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Crayon Obliteration over Ballpoint Pen Writing

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ABSTRACT: A procedure based on solvent washing with ultrasonic bath was developed for restoration of a document with crayon wax obliterations. Several tests were performed in order to find the optimum solvents and experimental conditions. The method developed produced acceptable results.

KEYWORDS: questioned documents, crayon obliteration, obliterations, document restoration

Obliterations in questioned documents face the expert with the problem of analyzing something concealed by different types of materials, including ink, correction fluid and pencil, among others [*1–4*]. Most common we found obliterations of ballpoint ink covered with ballpoint ink.

A case was submitted to the Questioned Documents Section of the Puerto Rico Institute of Forensic Sciences in which all the lines of one side of a two sided handwritten letter made in ballpoint blue ink were obliterated by red and black wax crayon. The paper was school notebook paper and the ink was ball point pen ink.

Transmitted light and video scanner did little to help in deciphering the message. Microscopic examination (45×) revealed only small portions of the underwriting. The need of a method for removal of the crayon material from the document was evident. The efforts to physically remove the wax by gentle scratching with a scalpel blade were not successful. Most wax was removed but the writing was still not legible. Additional or more forceful scratching damaged the paper.

Organic solvents appeared to be the best alternative as crayons are essentially made of wax (a material with high organic content). Experiments were conducted to find an organic solvent which do not affect the ink nor the paper.

A standard procedure that could be easily applied and reproduced was also established.

Experimental

Nine different types of writing instruments were used. These are known by the commercial trademarks as: Niji Cera—Ball II, Zebra Lite Rite, Rabbit Ball Pen, Bic Roller, Pilot Razor Point, Pilot Permanent, Berol Fontaine, Kilométrico, and Pilot Precise Rolling Ball. Eight solvents were selected for testing: hexane, petroleum-ether, toluene, chloroform, acetonitrile, dibutyl phthalate, 1,2-dichloroethane and methanol.

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In order to test how the solvents would affect the chosen inks, a piece of paper over which something was written was submerged in the solvent. A fresh piece of paper was prepared for each test. Each paper was used only once in the course of the experiments. Once the solvents that do not affect the inks were identified additional experiments were conducted with pieces of paper prepared in the way described but with the word covered with crayon wax. The procedure of simple immersion of the pieces of paper into the solvent did not show the expected results: the crayon did not readily dissolve. Vibration in ultrasonic bath provided better results.

A preliminary experiment was performed with a dummy document using the method to be used on the original. The document submitted for examination was photographed and successfully treated by this method. The underlying writing was adequately visible for both deciphering the message and comparing the handwriting.

Results and Discussion

The variety of inks were chosen in order to have representation of different types of commercial inks available. Since chemical composition of different inks vary, it was necessary to test the effect of each solvent over each type of ink. Pieces of paper with writing on each type of ink were separately submerged in each solvent. Solvents were chosen through a range of polarity among the organic solvents which promised to dissolve the organic material of the crayons. Table 1 shows the results of this test. Those results show that hexane, toluene and petroleum ether do not affect to a great extent the nine inks tested. The solvents that showed this tendency were the less polar solvents of the group used. Those that are relatively polar make the inks fade presumptly because the materials of which the inks are composed are of polar character. The paper used in the experiments resisted all types of solvents. This fact restricts the selection of the solvent to those that do not affect the inks. Thus hexane, petroleum ether and toluene were chosen to conduct experiments directed in finding a procedure to wash the crayon material from documents.

In order to perform the second part of this experiment, pieces of paper were prepared, as described for the ink test, but with the written word obliterated by crayon. Submersion of the papers in the solvent did not remove the crayon material. This fact suggested the need of some mechanical action over the obliterated paper. Agitation of the paper submerged into the solvent or rubbing the paper with a cleaning tissue dampened by the

TABLE 1—*Effect of solvents on several inks.*

Writing Instruments	Hex	PEth	Tol	Chlo	Acn	DPth	Dich	Met
Niji Cera—Ball II	NA	NA	NA	NA	A	NA	NA	A
Zebra Lite Rite	NA	NA	NA	A	A	NA	A	A
Rabbit Ball Pen	NA	NA	NA	A	A	A	A	A
Bic Roller	NA	NA	NA	NA	NA	NA	NA	NA
Pilot Razor Point	NA	NA	NA	NA	NA	NA	NA	A
Pilot Permanent	NA	NA	NA	A	A	A	A	A
Berol Fontaine	NA	NA	NA	NA	NA	NA	NA	NA
Kilométrico	NA	NA	NA	A	A	NA	A	A
Pilot Precise Rolling Ball	NA	NA	NA	NA	NA	NA	NA	A

NA: Not Affected Hex = Hexane; PEth = Petroleum Ether; Tol = Toluene; Chlo = Chloroform.

A: Affected Acn = Acetonitrile; DPth = Dibutyl Phthalate; Dich = 1,2-Dichloroethane; Met = Methanol.

solvent did not remove the material completely and caused extreme handling of the document. Application of the ultrasonic power to the document immersed in the liquid allowed the removal of the crayon material to a great extent without damaging the ink nor the paper. The amount of solvent used with this approach depends on the size of the document and/or the beaker. The document submitted to this treatment must be completely submerged into the liquid. The time must be determined while the ultrasonic power is applied to the system by observing when the material was removed from the paper. The intense mechanical vibrations produced by the ultrasonic bath help in the dissolution of the crayon wax. After removal of the document from the beaker the solvent evaporates in two or three minutes leaving the document free of crayon wax to a great extent and without damage or alteration of the writing and paper.

Photographs of a document before and after the treatment are shown on Figs. 1 and 2. Photographs are not of the actual document described herein as case is still in adjudication at the time of writing this paper.

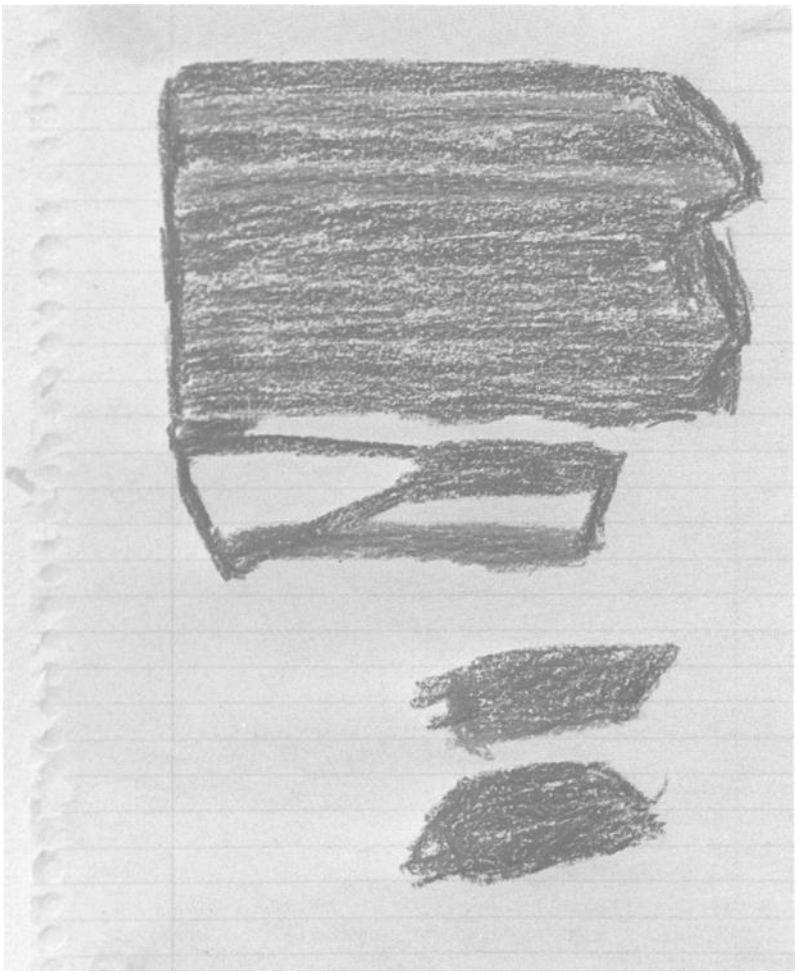

FIG. 1—*Photograph of the document as received in the Questioned Documents Section.*

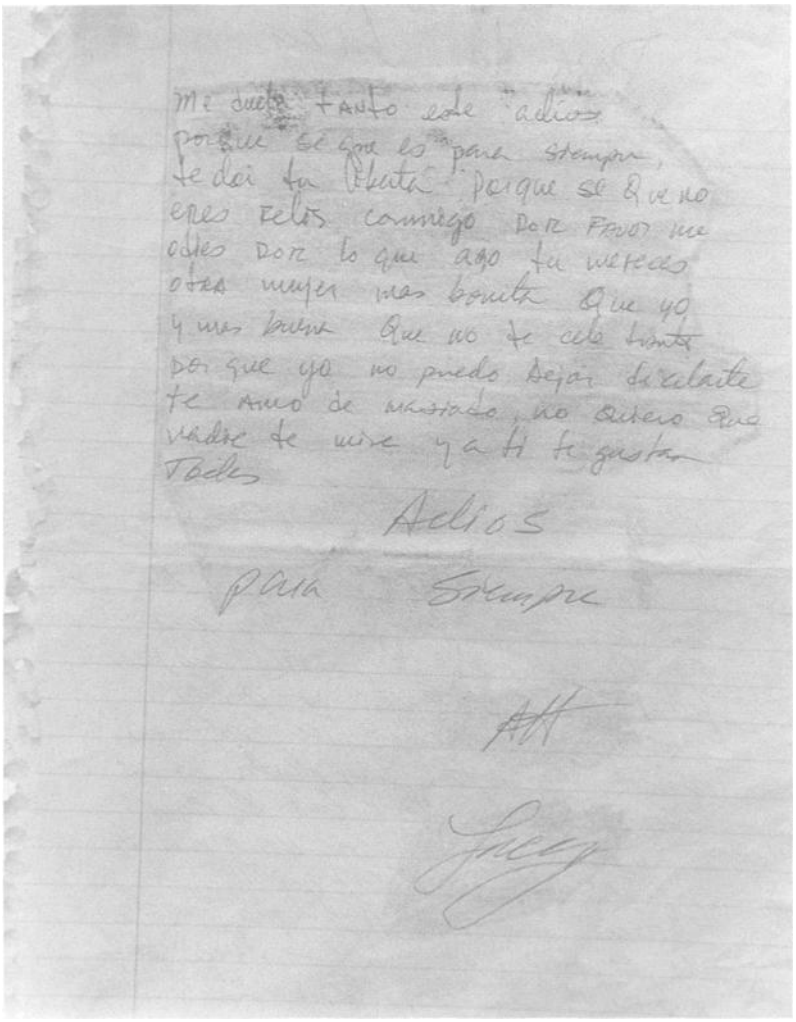

FIG. 2—*Photograph of the document after the treatment.*

Conclusions

A method was developed that allows removal of crayon material from a document. It is based on solvent washing in an ultrasonic bath. The procedure showed to be highly efficient and innocuous to the document. To our knowledge there is only another case of crayon obliteration reported [5].

Parker described the use of heat for removal of greasepen material from checks. This procedure is inadequate for our case because a larger area has to be treated. For this reason, it was not considered an alternative for restoration of the document.

The method described in this paper presents the first chemical procedure developed for restoration of such alteration.

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References

[1] Waggoner, L. R., "Examination of Correction Fluid Obliterations," *Journal of Forensic Sciences*, Vol. 32, No. 2, March 1987, pp. 539–542.
[2] Gupta, S. K. and Chowdhry, R., "Decipherment of Obliterations by Chemical Methods," *Journal of the Indian Academy of Forensic Sciences*, Vol. 13, No. 1, 1974, pp. 25–28.
[3] Waggoner, L. R. and Spradlin, W. B., "Obliterated Writing—An Unconventional Approach," *Journal of Forensic Sciences*, Vol. 28, No. 3, July 1983, pp. 686–691.
[4] Lyter, A. H., "Obliterations—When All Else Fails," presented at the combined meeting of the American Society of Questioned Document Examiners and the South Western Association of Forensic Document Examiners, Denver, Colorado, Sept. 1988.
[5] Parker, J. L., "Deciphering Greasepen Obliterations," presented at the Annual Meeting of the American Society of Questioned Document Examiners, Savannah, Georgia, 21–25 Sept. 1986.

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