Recovery of fingermarks from fired and unfired cartridge cases

Fingermarks present at crime scenes can be successfully used by forensic examiners to identify possible offenders. There are a lot of techniques designed to develop fingermarks on a wide variety of surfaces and the market nowadays offers a considerable range of chemicals and light sources to do so. Nevertheless, some evidences and specific situations remain difficult, with no consensus about the best enhancement method to be applied. Fired cartridge cases are good examples of such challenging surfaces. These small evidences are frequently left by murderers at crime scenes, but only a few cases of positive identification of suspects based on fingermarks recovered from cartridge cases were reported in the literature. This low identification rate is probably associated to the nature of the evidence itself and to the lack of standard operational procedure for its processing by forensic experts. Cartridge cases have small surface areas and fingermarks resulting from handling are generally damaged during the whole process of loading the gun, firing and extracting the cases, which fall onto the ground and remain exposed to the environmental conditions. Although damage inherent to fired cartridge cases cannot be avoided, it is possible to establish best practices when processing this kind of evidence.

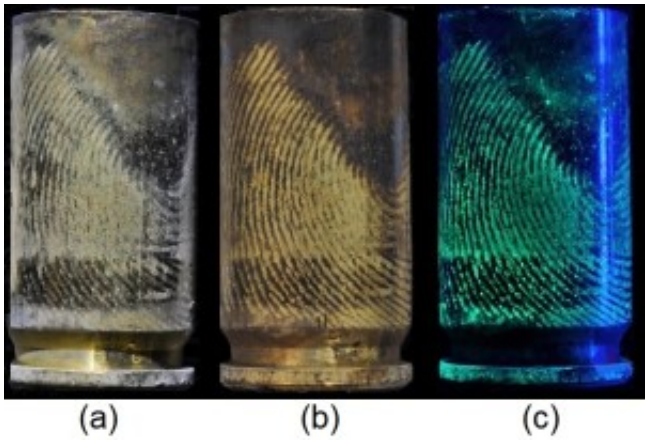

Fig. 1. Application of the suggested sequence of developers to a single fired cartridge case, photographed after (a) cyanoacrylate fuming, (b) gun blue solution dipping, and (c) fluorescent dying.

Aiming to establish best procedures for fingermarks' detection from such surfaces, seven practical developers were tested under the same conditions. The tests have been performed in a large number of samples consisting of fired and unfired brass cartridge cases and also of brass discs. Fingermarks deposited on these samples were developed by all the tested techniques after three different periods of time: 24 hours, 7 days and 14 days, considered reasonable when compared to real cases. The developed fingermarks were evaluated following an objective grading scale and the

best results were obtained using the sequence: cyanoacrylate fuming + gun blue solution dipping + fluorescent dying. These three techniques are compatible and require different lighting sources, increasing the probability of obtaining good friction ridge details. Moreover, both reagents are not expensive, are easy to use and thus can be employed by any forensic laboratory and police station. The authors believe that the application of the sequence described above by law enforcement agencies will increase the statistics of identification of suspects based on fired cartridge cases.

Figure 1 displays the sequential application of these developers to a single fired cartridge case. It is possible to see the enhancement produced after each step, resulting in more visible details that can be used for comparison and identification of the source (suspect). Sometimes ridge details developed by a previous technique can be lost by the application of the subsequent technique. For this reason, this work suggests photographing the samples periodically after each step in order to ensure that good details will be properly recorded.

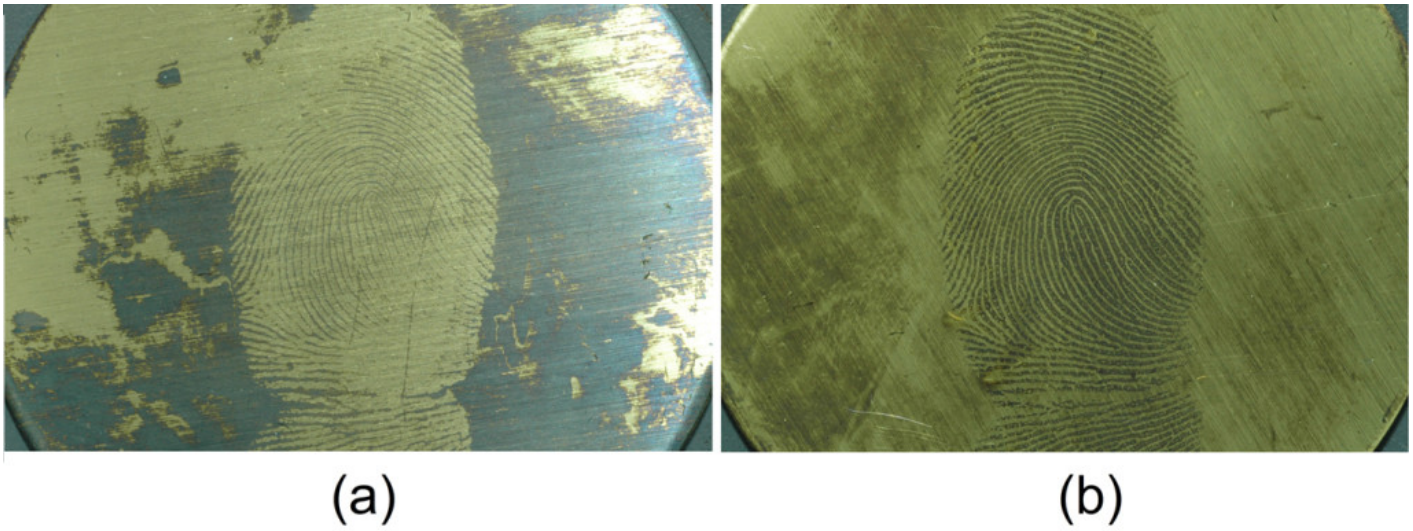

Fig. 2. (a) Regular development by gun blue on brass disc heated up to 63°C; (b) Reverse development by gun blue on brass disc heated up to 200°C.

An unexpected phenomenon was observed for fingermarks developed by gun blue in brass discs that were heated up to 200°C. Instead of presenting regular development, with clear lines in a dark background, a reverse development has occurred, with dark lines over a clear background. Both regular and reverse developments are shown in Figure 2. The mechanisms responsible for such behavior are not well understood until now, but the authors believe that this finding can be useful. Perhaps the pattern (regular or reversed) exhibited by a fingermark developed on metallic surfaces using gun blue solution can indicate whether the surface was touched before or after eventual heating. For instance, one could state the moment when the suspect was at an arson scene,

before or after fire, representing valuable information to be used by prosecutors and lawyers in courts.

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Publication

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