Physical trace evidence

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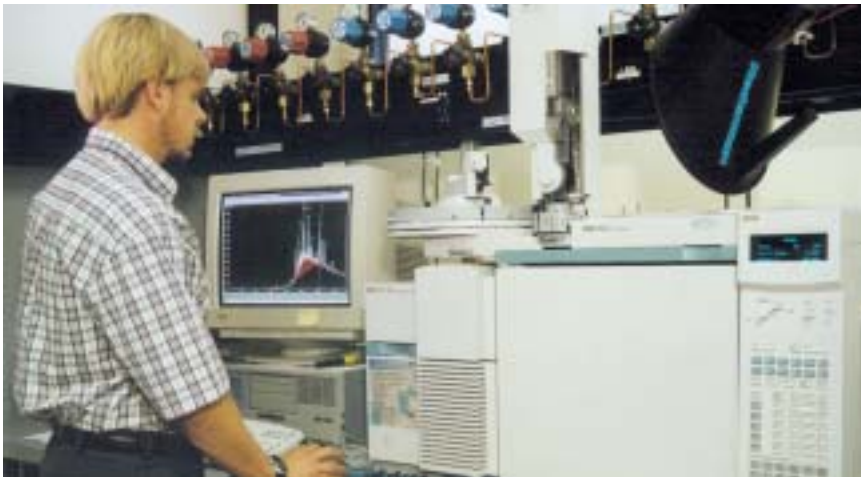

Analysing paint... The Pyrolysis Gas Chromatography and Energy Dispersive X-ray profiles inorganic and organic components of paint.

Locard's Principle of exchange is the basis on which forensic investigations rely, and states: when any two objects come into contact there is always transference of material from each object onto the other.

When someone commits a crime it is assumed, and often proven, that they leave evidence behind as well as take it away. Someone who commits murder may leave behind their fingerprints, shoe sole impressions, pieces of skin and hair. They may also take away with them blood on their shoes, gun shot residue on their clothes or hair from the victim.

Analytical Services Unit

The forensic scientists attached to the Analytical Services Unit (ASU) laboratory are responsible for the examination and chemical testing of flammable fluids, paint, polymers, glass and gun shot residue. This work is carried out on very small samples of a questioned material, and, accordingly, it is known as chemical trace evidence.

With Locard's Principle of exchange in mind, the task of the ASU forensic scientist is to recover and identify the trace material of interest, and to compare it to a control or reference sample.

Examples include testing for flammable fluid on clothing taken from an arson suspect, or glass from the clothing of a break and enter suspect, or foreign paint from a vehicle suspected to have been involved in a ram raid robbery.

Questions often asked are respectively: was there flammable fluid present on the clothing and what type was it; how much glass was found and did it match the broken glass from the scene; and could the foreign paint on the car have come from the wall of the damaged premises.

Specialised equipment and databases

A variety of specialised instrumentation is used to carry out these analyses. At present there are five different types of instruments in use at the ASU. For example, in the analysis of paint the techniques of Pyrolysis Gas Chromatography and Energy Dispersive X-ray analysis are used to profile the organic and inorganic components respectively.

The use of databases to assist in the interpretation of results is becoming more common in forensic work. With chemical trace evidence, the ability to match the recovered questioned material directly with the suspect, as can be done now with DNA, is not possible.

Databases and reference collections used in chemical trace evidence may provide information such as what class or type of material the question sample is and how commonly it occurs.

In addition to assisting in the police criminal investigation, information from databases can be useful in assessing the significance of evidence in determining a suspect's guilt.

National Glass Database

The National Institute of Forensic Science (NIFS) is currently building a National Glass Database that collates the source of the glass with its physical properties, for example refractive index, colour, patterning, and method of manufacture.

For example, if a piece of glass is recovered from a suspect's clothing has a refractive index common to 80 percent of the glasses on the database, then there is a greater possibility that the suspect could have coincidentally picked up the glass from another source. This is less likely if the glass refractive index value only occurs in two percent of the glasses in the database. The ASU has contributed glass data obtained from control glass and from broken windows at crime scenes. Scenes-of-crime officers collected these samples over a two year period.

Paint Data Query System

An automotive paint database known as the Paint Data Query System (PDQ) is being developed internationally.

Originating from the Royal Canadian Mounted Police, this system is based on an analysis technique known as infrared spectrometry. Fully developed, this system will enable vehicle type and manufacture to be determined from small quantities of multiple-layer paint recovered from a scene.

This year the ASU has collected some 40 samples of painted panels from new and near new vehicles and has submitted these to the coordinating international agency.

The Queensland Police Service has allocated funding to acquire the specialised instrumentation and software to enable paint samples to be run and evaluated using the PDQ system. It is likely that it will become a valuable forensic tool within the next five years.

Finding the link

Evidence that is collected from a crime scene and from a possible offender can hopefully be matched together to make that important link between the crime and criminal responsible.

Scientific officers use both crime scene examination and laboratory work. Crime scene investigation allows items to be collected and information to be gathered from the scene. Laboratory work involves further analysis of such items to determine their value as evidence.