

Electron Microscopic Study on the Morphology of Female Mummy's Hair in Chosun Dynasty

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Recently, well preserved medieval mummies have been found in the tombs mainly constructed during the Chosun Dynasty (1392 - 1910). In this study, we tried to add the novel data on the scanning electron microscopic characteristics of the mummified hair collected from newly found female mummy in Paju. The female mummy was found in september, 2002 during the traditional reburial process for the buried ones. 440 year old mummified hair showed very intact appearances during observation with electron microscope. Even in comparison with those of the normal living individuals, the mummified hair could be preserved much better because the scales on the surface of the hair were not damaged. The structures of the cortex, medulla and cuticle were well preserved. The cuticle layer was easily discernable, which are composed of six to seven cuticular cells. And in the cortical layer, many macrofibrils and some melanin granules between them were observed. We observed well preserved rectangular macrofibrils running parallel along the direction of hair shaft. And, melanin granules were identified among the macrofibrils in the cortical layer. As to the cause for the well-preservation of 440 year old hair sample, the presence of surface coat on the hair, which are composed of various materials. As calcium was included in the surface coat in Electron Dispersive X-ray Spectroscopy(EDS), the hardening process of the surface coat by calcium might inhibit the water or fungi infiltration into the hair.

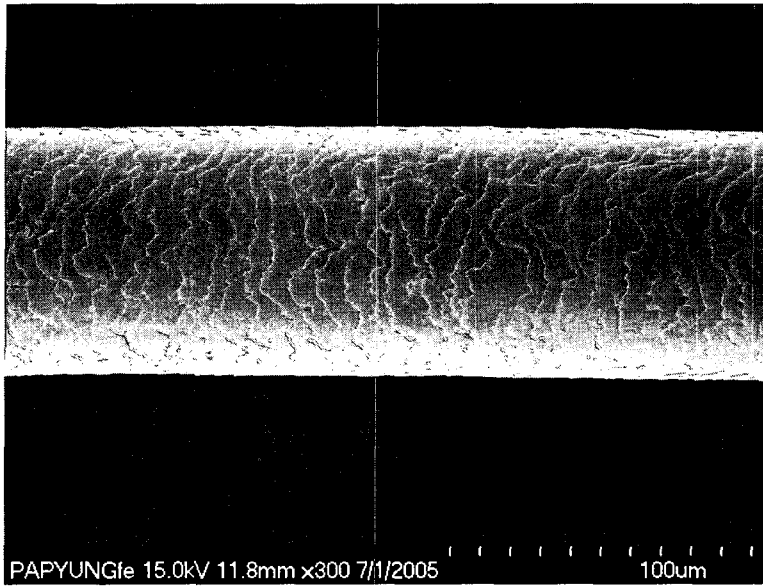


Fig. 1. Scanning electron micrograph of female mummy's hair shaft shows well preservation condition.

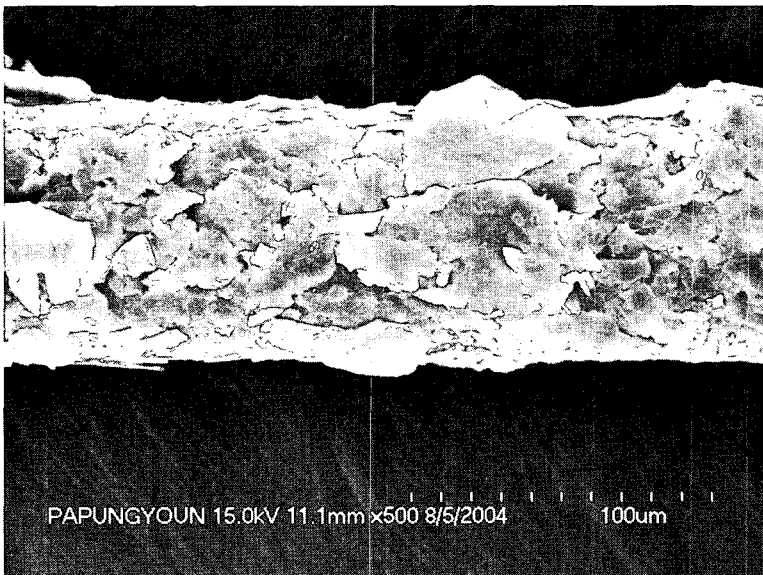


Fig. 2. Scanning electron micrograph of female mummy's hair shaft untreated with ultrasonic cleaner. The surfaces of the scale are coated by thin layer of inorganic materials.

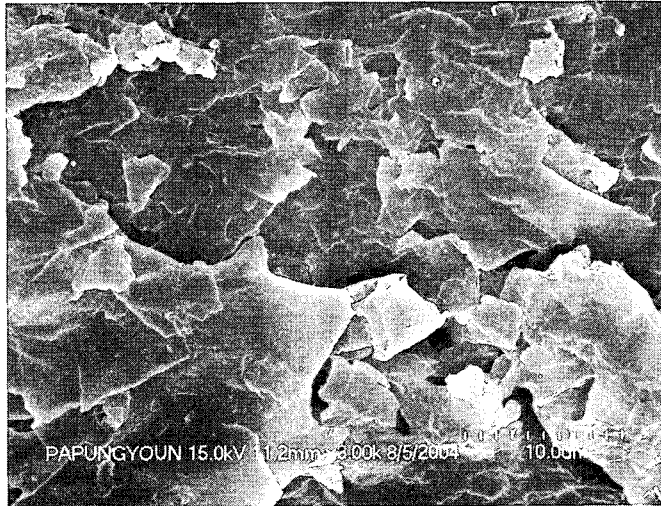


Fig. 3. Magnified images of the hair surface in figure 2. The coated materials are composed of thin layers crystalline like materials.

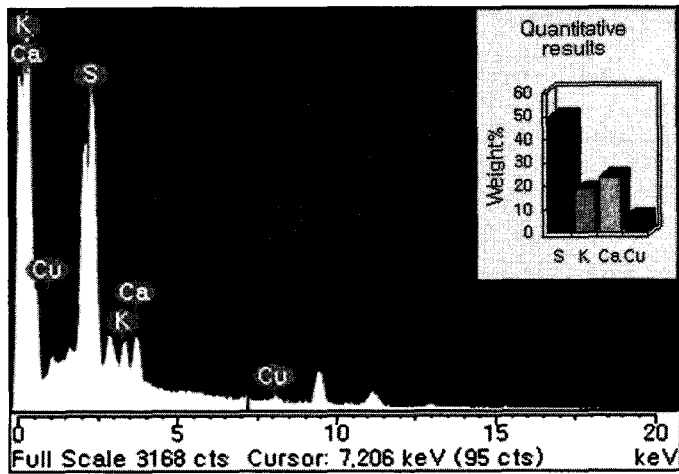


Fig. 4. Electron Dispersive X-ray Spectroscopy (EDS) to analyze the material found in the surface of the hair. Sulfur (S), potassium (K) and calcium (Ca) are detected.



Fig. 5. Scanning electron micrograph of cross section of hair shaft shows well organized cuticle, fully developed cortex, and medulla. Note that the melanin granules scattered exocortex.

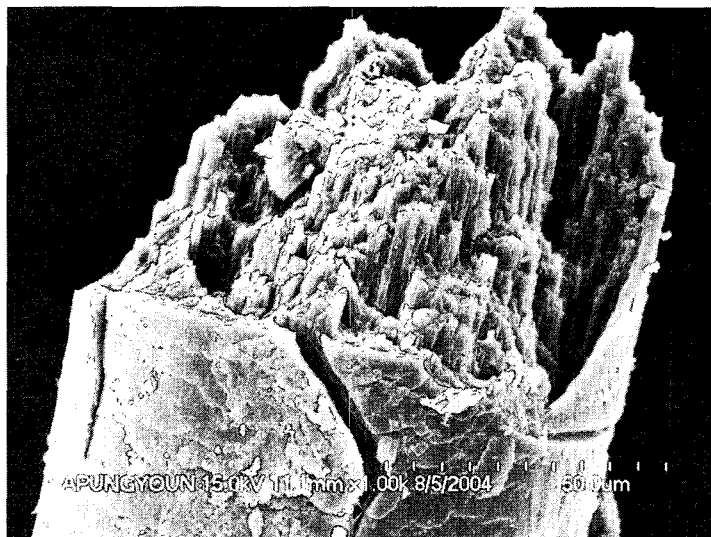


Fig. 6. Scanning electron micrograph of freeze fractured hair shaft shows macrofibrils in the cortex.