The Identification of Fibers from a Mummy Bundle, Tarapaca Valley, Chile

Tessa de Alarcon, Elizabeth Drolet, Robin O’Hern and Cindy Lee Scott
Professor Ioanna Kakoulli, Visiting Post-Doctoral Fellow Jenny Hallstrom and Staff Research Associate Vanessa Muros
UCLA/Getty Masters Program in the Conservation of Archaeological and Ethnographic Materials

Analysis and Results

The mummy bundle from which the samples were taken. Image courtesy of the Tarapaca Valley Archaeological Project.

POLARIZED LIGHT MICROSCOPY

In normal light, the waves of light vibrate in multiple directions. In polarized light, a filter causes the light to vibrate in only a single direction. In plane-polarized light some optical features not visible in diffuse light become apparent. Viewing materials under crossed-polar enabling the identification of isotropic and anisotropic materials (McCrone et al., 1978).

Individual fibers were removed from each sample and mounted in Cargille Melmout with a refractive index of 1.539. The samples were examined using an Olympus BX51 polarized light microscope at 10x, 20x, and 50x magnification. Each sample was viewed with transmitted light, in both plane-polarized and crossed-polars, and all diagnostic optical features were noted.

The broken medulla and pigment distribution of Sample 2, which is likely human, are visible in the images to the left.

Sample 5, below, is a camelid fiber, which has a much thicker medulla and very different pigment distribution than Sample 2.

The cross sections of camelids vary because some hairs have no medulla, some have a single medulla and others a double medulla.

The images depict the cross-sections of Sample 3 (above) and Sample 1 (below). The samples appear to be camelid fibers. These images highlight the variability of cross-sectional shapes possible in camelid species. Both the size and shape are considerably different, as are the type of medulla.

Infrared Transform Infrared Spectroscopy (FT-IR) is a useful tool for the identification of organic and inorganic compounds based on their molecular vibrations when exposed to infrared radiation. These vibrations include symmetrical and asymmetrical stretching, bending and scissoring (Infrared Spectroscopy. Theory, 2002).

FT-IR was used primarily to distinguish animal hairs from cellulosic fibers. The presence or absence of amino acids in the spectra was used to differentiate between these two types of fibers.

Identifying the exact species from which the fibers originate was not so easily done. The expected peaks for camelid fibers are very similar to those for human hairs. There is not sufficient additional research currently existing to fully quantify and qualify the differences one might expect to see in trying to identify camelid wool from human hair or to distinguish between llama, alpaca, vicuña and guanaco.

SCALES

Scale casts can provide important morphological information for the identification of a fiber. Scale casts capture the surface arrangement of the scales. Scales are plate-like structures on the exterior of the hair shaft and make up the cuticle of the hair.

Human hairs always have an imbricate pattern. Animal hairs have a wide range of scale patterns and can vary from root to tip (Petraco and Kubic 2003).

Camelids can have a mosaic pattern that is distinct from human hair and an imbricate pattern which is similar to human hair (Appleyard 1978; Petraco and Kubic 2003).

All hairs from the same person have the same cross-sectional shape. The shape of the cross section of an unknown human hair fiber can inform the viewer about the human’s ethnicity.

The cross sections of camelids vary because some hairs have no medulla, some have a single medulla and others a double medulla.

The great variability of form for camelid fibers prevents us from making definitive identifications and the fibers would benefit from further investigation.

Acknowledgements

We would like to thank Vanessa Muros for her assistance locating literature as well as for her numerous demonstrations of sample preparation techniques. Thanks to Isoma Kakoulli for providing us with the in-depth information on the context of the samples as well as for her contributions of additional reference materials and slides. We would also like to thank Professor Kym Faull for his assistance with identifying avenues of future research and analysis.

References Cited


Acknowledgements

We would like to thank Vanessa Muros for her assistance locating literature as well as for her numerous demonstrations of sample preparation techniques. Thanks to Isoma Kakoulli for providing us with the in-depth information on the context of the samples as well as for her contributions of additional reference materials and slides. We would also like to thank Professor Kym Faull for his assistance with identifying avenues of future research and analysis.

References Cited


