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Automotive Body Primers: Their Application in Vehicle Identification

Investigations involving automotive paints have become a major portion of the cases handled by the Chemistry Section at the Centre of Forensic Sciences. The accelerating trend to imported cars has made the task of automotive paint examination and identification more demanding. The identification of domestic vehicles by their paint has been based on finish coat colors, chemistry, and the primer color combinations. The latter has been somewhat haphazard and undocumented. A more expedient approach is needed.

This report will describe the approach to the examination of automobile paint being developed in this laboratory. The knowledge gained from this approach, its discriminating value, and its limitations will be considered.

In compiling information and developing a system for automotive paint examination, there were two objectives: (1) to acquire a rapid, reliable system of identifying the possible and probable source vehicles of paint chips from an unknown hit-and-run vehicle to assist in an investigation, and (2) to be of greater assistance to the courts by providing evidence based on documented information as to the types of vehicles from which automotive paint may have originated.

Method

From our experience in automotive paint examination and Tippet's study [1] of British automotive primers, it was felt that the primer color combinations used by the various manufacturers would be useful identifying characteristics. The original finish coats would then serve to further eliminate manufacturers and focus on years and models. Our initial approach to vehicle identification is therefore based on primer color combinations, variations in the shade of color, and general microscopic appearance of the primers. It is limited to paint chips having at least two original primer layers present.

Samples from approximately 1000 damaged domestic and foreign vehicles in the Toronto Police Pounds have been collected and catalogued. This source of reference samples was selected to supplement and verify the information and materials provided by the automobile manufacturers.

A set of microscope slides, referred to as the manufacturers' slides, has been assembled and carries the automobile manufacturers' names as titles and the years as subtitles. A representative chip from each vehicle sampled, having original primers, is cut obliquely to expose all the primers. These chips are mounted on the appropriate manufacturers' slides under their production year, using a rubber cement. A portion of one of

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these slides is shown in Fig. 1. In the Manufacturers' Slides Index, each mounted sample is recorded under its manufacturer by year, model, finish coat color, analysis of finish coat (if done), primer sequence, and area of vehicle sampled.

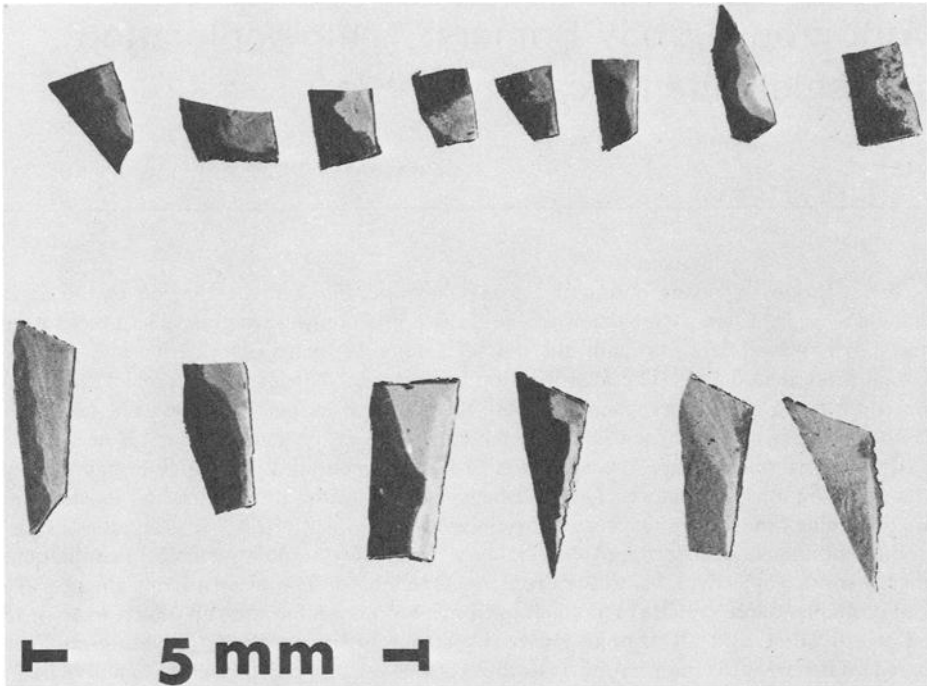


FIG. 1—A portion of a manufacturer's slide.

To rapidly locate all the samples in the collection which have the same primer color combination, a standard primer comparison slide was made. Samples were selected from the manufacturers' slides for this purpose. This standard slide is composed of five rows of primer color combinations:

Row A	gray and red or brown
Row B	gray, red, and black or dark brown red, black, and brown
Row C	gray and gray
Row D	gray and charcoal or black
Row E	red and red

Each row contains a number of standards which represent the variations in shades of colors of that particular primer color combination. This slide is used to classify each sample in our collection by selecting the standard which is the closest match and assigning to it a code such as A-5, B-2, etc.

A Standard Slide Index lists, for each standard primer chip, the vehicles represented on the manufacturers' slides carrying the chip's code. Thus, this index displays the prevalence of each primer standard, the models and manufacturers using indistinguishable priming systems, and the vehicles which have unique primers.

A questioned paint chip is examined using a $\times 10$ to 40 magnification binocular microscope. The primer color combination is noted, the appropriate row on the standard slide selected, and one or more standards chosen whose colors most closely match the questioned sample. The Standard Slide Index directs the examiner to the appropriate manufacturers' slides where the questioned sample is compared to the known samples. This final microscopic comparison frequently eliminates several manufacturers and focuses attention on a particular manufacturer or model. This elimination process may be extended by reference to the manufacturers' finish coats, their color and chemical composition. Any repaint layers, foreign materials, surface phenomena, etc. further pinpoint the source vehicle. This display format allows an examiner to easily and rapidly compare microscopically a questioned paint chip to a large number of known samples.

Discussion

Based upon the samples studied, a number of manufacturers and models appear to have typical and some have unique primer color combinations. Other manufacturers cannot be distinguished by the microscopic examination of their primers. The following comments are based exclusively on samples collected from known vehicles and cover predominantly the years 1968 to 1972.

A gray and red or brown primer color combination (Row A) is frequently observed on both domestic and foreign cars. Since these colors do vary in shade, it is possible to discriminate among many of these vehicles. There are particular gray and red or brown primer combinations which identify each of Toyota, Mazda, Datsun, Cortina, Triumph, Volvo, and some General Motors cars. If both primers are very pale in color, a Fiat is indicated. By the microscopic examination of the primers alone, it is virtually impossible to differentiate Chrysler products from the majority of the standard-size Ford cars.

The Row B primer color combinations of gray, red, and dark brown and of red, black, and brown characterize a number of vehicles made in Great Britain. There is a gray, red, and black priming system which is unique to Pinto and Maverick.

The presence of two gray primers (Row C) appears to impart less individuality to a paint chip than some of the other primer color combinations. Several Japanese as well as some British manufacturers and General Motors use this priming system. A comparison of the questioned primers with the samples on the manufacturers' slides should eliminate several of the possible sources. The two gray primers used on the Capri and some Datsun and General Motors vehicles identify these cars.

Gray and black primer color combinations (Row D) are used extensively. Variations in the shades of color identify Volkswagen and Toyota Coronas. The gray and black priming system used by General Motors is fairly distinctive but it may be confused with that used on Lincolns. American Motors appears to be consistent in its use of gray and charcoal gray or brown primers on all its cars. This combination can be recognized but may be confused with several Ford products and some British-made cars. Gray and black primers have been found on samples from Mavericks, Pintos, and Lincolns. Usually there is an incomplete layer of red between the gray and black Pinto and Maverick primers, rendering the cars readily recognizable.

The two-red primer combination (Row E) is specific to General Motors and is the only priming system observed on Vegas.

Our primer collection is by no means comprehensive; however, we have progressed from little reliable information and few samples to a collection representing many of the cars driven in Ontario. This primer collection, and thus our knowledge of automotive primers and their identification value, is progressively expanding. Similarities among

some manufacturers are evident, for example, the overlap between Ford and Chrysler previously discussed. To distinguish between overlaps, the finish coats must be considered or more sophisticated techniques such as pyrolysis gas chromatography and infrared spectrophotometry should be investigated for further differentiation of the primers. Other manufacturers, particularly among the imports, have definitive primer color combinations. From year to year consistencies in the priming systems used on many cars are apparent, although most manufacturers utilize a variety of primer color combinations. The manufacturers' information is invaluable in confirming the primer color combinations used and the year-to-year consistencies, as well as in alerting us to changes.

This has proved to be a practical approach to vehicle identification. In 10 to 20 minutes an inexperienced examiner can often identify the possible source vehicles of a chip of original paint. He or she does not need to rely solely on memory and experience since this approach is systematic and has a built-in training program. As an examiner's familiarity with the collection and this approach increases, vehicle identification efficiency likewise increases. A cautious examiner will not base conclusions on this primer collection alone but will also consider the samples and information provided by the manufacturers.

Canadian forensic science laboratories are collectively requesting the domestic and foreign automobile manufacturers to supply metal panels bearing the primers and a finish coat applied as they would be on each of the assembly lines. It will be from these panels that the primer standards will eventually originate. The authenticity of these materials and information must be confirmed by frequent checks against paint from known vehicles. A word of caution: One must keep an open mind toward the manufacturers' information and samples since assembly line overspray, spot repairs, and sanding can cause deviations from the standard application procedures.

A comprehensive manufacturers' reference collection would enable us to determine the number of manufacturers and models of automobiles having a specific primer combination and finish coat. This is the ultimate goal.

Currently, in a matter of minutes we can often identify the possible source vehicles of a tiny chip of original paint. In court we can now often state that the paint is characteristic of the vehicle in question, and comment on its distribution frequency—more meaningful evidence than a simple expression of possibility.

Summary

An approach to vehicle identification based on the varied primer color combinations used by the automobile manufacturers is outlined. A description is given of the primer color combinations found on a number of domestic and foreign cars. The expediency of this system of vehicle identification by successive elimination is discussed.

Acknowledgments

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Reference

- [1] Tippett, C. F., "Identification of Make, Model and Year of Manufacture of a Car by an Examination of its Paint Flakes," *Medicine, Science and the Law*, Vol. 4, 1964, pp. 22-25.

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