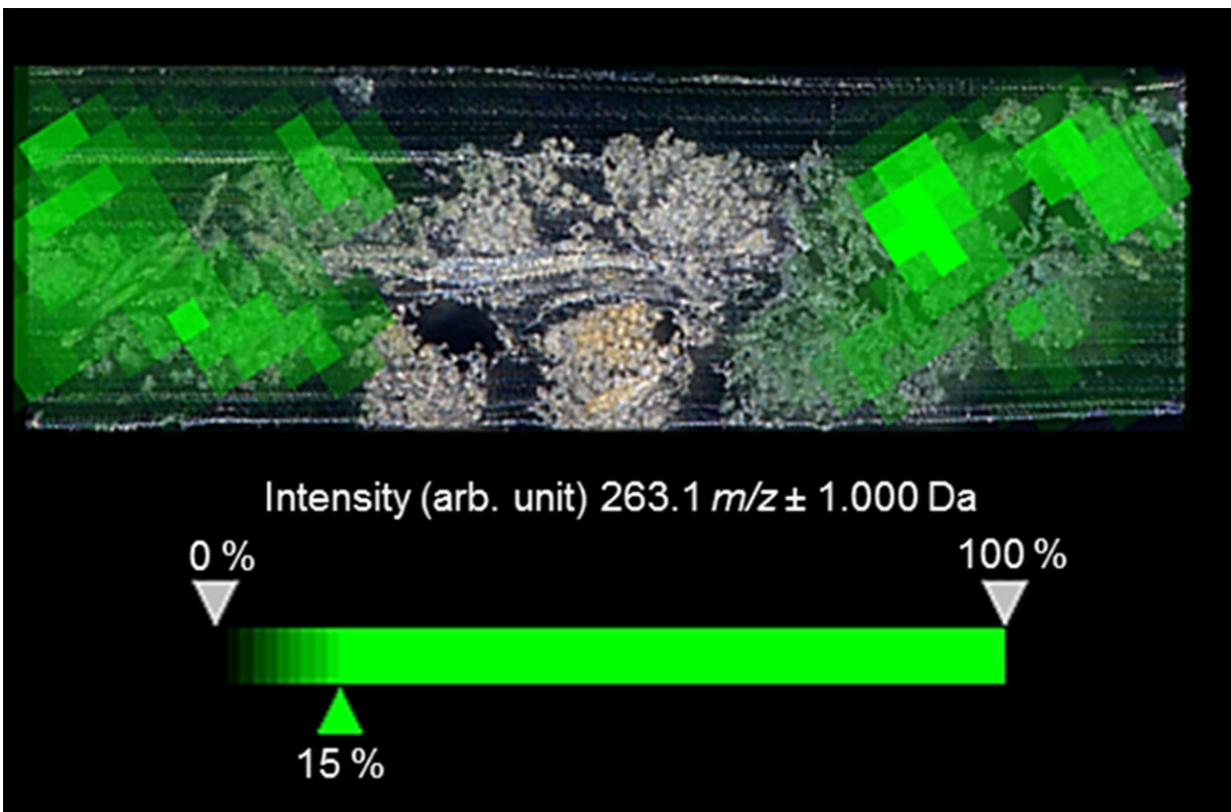
Samples like these were examined by the chemists from MLU. Credit: Annemarie Kramell

Even thousands of years ago, people wore clothing with colourful patterns made from plant and animal-based dyes. Chemists from Martin Luther University Halle-Wittenberg (MLU) have created new analytical methods to examine textiles from China and Peru that are several thousand years old. In the scientific journal *Scientific Reports*, they describe the new method, which can reconstruct the spatial distribution of dyes, and hence the patterns, in textile samples.

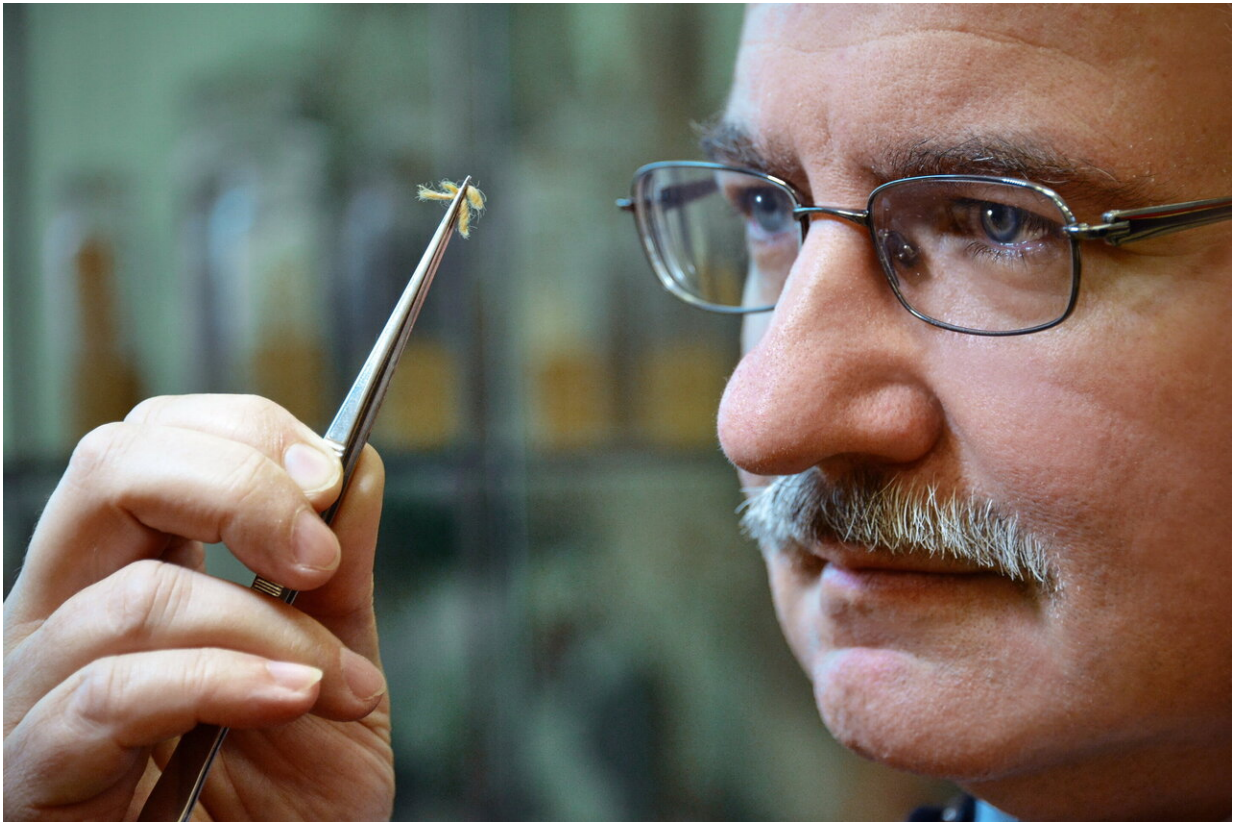
Chemists Dr. Annemarie Kramell and Professor René Csuk from MLU examined two ancient textile samples. One comes from the ancient Chinese city of Niya and was probably once part of a shirt. It is over 2,000 years old. The other [sample](#) comes from Peru and dates back to 1100 to 1400 AD. It was produced by the Ichma people who lived in Peru at that time. Today, there is often little evidence of the colourfulness of such ancient clothing. "Time has not treated them well. What was once colourful is now mostly dirty, grey and brown," says René Csuk. Over time, the natural dyes have decomposed as a result of the effects of light, air and water, explains the chemist. In the past, only natural dyes were used. "The roots of a genus of plants called *Rubia*, for example, were used to create the red colours, and ground walnut shells produced the brown tones," says Annemarie Kramell. Even back then, people mixed individual [materials](#) to create different shades.

The researchers have developed a new analytical [method](#) that allows them to detect which materials were used for which colours. With the aid of modern imaging [mass spectrometry](#), they have succeeded in depicting the dye compositions of historical textile samples as isotopic distributions. Previously, the dyes had to be removed from the textiles. However, that previous method also destroyed the pattern. This new approach enables the chemists from MLU to analyse the dyes directly from the surface of the textile samples. To do this, the piece of material under investigation is first embedded in another material. "The piece is placed in a matrix made up of a material called Technovit7100. Slices

are produced from this material that are only a few micrometres thick. These are then transferred to special slides," explains Csuk. Similar methods are used, for example, in [medical research](#) to examine human tissue. The advantage is that this method can be used to study very complex samples on a micrometre scale. "This enables us to distinguish between two interwoven threads that held originally different colours," says Csuk.



With the help their new method the researchers were able to reconstruct the distribution of the dyes. Credit: Annemarie Kramell



Chemist René Csuk inspecting a textile sample. Credit: MLU / Michael Deutsch

As part of the new study, researchers were able to detect indigo dyes in the samples. However, the method can also be applied to many other dye classes and provides insights into the process of [textile](#) production in past cultures, the two scientists conclude.

The research was funded by the Federal Ministry of Education and Research as part of the project "Silk road fashion: Clothing as a means of communication in the 1st millennium BC, Eastern Central Asia". The Hans Knöll Institute in Jena and Dr. Gerd Hause from MLU's Biocentre were also involved in the project.

More information: Annemarie Elisabeth Kramell et al, Mapping Natural Dyes in Archeological Textiles by Imaging Mass Spectrometry, *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-38706-4](https://doi.org/10.1038/s41598-019-38706-4)

Provided by Martin-Luther-Universität Halle-Wittenberg

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