



### **B105 Removal of Calcareous Deposits From Firearms Artifacts From the Fetterman Battlefield Site**

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After attending this presentation, attendees will learn how to remove calcareous deposits from firearms evidence recovered from semi-arid environments.

This presentation will impact the forensic community and/or humanity by presenting to the forensic science community a method for successfully cleaning metallic artifacts (e.g. bullets and cartridge cases) preparatory to microscopical examination.

A variety of firearms-related artifacts were recovered from the site of the 1866 Fetterman Battle, which occurred in what is now northern Wyoming. These artifacts include expended cartridge cases and bullets representing from three models of Spencer repeating carbines, .58 cal. Springfield rifled muskets, and expended percussion caps from .58 cal. Springfield rifled muskets, and bullets fired from a variety of pistols. A preliminary examination of the artifacts revealed that almost all were heavily coated with calcium carbonate deposits that would interfere with microscopic comparisons of firing pin impressions and rifling marks. It was therefore necessary to develop a method for cleaning these artifacts that would not damage the microscopic details on the surfaces of the artifacts. Ultrasonification was rejected because of the brittle condition of many of the copper cartridges. Therefore chemical cleaning methods were considered. Two commercial products designed for the removal of lime deposits from cooking ware were tested: CLR (Jelmar, Skokie, IL) and Lime-A-Way (Reckitt Benckiser, Inc., Parsippany, NJ). These products are widely available in hardware and grocery stores. A 10% (w/v) aqueous solution of sodium metaphosphate was also tested. Museum conservators recommend the use of sodium metaphosphate solutions for removal of calcareous deposits from metal artifacts such as coins.

Eighteen expended Spencer cartridges recovered from an area southwest of the battle site (and hence not believed to have been fired during the battle) were selected for a comparison of the three cleaning solutions. The cartridges were randomly divided into three groups of six cartridges each. The base, including the firing pin impression, of each cartridge was photographed prior to cleaning. Each cartridge was treated in the following manner: (1) the base of the cartridge was gently swabbed with a cotton-tipped applicator saturated with one of the cleaning solutions until it appeared that no more calcareous deposit was being removed; (2) the base of the cartridge was then rinsed with water and acetone; and (3) a thin layer of paste wax was then applied to the base of the cartridge to prevent further corrosion. The cartridges were then photographed as described above. The photographs of each cartridge were compared before and after treatment to assess the degree of removal of the calcareous deposits.

None of the cleaning solutions appeared to damage the microscopic detail of the firing pin impressions. Lime-A-Way was found to work the best in cleaning the cartridges: it worked the fastest and removed calcareous deposits best from the microscopic features of the firing pin impressions. CLR did not remove all of the calcareous deposits from the microscopic features of the firing pin impressions. CLR is more expensive per unit volume than Lime-A-Way. Sodium metaphosphate did not perform satisfactorily, in that it left significant amounts of deposits in the firing pin impressions.

**Firearms, Archaeology, Microscopy**