CASE REPORT

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The Matching of Automotive Paint Chips by Surface Striation Alignment

REFERENCE: VanHoven, H. A. and Fraysier, H. D., **"The Matching of Automotive Paint Chips by Surface Striation Alignment,"** *Journal of Forensic Sciences*, JFSCA, Vol. 28, No. 2, April 1983, pp. 463-467.

ABSTRACT: The technique of physical comparison for paint chips by the characteristics of their physical alignment is common practice. Sometimes, however, the examiner may find only a small unremarkable area of physical alignment between paint chips. It is important in such cases to use some additional method or methods that will affect a more scientific proof of identity. This paper describes two interesting cases in which automotive paint chips are matched by the alignment of their surface scratches (striations).

KEYWORDS: forensic science, paints, striations, alignment, individual characteristics, scratches

Individual characteristics include structure or combinations of structure that are unique, distinctive, and random in nature. These characteristics normally result from wear, devices used in the manufacturing process, and grinding or polishing. This type of structure analysis has already been done in relation to toolmarks by Burd [*1,2*] and more recently by Cassidy [*3*]. Firearms is another area in which this type of analysis has been done as Townshend [*4*] and Judd [*5*] have reported. A more recent area in which the examination of striations as individual characteristics has been explored is in glass analysis, which has been done in our laboratory and by VonBremen [*6*] and Thornton [*7*]. Another area in which the examination of striations should not be overlooked is the analysis of paint chips.

Automotive paint chip analysis is an examination frequently performed in forensic science work, since the transfer of paint occurs in a variety of cases from burglary to hit-and-run accidents. Because of the unique makeup of color and layers of different combinations, the chemical and physical characteristics of paint have been extensively studied [*8-13*]. The aligning of fractured edges is commonly done, but on occasion this procedure is not sufficient when only an unremarkable short area of alignment exists.

The topcoat layer of automotive paint is fairly hard and resilient, yet it receives minute scratches when coming in contact with other surfaces. From the time the paint finish is applied, scratches are formed resulting from waxing or polishing, extreme weather or road conditions, and even by contact with clothing. These scratches or striations are unique and in-

Received for publication 2 April 1982; accepted for publication 16 Aug. 1982

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dividual to the particular paint surface. When the surface fractures, these individual characteristics can subsequently be examined and aligned. Two cases are presented in which automotive paint chips are matched by the alignment of their surface scratches (striations).

Experimental Procedure

Paint chips in two recent cases were examined with a Leitz comparison microscope using fiber optic illumination in the absence of room lights. A shallow grazing angle of light was used as the light was raised and lowered until striations were found. The samples were initially examined with a 80-mm objective and, once striations were observed, the objective was changed to 50 mm. A magnification of ×36 was found to provide adequate field coverage to align sufficient striations; further magnification or enlargement may be desirable for presentation. The microscope was equipped with a Polaroid® camera with a Graflok® back. In both cases Polariod Polacolor and 55 positive/negative (P/N) film was used, although a faster film would allow for shorter exposure time.

Case 1

An individual was struck and killed in a hit-and-run accident. Inside the body bag a small paint chip with adhered fiberglass was located. Subsequently a vehicle was apprehended and the damaged fender portion examined. Although the paint chip from the body bag generally fit in a reconstruction of the fender, only a small area on one side of the paint chip retained enough topcoat paint for alignment with the fender (Fig. 1).

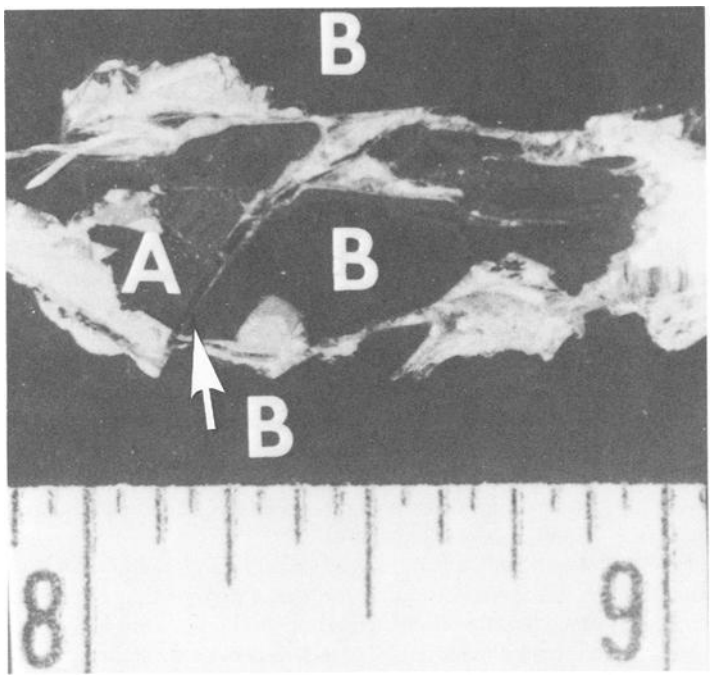

FIG. 1—*Photograph of paint chip* A *from the victim's body bag aligned in a reconstruction of fender portions from the suspect vehicle* B. *Arrow indicates the area of observed surface striations (Monroe County Public Safety Laboratory [MCPSL] Negative 1813-82). Scale is* × *2 1/4. 1 in.* = *25.4 mm.*

Case 2

A vehicle was struck by a bullet resulting in a hole and some missing paint on one fender. Paint chips from the suspected scene were recovered and a correlation between vehicle and scene was requested. A paint chip was found to align with the damaged fender area in a small smooth area only (Fig. 2).

Results

The initial effort in Cases 1 and 2 was to align the contour of the paint chips with each other. Because of the relatively small areas for comparison, the results were unremarkable enough for confirmation; however, while manipulating the illumination, minute striations were observable. It must be stressed that the correct angle of illumination is essential to the observation of these faint scratches. Considerable time was spent in each case adjusting the fiber optic illuminators at a low grazing angle. The angle will vary with the depth and angle of the striations as well as the surface color and texture of the paint. In some cases, the lights must be raised almost to the microscope objective. In Case 1, the photograph of aligned striations (Fig. 3) on a blue metallic paint surface required a 4-min exposure using 55 P/N film with an f-stop of f/8 and a 50-mm objective. This gave a photograph of fairly good contrast, showing metallic content as well as matching scratches. In Case 2, the photograph of aligned striations (Fig. 4) on a white nonmetallic paint surface required a 10-min exposure using 55 P/N film with an f-stop of f/5.6 and a 50-mm objective. Case 2 required two-and-one-half times the exposure with a larger f-stop opening, yet the film was still slightly underexposed as a result of the location of

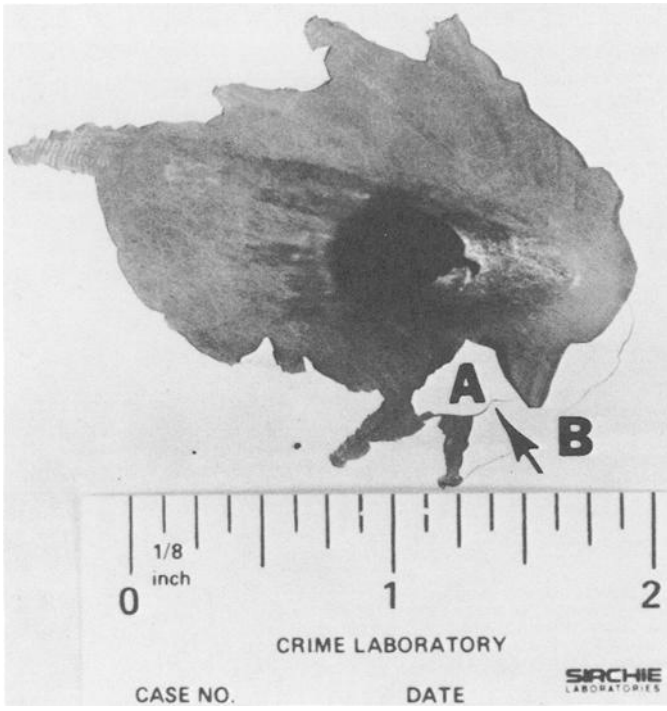

FIG. 2—*Photograph of paint chip* A *from the scene aligned along a portion of one edge with the paint on the fender of the victim's vehicle* B. *Arrow indicates the area of observed surface striations (MCPSL Negative 1844-82). Scale is* ×5. *1 in.* = *25.4 mm.*

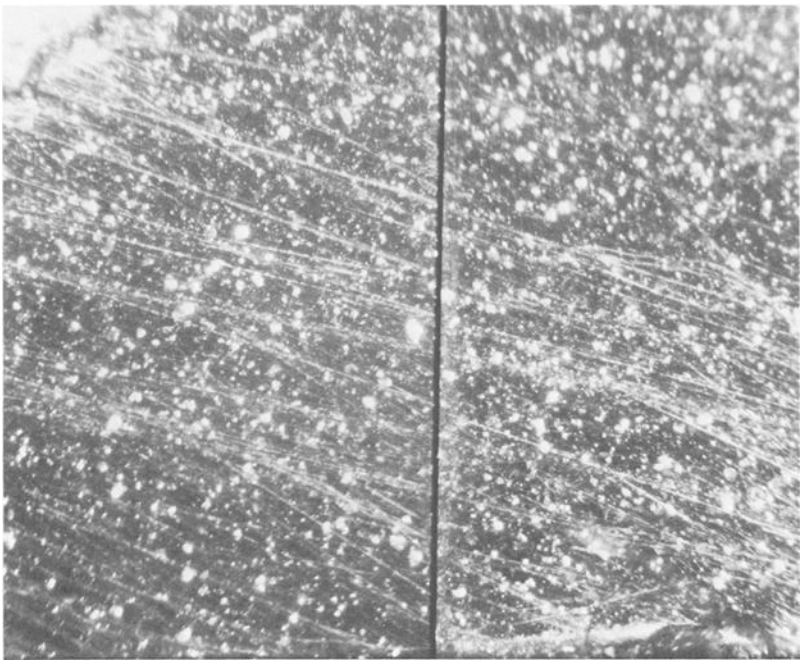

FIG. 3—*Comparison photomicrograph of matching surface striations on paint chips from the suspect vehicle fender* (left) *and from the victim's body bag* (right) *(MCPSL Negative 1815-81). Scale is* ×72.

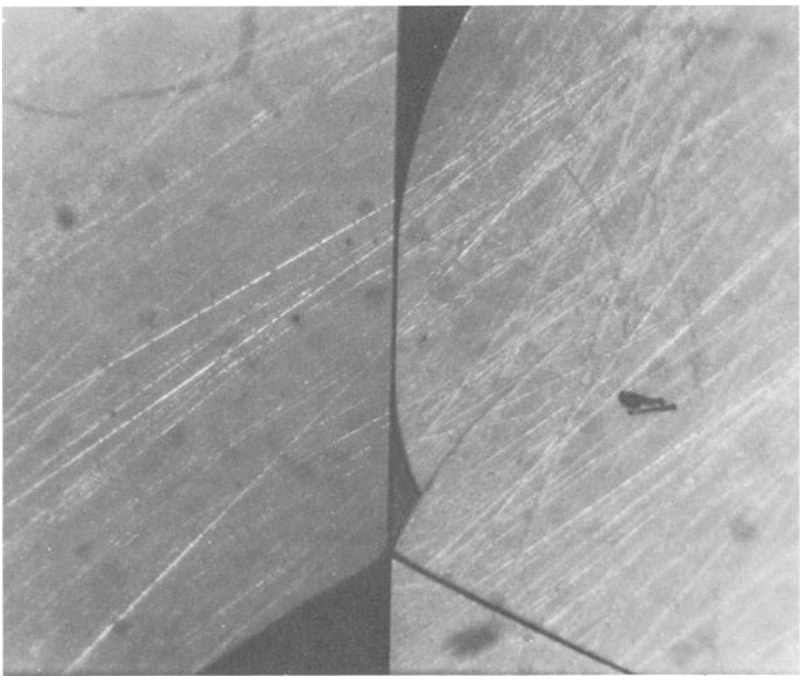

FIG. 4—*Comparison photomicrograph of matching surface striations on paint chips from the scene* (left) *and from the fender of the victim's vehicle* (right) *(MCPSL Negative 1846-81). Scale is* ×72.

the lights required to observe surface striations. Although low angle light levels make the photography more difficult, the matches are readily observable optically.

Conclusion

It can be proved by careful examination of paint chip surfaces for minute striation that two paints chips thought to have the same source in fact do have the same source. This can shift the conclusion from one of class similarities to one of individual characterization. It should be noted that the same careful examination of surfaces can turn up individual characteristics caused by rust or stain patterns, pitting, or other faint artifacts on not only paint chips, but glass, plastic, or a variety of comparative surfaces. These other artifacts are often found on the botton of the paint chip and can aid in the initial alignment.

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