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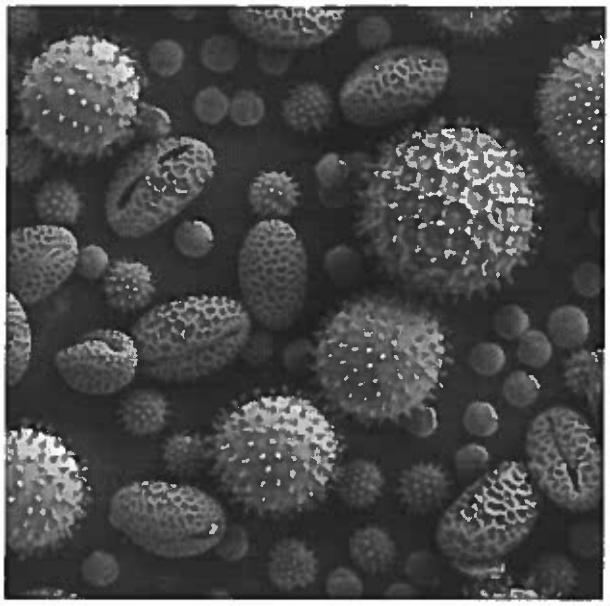
Forensic Palynology

Forensic palynology relates to the application of the study of pollen and spores to legal matters, often used to establish links between objects, people and places based on the analysis and identification of pollen.



Pollen and Spores

Pollen refers to a powder containing the male gametophytes of seed-producing plants, produced and dispersed in order to pollinate and reproduce. Pollen grains are dispersed in a variety of ways. Anemophilous plants produce pollen to be dispersed by wind. The extent of travel can depend on a variety of factors including the strength and direction of the wind, the weight and shape of the grain, and atmospheric conditions, though the pollen will typically fall within around 2km of the parent plant. Pollen produced by hydrogamous plants is transported by water, whereas zoogamous plants use animals such as bees, birds and rodents to disperse their pollen. Finally, autogamous plants are self-pollinating, so the pollen they produce does not need to travel. If the pollen reaches a suitable plant, it can germinate (ultimately producing a plant from a seed). Pollen grains typically have a fairly hard coat to protect them as they pass from one plant to another, making them relatively resilient to destruction. Spores, on the other hand, are units of asexual reproduction.

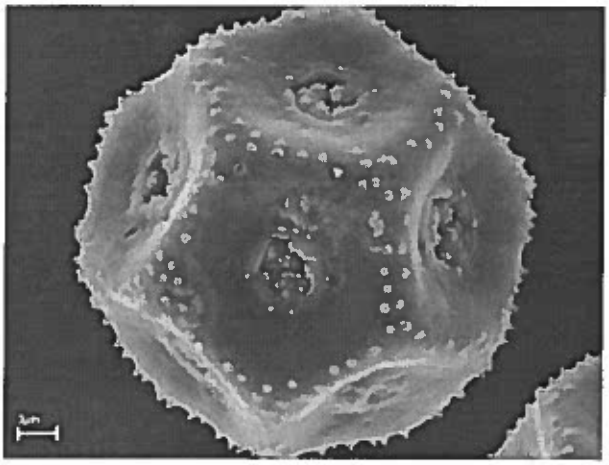
Pollen Analysis

Pollens and spores are extremely small in size, produced in vast amounts, dispersed by various mechanisms and are fairly resistant to destruction. All of these features make them especially ideal for use in a forensic investigation. The morphology of pollen and similar substances is fairly

complex, meaning that with the appropriate equipment, expertise and reference materials, it is possible to distinguish between and identify pollen grains. Pollen can particularly differ in shape, size, wall structure, and general appearance.

If possible, the palynologist should ideally visit the crime scene to collect samples, conduct a vegetation survey, and take any photographs as needed. Being familiar with the layout of the scene and the plants present can be of great use when establishing the source of pollen collected. Any evidential samples will be collected (such as from objects or people), but in addition to this control samples will be collected. This provides samples with which to compare any evidential samples.

Analysis of pollen is often carried out using transmitting light microscopy, which simply refers to any type of microscopy in which a light source is transmitted through the sample, allowing the specimen to be viewed through a lens. In addition to this, scanning electron microscopy (SEM) may be utilised. This technique may be used alongside systems such as QEMSCAN (Quantitative Evaluation of Minerals by Scanning Electron Microscopy), which allows for the automated analysis of minerals and other substances. The palynologist will study, analyse and compare pollen grains using their own expertise but also pollen reference collections if available.



Forensic Applications

Palynological samples can be recovered from a wide range of sources, including people, such as on their clothes, in their hair or even in their nasal passage, vehicle tyres, air filters in cars, on objects and in mud. Because of the dispersal mechanisms of some plants, pollen can be readily picked up and transferred. A person can easily inadvertently pick up pollen from a crime scene, whether it be in mud on their shoes or on their clothes from directly brushing against a plant in the area.

With this in mind, a primary use of palynology in a forensic investigation is to establish a link between two places, objects or people. For instance, it may be possible to link a suspect to an object,

a vehicle to a crime scene, or even link two separate incident scenes. If a suspect was present at a particular crime scene at which pollen can be found (for instance a field or garden), they may have picked up pollen on their clothing or in their hair. Because pollen is so resilient, it can often stick to other objects even after that object has been washed. If the pollen recovered from the suspect matches pollen collected from the crime scene, this could suggest that the suspect was in fact present at that scene. However it must be considered that although the presence of pollen may establish a link, the lack of pollen does not necessarily prove that there is not a link.

Similarly, palynology may be able to determine the location of a crime scene if it is not known. For instance, a body that is believed to have been moved may carry pollen grains that can be analysed and traced to a likely location. This may particularly be suspected if the body carries large amounts of a particular pollen that is not found at the location in which the body was found.

The study of pollen can also be used to determine the travel history of an item. In some cases it may be necessary to ascertain where an item has originated from, especially illicit drugs, money, antiques and even food. By analysing pollen recovered from suspect items, it may be possible to trace that item to a particular country if the pollen grains identified are sufficiently distinctive. Although this application of palynology may not necessarily be able to establish an exact location, it may be least be possible to rule out certain geographical locations and point the investigation in the right direction.

It may even be possible to estimate the time of year at which a crime took place. In the investigation of a somewhat older crime scene, pollen collected may actually be released at a different time of year, indicating the crime occurred during this period.

Of course despite the links palynology may establish, further evidence may be needed to support any conclusions reached. Pollen recovered from a suspect that happens to match that of a crime scene may simply suggest that the individual had visited that area at some point recently, not necessarily prove that they have committed a crime.

Although forensic palynology has been utilised for decades, it is unfortunately not widely accepted as a reliable forensic technique, instead frequently seen as a last result failing more 'standard' investigative techniques. In addition to this, there are very few people properly trained to analyse palynological samples, thus samples are often collected and handled by untrained staff, inevitably leading to issues of sample preservation and contamination.

Case Study

The first documented use of the analysis of pollen and spores to a forensic investigation was in Austria in 1959. Whilst on a trip down the Danube River, an Austrian man disappeared. His body could not be found. A friend and business partner of the victim soon fell under suspicion, and was arrested and charged with murder. Unfortunately without a body, and of course the suspect proclaiming his innocence, there was not much of a case against this man.

During a search of the man's cabin, a pair of muddy boots were recovered, providing the authorities with a new avenue of investigation. Palynologist Wilhelm Klaus of the University of Vienna was called upon to provide his expert opinion regarding a mud samples recovered from these shoes. Klaus was able to identify a number of modern pollens in the mud, including spruce, willow and alder pollen, along with a significantly older fossil pollen. Only a small area north of Vienna was consistent with this combination of types of pollen. The defendant was confronted with this new piece of information, at which point he finally cracked and confessed to the murder. He led police to the clandestine grave which was, interestingly, in the region selected by Wilhelm Klaus.

Bryant, V. M. Mildenhall, D. C. 1998. Forensic palynology: a new way to catch crooks. Association of Stratigraphic Palynologists Foundation Contribution Series 33, pp. 145-155.

Mildenhall, D. C. Wiltshire, P. E. J. Bryant. V. M. Forensic palynology: Why do it and how it works. For Sci Int. 163 (2006), pp. 163-172.

Mildenhall, D. C. Forensic palynology in New Zealand. Review of Paleobotany and Palynology 64. pp. 227-234.

Mildenhall, D. C. Civil and criminal investigations. The use of spores and pollen. SIAK Journal. 4 (2008), pp. 35-52.