The International Union of Geological Sciences, Initiative on Forensic Geology

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Founder and Chair, International Union of Geological Sciences (IUGS), Initiative on Forensic Geology (IFG)

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IUGS Initiative on Forensic Geology

Forensic geology, also known as 'forensic geoscience' or 'geoforensics' is; *'the application of geology to policing and law enforcement, which may potentially be applicable to a court of law.'*

In 2006, Dr Laurance Donnelly established the Geological Society of London, Forensic Geoscience Group and became its first chair. In 2009, he then established the IUGS Working Group on Forensic Geology. In 2011, this working group evolved into the IUGS Initiative on Forensic Geology (IFG). IUGS-IFG is the first international group for the global advancement of forensic geology.

'The ground' is a link between some geologists and law enforcement and police officers. Whether the ground is being explored to locate mineral resources, investigated to provide the geotechnical parameters and geohazards assessments or searched to locate concealed illicit items or victims; an understanding of the geology is essential.

The expertise provided by a forensic geologist is generally regarded to fall into the three following categories; ground search for burials, crime scene examination and geological trace evidence recovery and analysis.

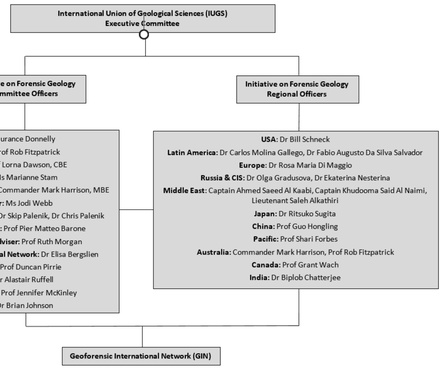
The IUGS Initiative on Forensic Geology (IFG) was launched at the 62nd Executive Committee meeting of the IUGS, at UNESCO headquarters, in Paris, France, on 22 February 2011.

The aim of IUGS-IFG is to develop forensic geology internationally and promote its applications.

The objectives of the IUGS-IFG are to:

1. Collate and disseminate data and information on forensic geology applied to policing and law enforcement, criminal, environmental and civil investigations;
2. Promote international meetings, seminars, conferences and training;
3. Develop a 'Committee' to act as principal advisers, collaborators and active participants;
4. Develop an international network whereby each 'member' will act as a principal contact in their respective country for the collation and dissemination of information on forensic geology;
5. Collate, make available and where appropriate review any existing documentation and publications in forensic geology; and
6. Produce a document endorsed by the IUGS Committee to be called; *'A Guide to Forensic Geology'*.

The IUGS-IFG Committee comprises representatives from major geographical regions of the world and includes specialists from academia, industry, consultancy, operationally based forensic geologists, the police, law enforcement agencies and forensic organisations.



The IUGS Initiative on Forensic Geology Committee

A homicide grave in clay (Schneck, in Donnelly et al 2020 (pending)

Geological assessment of intelligence (Shroder 200, in Donnelly et al., 2020 (pending))

Crime scene (Donnelly 2008,)

The Scene

A forensic geologists may be required to assist the law enforcement investigator, crime scene manager or forensic scientists to examine a crime scene; to collect geological samples and provide interpretations of the soil, sediment, rocks, and man-made materials.

This may include a variety of exhibits that have been seized by law enforcement as part of an investigation to provide evidence. The methodologies for the recovery of geological samples from crime scenes and exhibits are discussed. Information is provided on exhibits handling, the recovery of geological evidence from clothing, footwear, motor vehicles and other exhibits. All of these have the potential to support or comprise a case if not properly undertaken in a forensic capacity.

Forensic geology training (Ruffell and Donnelly)

Geological trace evidence may be required to determine if there may be a comparison between two or more samples to determine if they originated from the same source or not. Geological trace evidence may be transferred onto the body, person or the clothing of a victim or offender or an associated item/object. This is based on the principle devised by Dr Edmond Locard (1877-1966) on the premise that when two items or objects meet, every contact leaves and trace; this may be beyond detection or short lived, but nevertheless that transfer has taken place. When geological trace evidence is interpreted by an experienced forensic geologist this can help with crime reconstruction and may be admissible in a court as evidence to assist a prosecution or defence case. The aim may be to help determine if there could be an association between the samples collected. The range of fundamental and sophisticated laboratory techniques commonly used by a forensic geologist are outlined.

Recovery of geological evidence (Donnelly)

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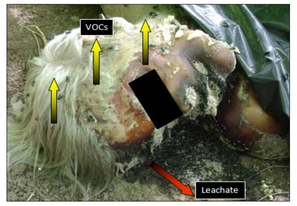
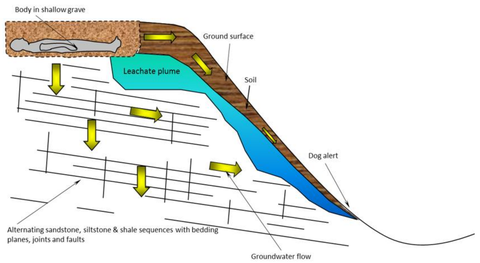


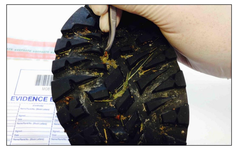
The gene ratio of leachate during human decomposition (Donnelly, in Donnelly et al., 2020, pending)



Conceptual Hydrogeological Model (CHM) for a shallow, unmarked, homicide grave (Donnelly 1994, in Donnelly & Harrison 2010,)

The Sample

Geological trace evidence involves the collection, analysis, interpretation, presentation and explanation of geological evidence. Trace evidence may be transferred onto the body, person or the clothing of a victim or offender or onto vehicles or other objects from and to a crime scene. This, when interpreted by an experienced forensic geologist can help with crime reconstruction and may be admissible as evidence in a court to support a prosecution or defence.



The recovery of geological trace evidence (Dawson, Ruffell, Donnelly)

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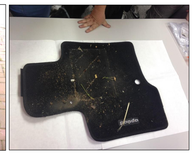


The recovery of geological trace evidence (Donnelly)

Geological trace evidence includes; minerals, rocks, soils and sediments (superficial deposits), minerineralised rock, ore and mineral concentrate, refinery and smelter products (e.g. blister, anode, cathode, dore, matte, sweeps and bullion), anthropogenic (artificial) deposits (e.g. made ground, filled ground and disturbed ground), man-made materials derived from geological raw materials (such as bricks, concrete, glass or plaster board), micro-fossils, groundwater, leachate or surface water, gases and volatile organic compounds..

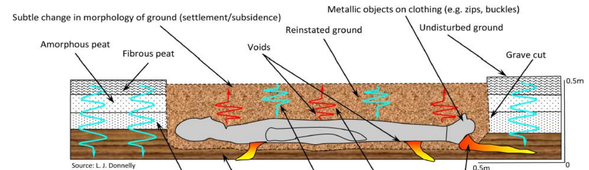
The recovery of geological trace evidence (Donnelly)

The analysis of geological trace evidence is typically conducted to determine if there may be a comparison between two or more samples to determine if they originated from the same source or not. Geological trace evidence may be transferred onto the body, person or the clothing of a victim or offender or an associated item/object. This is based on the principle devised by Dr Edmond Locard (1877-1966) on the premise that when two items or objects meet, every contact leaves and trace; this may be beyond detection or short lived, but nevertheless that transfer has taken place.

Geological investigations at crime scenes (Donnelly)

The Search

The need to conduct complex, open area searches for burials brought together the very different yet complimentary experiences of a geologist and a law enforcement officer; both interested in 'the ground', but from differing perspectives. A new and innovative search strategy developed. A law enforcement perspective provides; an evaluation the offenders motive and resources, behavioral profiling, victimology assessments, management of search assets, logistical and tactical planning, acquisition of aerial imagery, classification of search types, press and media management, family liaison, crime scene management, forensic recovery and recording, briefings and de-briefing. A geological perspective provides; reconnaissance (walk-over) survey, collation and assessment of geological data and information as part of a desk study, geological evaluation of intelligence and aerial imagery, evaluation of geomorphology and hydrogeology, determination of geophysical, geotechnical and geochemical properties, assessment of target detectability, appraisal of diggability and the production of a conceptual geological model for the target.



Conceptual Geological Model (CGM) for a shallow, unmarked, homicide grave (after Donnelly, 2002 in Donnell et al., 2020 (pending)

This combined approach enabled an appropriate selection of search assets to be identified. A pragmatic, proportionate and cost-effective methodology was then devised to provide the highest level of assurance for the presence or absence of the target suspected by the law enforcement officer or police officer to have been buried as part of a criminal act. This approach became verified and refined over a decade and this blended, new strategy for open area ground searches, has since been adopted for ground searches in the UK and internationally.

Search for a homicide grave using victim detector dogs and soil probes (Donnelly)

The Conceptual Geological Model (CGM) enabled to most suitable suite of geophysical methods and associated search assets to be chosen, which were appropriate for the prevailing geological conditions and grave being sought.

Phase 1: Pre Search: This largely involves defining the search type, area, identification of the search assets and their method of deployment, planning and logistics. The authors recommend a ground search should extend from the macro to the micro scale and from the invasive to the non-invasive.

Phase 2: Search: The implementation of the search should follow and agreed standard Operational Procedure (SOP). This should also be dynamic and flexible to be modified based on materially relevant field observations at the time the search is conducted.

Phase 3: Post Search: Once a positive observational, geophysical, geochemical or VDD anomaly (also known as a 'hit' or 'indication') has been identified and verified, the recovery and recording stage of the search should take place. This may require additional support from, for example, a Crime Scene Manager (CSM), forensic scientist or forensic archaeologist with appropriate qualifications and experiences.

Ground searches for burials using a helicopter for geomorphological observations and geophysics (Donnelly)

A combined geological and law enforcement (police) approach may provide the greatest levels of assurance to help detect a target that has been buried associated with a criminal act, terrorism or organised crime. Or negate its presence so far as possible within the limits of the resources available. This strategy enables the searcher to develop a methodology that best suits the prevailing geology and in context with the nature of the targets being sought. This method offers a high assurance, cost-effective, proportionate and pragmatic search to be deployed to negate or locate the presence of suspected target buried at a shallow depth in the ground. This strategy is now increasingly being used in the UK and internationally for open area searches for burials. The recovery and recording of any 'finds' should be in a manner consistent with the requirements for the item(s) to be exhibited and admissible in a court of law