Journal of Criminal Law and Criminology

Volume 50
Issue 3 *September-October*

Article 18

Fall 1959

# Illustrating the Fit of Glass Fragments

Donald F. Nelson

# ILLUSTRATING THE FIT OF GLASS FRAGMENTS

DONALD F. NELSON

Donald F. Nelson, M.Sc. is a chemist on the staff of the Dunedin Branch of the Dominion Laboratory, New Zealand and is at present Acting Government Analyst, Dunedin. Mr. Nelson joined the laboratory staff in 1940 and has spent most of his service in the Dunedin Branch Laboratory where he is engaged in laboratory problems for the Departments of Health and Police. Many of his duties during the last few years have included problems in the field of toxicology and forensic investigation.—EDITOR.

The evidential value of glass fragments in the investigation of crime is well known. The most conclusive evidence of source of a piece of broken glass is an exact fit with a broken edge or surface of the original.

As has been stated by Kirk (1) and O'Hara and Osterburg (2), it is usually difficult to see when pieces match exactly and, hence, to demonstrate the fit in court. If there is a pattern cast into the glass it may be possible to match the pattern independently of the edge matches. An example of this is described by Edlin (3) where striations on two pieces of headlamp glass matched perfectly across the fractured edges. These striations were no doubt due to tool marks which had been left on the moulds in which the headlamp glasses were cast.

O'Hara and Osterburg point out that the break is often along clear straight lines with no characteristic curves evident. The common fracture is most evident in the cross-sectional view in which each surface will have characteristic curves called rib marks. In such cases O'Hara and Osterburg recommend photographing the broken fragments in turn with the cross-section parallel to the lens of the camera, using oblique lighting. Enlarged transparencies are then prepared. By placing one transparency over the other in the proper position it is possible to superimpose the characteristic curves so that they coincide. This is suitable for demonstration in court.

Where a small flake has separated from a larger piece of glass, e.g. window or headlamp, this method cannot readily be used because the surface which matches is often convex on the chip and concave on the original glass. Photographing these surfaces in the chip and the original by lighting and focussing in comparable manner may make it very difficult to prepare convincing transparencies.

Radley (4) describes a technique used by Thompson, where the flake and the parent glass are photographed with oblique lighting. Instead of superimposing transparencies, prints are placed side by side for comparison. This technique, however, poses the same difficulties of lighting and focussing as the method of O'Hara and Osterburg.

Stapleton (5) has described a method for illustrating the fit of such small pieces of glass. He recommends casting the hollow from which the chip is thought to have separated with Negocoll.[1] The casting is then compared with the chip. Photographs of the casting and the chip can be used to illustrate the agreement in court.

The method here suggested for illustrating the fit of a flake of glass in the hollow from which it was broken is based on the following. When small chips of glass are examined under the microscope two types of lines can usually be observed:

a. Rib marks: curved "oyster shell" striations.
b. Hackle marks: straight or slightly curved lines approximately at right angles to the rib marks.

Owing to the usually curved profile of the rib marks, their appearance under the microscope is variable, depending on the illumination. This causes difficulties in microscopical comparison and, also, the difficulty of photography in the methods mentioned above. On the other hand, the hackle marks usually have an angular profile, and their appearance under the microscope is much less dependent on the illumination. They generally appear as lines, clearly defined in position and length.

When a convex chip is placed in its correct position in the hollow from which it was broken and the broken surface is viewed under the microscope through the chip, although the rib marks are

[1] "Negocoll" is a commercial agar preparation used for moulage. O'Hara and Osterburg (p. 134) discuss the composition and use of similar preparations given in the literature.

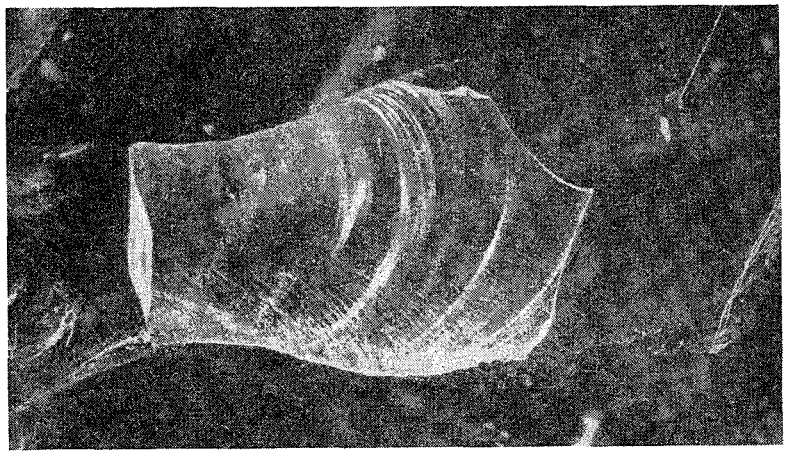

*Figure 1*

Chip in position on parent glass. Magnification eight times.

hard to define, or are actually invisible, the hackle marks usually stand out clearly. If the chip is slightly displaced the hackle marks may be observed in duplicate, i.e. the hackle marks in both the chip and the parent glass may be observed and compared side by side. There are generally dozens, often hundreds, of these lines which agree in position and length.

Photomicrographs of hackle marks taken when such a chip is (a) exactly in position on its parent glass and (b) slightly displaced, may be used in court to illustrate the way in which the glass has been studied and to demonstrate why the chip must have come from a particular piece of glass.

This method was used successfully in a recent "hit-and-run" prosecution in Dunedin. At the scene of the accident a large quantity of broken headlamp glass was recovered. These broken pieces were assembled on plasticine and found to be almost the whole of a "Ford Twolite Headlamp." The unbroken headlamp of a suspected motor car was also a "Ford Twolite Headlamp." From behind the reflector in the broken headlamp of this motor car were removed two small flakes of glass about ⅜ inch long. These flakes both fitted exactly into the rear surface of one of the pieces from the middle of the broken headlamp.

In figure 1, one chip is shown lying exactly in position on its parent glass, photographed with oblique lighting. Rib marks and hackle marks may be seen on the chip. In figure 2, part of the chip near the upper edge is shown as seen under the microscope with transmitted light when the hackle marks on the underside of the chip are focussed. In figure 3, the chip is slightly displaced, so that the hackle marks may be seen duplicated. The

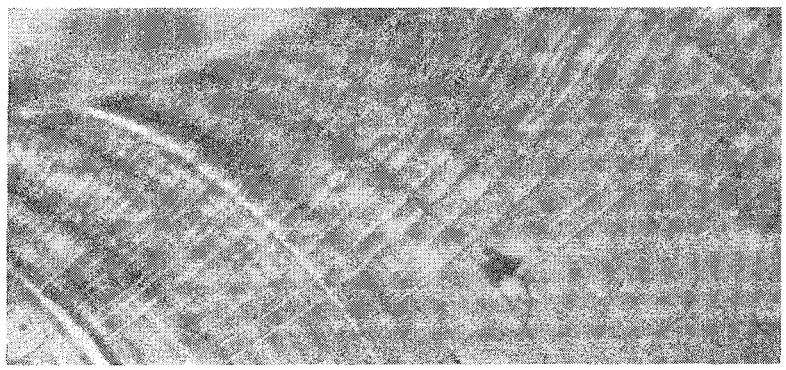

*Figure 2*

Part of chip when exactly in position showing hackle marks. Magnification ninety times.

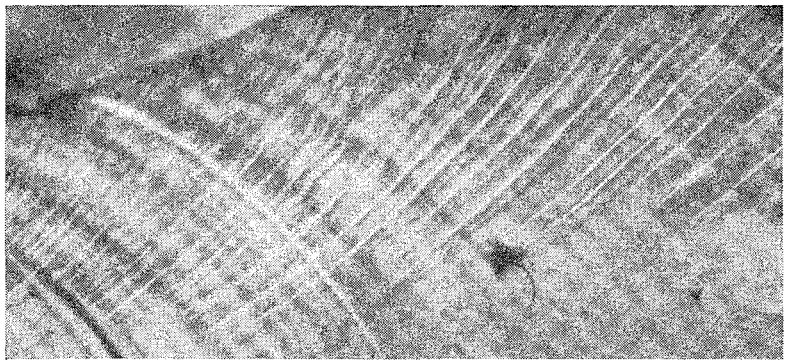

*Figure 3*

Same part of chip as in figure 2 but slightly displaced to show duplication of hackle marks. Magnification ninety times.

xtraneous dirt and dust common to both plates and 3 show that this duplication of the hackle narks is not due to camera shake. A suggestion hat the duplicate hackle marks are merely hadows of the marks on the chip may be countered y a further photograph showing the two sets of narks skew rather than parallel.

## Summary

When it is required to demonstrate how a flake f glass fits exactly into the original glass from hich it was broken, it is recommended that hotographs be prepared showing hackle marks a) when the flake is exactly in its original position nd (b) when the flake is slightly displaced.

## Acknowledgments

I thank Miss V. Z. Symonds for technical assistance and the Director, Dominion Laboratory, New Zealand, for permission to publish.

## REFERENCES

1. Kirk, P. L., Crime Investigation: Interscience, New York 1953, p. 240.
2. O'Hara, C. E. and Osterburg, J. W., An Introduction to Criminalistics, McMillan, New York 1949, p. 302.
3. Edlin, C. H., A New Feature Applicable to the Examination of Fragments of Motor Headlamp Glasses. Forensic Science Circular No. 5: H.M. S.O., London, 1939, p. 18.
4. Radley, J. A., Photography in Crime Detection, Chapman & Hall, London 1948, p. 30.
5. Stapleton, D. J., Evidence of Fractured Glass in the Investigation of Crime. Forensic Science Circular No. 6, H.M.S.O., London, 1940, p. 21