MUD or **MURDER**?

Katy Freeborough explains how geological sleuthing can help solve crimes.

Ashley Cooper/Alamy

A body has been found in woodland. A suspect denies having been to the site. There is little evidence apart from a tiny amount of the victim's blood – or is there? Could a geological sleuth provide the answer from mud on the defendant's shoe? The British Geological Survey (BGS) hopes so through its development of forensic geology techniques.

Sir Arthur Conan Doyle introduced the idea of forensic geology in his first Sherlock Holmes story, A Study in Scarlet, in 1886: 'Knowledge of Geology. – Practical, but limited. Tells at a glance different soils from each other. After walks has shown me splashes upon his trousers, and told me by their colour and consistence in what part of London he had received them.' In forensic investigations, for example, where earth from a crime scene has stuck to a car's wheel arch, a suspect's clothes or shoes, the police may well ask where the particles came from.

Information on the surroundings from which this earth originated could help locate a site or link a suspect to a crime scene. It may ultimately provide the extra evidence needed to solve a crime.

BGS experts know that the type of rock underlying the soil mainly controls the soil's minerals, their chemistry and the size of soil particles. Certain minerals and their components are only found in particular areas of the UK. Results from tests on soil found on a suspect or a victim, or their possessions, can be compared to geological maps, wide-ranging databases and vast sample stores, to narrow down search areas or tie a suspect to a location. Pollen from soil, clothes, human remains or cars can help identify the type of vegetation at a site. This could tell an investigator whether the crime scene was a woodland, garden or a lakeside and may provide a link between a suspect and the scene. Pollen and other tiny organisms on or in a decomposing body could point to the time of year a crime was committed.

Our bones and teeth contain isotopes (the different forms of certain elements) in quantities controlled by the place where we live and our diet. Isotopes can help to identify an unknown person's origin. Body fats, when buried, decay at different rates and leak into the soil. Analysing the soil may indicate the time of death. There is great potential for applying geoscientific techniques to forensic investigations.

We tested our expertise in forensic investigations in a 'blind' forensic test case. One cold October afternoon, we got a colleague to walk in three different environmental settings and then we collected soil from their boots.

We gave the samples to four experts, asking them to describe or pinpoint where the sample may have come from, by looking at the pollen, minerals, man-made particles, and the structure of any organic matter.

The results were very encouraging. No individual method identified the location but using the scientific methods together provided useful information on the origin and source of the samples. The minerals helped place the samples in an area based on the underlying geology. The organic material and other particles provided more detailed site information – the pollen and lignin types showed that one location was a wheat field and another a lakeside.

> Analysing the soil may indicate the time of death

BGS and others in recent forensic investigations have frequently used such techniques. Chalk and brick fragments in material from a suspect's car demonstrated that it had transported the bodies of two murder victims to where they were discovered. In another case, the mineral fragments on a victim's body demonstrated that it had been buried in a trench where the suspects were known to have been present.

Scientists at BGS continue to develop their techniques, adding to the number of successful criminal investigations.

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