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Electron Microscopy Contribution to the Restoration of the Oldest Historical Flag of Entre Ríos, Argentina

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The oldest flag of the Province of Entre Ríos (Argentina) is preserved at the Government House of Entre Ríos, in Paraná City. It was blessed in 1858 and belonged to the Regimiento 1ro de mayo, N°1 de Línea, which escorted President Justo José de Urquiza. Due to the action of different deterioration factors, it was in a very poor state of preservation. On the initiative of the Governor of the Province, it was restored in the first months of this year.

Deterioration of cloth is usually caused by the way in which the object has been exhibited over the years and by the light to which it has been exposed, what makes their materials begin falling apart and losing color. Depending on the damage, specialists apply various conservation and restoration techniques, even specific procedures developed by themselves [1] [2].

With the help of a Desktop SEM, fibers extracted from the flag were studied and their morphology was compared with other textile fibers (Figure 1) and with fiber catalogs. The cloth is made of silk. It presents an intrinsic deterioration factor, characterized by the breakage of polymer chains and the appearance of longitudinal tears, along the fibers, even with loss of material [3].

The "Bookkeeper"deacidification process, which is one of the most widespread and popular non-aqueous deacidification techniques, was developed to neutralize acidity in paper. This process uses microscopic particles of magnesium oxide (MgO) dispersed in an inert fluorocarbon [4]. The average size of a particle is in the order of 1 micron. Its small diameter helps the particles penetrate and attach to the cellulose fibers of the paper, where they act as chemical sponges absorbing, trapping and neutralizing the acid that attacks the material. The impregnation is done by spraying or bathing, the MgO particles are deposited in the paper structure and the inert perfluorinated compound evaporates and disappears [5]. This procedure extends paper useful life from three to five times, therefore verifying whether its effect on textiles would be the same was desiderable. Since it was the first time in Argentina that this procedure was applied to a historical textile, it was also interesting to verify that no alterations in the flag cloth were introduced by the process.

This checking was carried out by taking samples of the white and blue cloths, before and after the procedure, and observing them through the SEM. It was found that with the use of Bookkeeper (BK) there were no morphological alterations in fibers neither were foreign elements added to the tissue (Figure 2). Although this first analysis yielded good results, further continuity on this evaluation was estimated as necessary before applying the procedure to the whole flag cloth.

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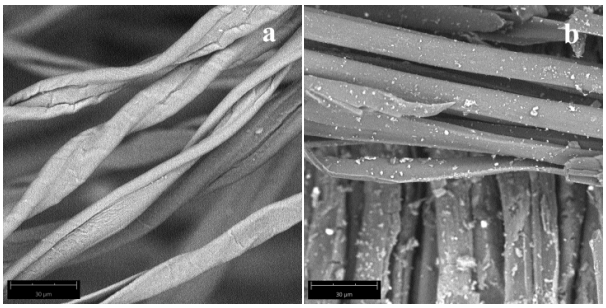

Figure 1: Comparison between cotton (a) and silk (b) fibers. Curled shape of the cotton fibers and more regular section of the silk are observed. (SEM Phenom Pro, 5 KV and 10 KV, Charge Reduction Holder)

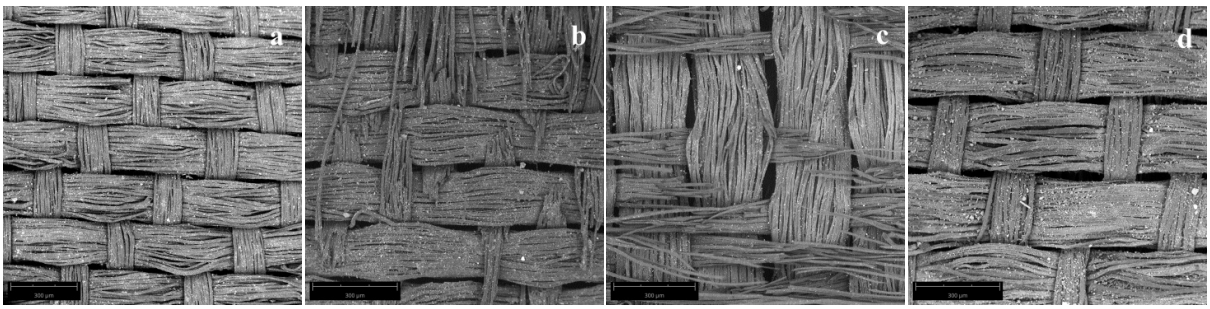

Figure 2: Flag cloth: white sector before applying BK (a), white sector after applying BK (b), blue sector before applying BK (c) and blue sector after applying BK (d). (SEM Phenom Pro, 5 KV and 10 KV, Charge Reduction Holder)

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