Forensic Geoscience Group - the first decade

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The Geological Society of London (GSL), Forensic Geoscience Group (FGG): The First Decade, 2006-2016

Dr Laurance Donnelly
Founder and First Chair, GSL-FGG
Chair, IUGS-Initiative on Forensic Geology (IFG)
Arup, 6th Floor, 3 Piccadilly Place, Manchester, M1 3BN
Laurance.Donnelly@arup.com and geologist@hotmail.co.uk

Dr Alastair Ruffell
Co-founder and Second Chair GSL-FGG
Queens University Belfast, Department of Geography and Archaeology, Belfast
a.ruffell@qu.ac.uk

The Forensic Geoscience Group (FGG), is the newest of the Geological Society's 23 Specialist Groups and Joint Associations. It was established in December 2006, by Dr Laurance Donnelly, who served as its first chair (2006-2011). Dr Alastair Ruffell served as the second chair (2011-2016). Dr Jamie Pringle is the current FGG Chair (2016). This article provides a personal account to document the establishment of FGG and some of its main achievements during its first decade.

Historical Overview

Forensic geology is by no means new! According to legend an examination of soil and rock fragments found in horse hooves assisted Roman soldiers in locating the camp of the enemy. The documented application of geology to assist with a police investigations dates back to the middle part of the 19th Century. Professor Christian Gottfried Ehrenberg (1795–1876), a German scientist working in Berlin, was able to assist the police and identify the provenance of sand that had been used to substitute stolen silver being transported in wooden barrels on a train in Prussia (northern Europe).

Sir Arthur Conan Doyle and his fictitious work of Sherlock Homes, (1887-1927), made reference to the idea that geology (soil analysis) could help investigate crime. The colour and consistency of splashes of 'mud' on trousers helped Holmes to identity what part of London a visitor to 221B Baker Street had been walking. Hans Gustav Adolf Gross (1847-1915) was an Austrian examining magistrate and professor of criminology working in Austria. In 1893 he published, *'Handbuch für Untersuchungsrichter, Polizeibeamte, Gendarmen'* (Handbook for Magistrates, Police Officials & Military Policemen). He noted that, *'Dirt on shoes can often tell us more about where the wearer of those shoes had last been than toilsome inquiries.* George Popp (1847-1915) was working in Germany in 1904 on the murder of Eva Disch who had been strangled with her own scarf. He analyzed nasal mucus on a handkerchief found at a crime scene and the fragments of coal, snuff, and hornblende crystals were consistent with materials found beneath the finger nails of a suspect. Popp subsequently investigated other murders using microscopic analysis (the Margaret Filbert murder in Bavaria 1908) and he noted how the stratigraphic layering of different soils on shoes could be used to build a profile of an offenders movements that showed he was present at a scene of crime. These cases were based on the principle formulated by the forensic scientist, Edmund Locard (1877-1966). He developed the concept that, *'every contact leaves* a *trace,*' which subsequently became known as *'Locard's Exchange Principle'.*

In 1936, the Federal Bureau of Investigation (FBI) first applied soil analysis to a kidnapping case (The Matson Kidnapping) to identify where a victim had been prior to his murder. The investigation of the Green River Murders in the mid 1980s also used evidence from microscopy, whereby a serial killer was convicted of 48 murders and later confessed to dozens more. Murray & Tedrow published *'Forensic Geology'* in 1975, the first text book to combine geology with operational cases. In the UK, during the 1970s and 1980s, the Home Office Central Research

Establishment, at Aldermaston, made advances in areas such as soil density gradient examination techniques, cathodoluminescence, colour analyses and particle-size analysis. The Forensic Science Services (FSS) (now closed) was set up in the early part of the 21st Century as the Natural Justice Group and included forensic soils science services to police forces and Government departments.

Renaissance in Forensic Geology

In 1994, Dr Donnelly began searching Saddleworth Moor, in the Pennines, for the last remaining victim of the Moors Murders (ongoing). He used geological methods and strategies not conventionally used by the Police. Up until this time most police searches followed a counter-terrorism strategy, using finger-tip line searches, some metal detectors and search (cadaver) dogs. This reflected the police training received from the military after the Irish Republican Army (IRA) attempted to assassinate the Prime Minster (Margaret Thatcher) in 1984, when they planted a time delayed bomb in the Grand Hotel, in Brighton. These types of police and military led ground searches rarely considered a detailed evaluation of the geology.

By the early 2000s it became apparent to Dr Donnelly that even though the police and law enforcement are not conventionally trained in geology, and geologists are not familiar with police and crime scene protocols, there were clear benefits of including geologists in certain types of criminal investigations in the UK and globally. This included searches in Northern Ireland for the Disappeared associated with the IRA, being conducted by Dr Ruffell, and very successfully by the Independent Commission for the Location and Identification of Victims' Remains.

Geologists supporting the police usually worked in isolation and fellow geologists were largely unknown to each other as they often tended to work covertly on sensitive of high profile case work. There was: no collaboration between geologists; no opportunities to discuss case work or research; no sharing of knowledge information or ideas; no encouragement to publish papers, guidance or protocols; no opportunities for career development; no incentives for the advancement of 'forensic geology' and no formal professional representation for geologists working in the field of forensic science, policing and law enforcement. This was about to change…

On 12th March 2002 a presentation entitled, *'How Forensic Geology Helps Solve Crime: Forensic Geology and The Moors Murders',* was delivered by Dr Donnelly, as part of the All-Party Parliamentary Group for Earth Science, at Westminster Palace, House of Commons, in London. This drew attention to the applications of geology to police case work. This was followed by an invitation for Dr Donnelly to discuss forensic geology on BBC Radio 4 programme, *'Material World'.* These events attracted interest in forensic geology from other geologists, forensic scientist, police officers, politicians and the media. In 2002, he began formulating a plan to develop a professional group on forensic geology, but where was this group to become focused?

In 2003, a forensic geoscience meeting was held at the Geological Society in London (Pye and Croft, 2004). Also in 2003, the Centre for Australian Forensic Soil Science (CAFSS) became established based on the successful application of forensic geology using largely polarizing microscope and x-ray diffraction (in 2011 the Centre became a *'A Forensic Science Centre of Specialisation'*, which was approved by Australia New Zealand Policing Advisory Agency. Later, in Scotland, the development of a Geoforensic GIS tools (SoilFit) and the establishment of the Geoforensics and Information Management for Crime Investigation (GIMI) was established to develop new technologies in the forensic investigations of crime scenes.

Establishment of FGG

Following over 3 years of planning and obtaining support, in December 2005, a proposal was presented by Dr Donnelly to the Geological Society of London for the establishment of a new specialist group on Forensic Geology. Approval was subsequently provided by Council on 22nd November 2006 for the establishment of the *'Forensic Geoscience Group (FGG)'*. FGG's inaugural meeting took place at Burlington House, in London, on 18th December 2006, in time for the Geological Society's 200th anniversary in 2007. This establishment of FGG was supported by the then UK Police National Search Adviser, Commander Mark Harrison, MBE (now with the Australian Federal Police), and who was working with Dr Donnelly searching on Saddleworth Moor at this time. Mark subsequently

commented (Police Professional, September 25, 2008, 20-22), *'Forensic geology can bring significant benefits to policing. Geologists' focus on exploration fits very well into a police and forensic environment during a criminal investigation. The expertise of a geologist would be of assistance when working anywhere in the world'.*

The objective of FGG is to advance the study and understanding of forensic geoscience (known synonymously as, 'forensic geology' and 'geoforensics'). This is, *'the application of geology to policing, law enforcement and criminal investigations'.* Forensic geology may also assist with humanitarian, environmental, engineering and geotechnical investigations that may become subject to legal enquiry. Forensic geologists have also been involved in fake and fraud cases including; minerals and mining scams (e.g. Bre-X, 1987) rare fossils sales, diamonds, gemstones and rare earth metal investments and the mineralogical analysis of paint to reveal art forgeries. A forensic geologist may be invited by the police or a law enforcement agent to assist with certain types of criminal related to homicide, terrorism or organized crime.

Events and Publications
From 2006-2016 there have been at least 227 forensic geology events held throughout the world. At least seven books have now been published, two Geological Society of London Special Publications and numerous peer reviewed papers, conference proceeding, popular press and magazine articles. Members of FGG have been involved with many of these events and as authors, co-authors, contributors, advisors, editors or peer reviewers. *'A Guide to Forensic Geology'* is currently being written.

Multi-disciplinary
Forensic geology has brought together many of the Geological Society's Specialist Groups and Regional Groups. Numerous joint projects and collaborations have taken place with a host of commercial companies, police forces, forensic scientists, law enforcement agencies, other co-professional bodies, universities, research institutes, the media and school children.

International Scope
FGG developed the Geoforensic International Network (GIN), which brings together forensic geologists, geoscientists, police, law enforcement officers from approximately 40 countries that are interested to develop and promote forensic geology.

IUGS
In 2008, following the success of FGG, Dr Donnely was invited by International Union of Geological Sciences (IUGS) to set up an International Working Group on Forensic Geology. This was established in Uruguay and Namibia as part of the IUGS Commission on Geoscience for Environmental Management (GEM). The first IberoLatin American course on Forensic Geology was held in Colombia in 2009 with the *Instituto Nacional de Medicina Legal y Ciencias Forense* and the Federal Police in Bogota, Colombia. In 2011, IUGS promoted the Forensic Geology Working Group to the IUGS Initiative on Forensic Geology (IFG) (ongoing).

Training
FGG and IUGS-IFG have been invited to provide formal knowledge exchange, capacity building and training in many parts of the world for geologists, police, law enforcement, forensic scientists and lawyers. These have been delivered for the UK Police National Crime Agency (formerly the National Police Improvements Agency (NPIA) and Serious Organised Crime Agency (SOCA)); Russian Federal Centre of Forensic Science (RFCFS) of the Ministry of Justice of Russia, in Moscow; Australian Federal Police; Brazilian Federal Police; National Research Institute of Police Science of Japan; the Carabinieri and Polizia of Italy; Abu Dhabi Police, Navy and Coast Guard.

Teaching and Research
FGG has encouraged and endorsed the formal teaching of forensic geology modules on BSc Geology courses (e.g. University of Leicester), at MSc level (e.g. Università degli Studi di Messina, Dipartimento di Scienze dell'Ambiente, Messina, Sicily, Italy) and PhD research (e.g. Oxford University, University of Keele, Queens University Belfast and

both Birkbeck College and University College London). Research has also been undertaken at The Body Farm, in Knoxville, Tennessee, to understand the generation and migration of leachate and volatile organic compounds and how this can influence searches for homicide graves. FGG has supported a new human decomposition facility; the Australian Facility for Taphonomic Experimental Research (AFTER).

The Public, School Children and the Media

Forensic geology has captured the imagination of school children and university students. Numerous events held across the UK and globally for those aged 5-18 year. For instance, a mock crime scene was established at the 2013 International School Science Fair, held in Cornwall. Following a series of lectures the school children were able to conduct ground searches for (fake) nail bombs and weapons. Dressed in crime scene protective suits they collected samples from a vehicle, spade and clothing and the analysis of these soils provided geological evidence enabled them to help solve a fabricated crime. Forensic geology has been actively pursued by the media as this seems to have grasped the interests of the public, and many public lectures have been provided.

Police Operational Case Support

FGG was not set up to only support the UK Police. However, FGG committee members have been invited to enlist on the UK Police National Crime Agency, Expert Database as *'Forensic Geologists'.* As such, geologists have provided advice, guidance, soils analysis and ground searches for numerous police cases. Many of these were high profile attracting national and international media international interests. Today, major crime laboratories throughout the world, both public and private, conduct crime scene investigation including the analyses of soils and geological materials. Geologists are required to assist the police at a crime scenes to collect and evaluate geological samples. Geological trace evidence involves analysis, interpretation, presentation and explanation of geological evidence, at a scene of crime or from an item or object, as intelligence and as evidence. This includes; rock fragments, natural soils and sediments, artificial (anthropogenic) man-made materials derived from geological raw materials (such as bricks, concrete, glass or plaster board) or micro-fossils. Trace evidence may be transferred onto the body, person or the clothing of a victim or offender or onto vehicles or 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 physical evidence in a court.

Forensic geologists are now routinely called upon for ground searches, applying techniques adopted from mineral exploration and geotechnical ground investigations. These searches can be designed and implemented to locate homicide graves, mass graves related to genocide, weapons, firearms, improvised devices, explosives, drugs and items of value (e.g. stolen items, money, coinage, jewellery). Ground searches may take place in urban, rural or remote locations, in both the terrestrial and water environments (e.g. canals, rivers, lakes, reservoirs and the sea) A search may be conducted to; obtain evidence for prosecution, gain intelligence, deprive criminals of their resources and opportunities to commit crime or acts of terror, locate vulnerable persons, protect potential targets and venues, search for homicide graves and associated buried items or objects.

Due to the sensitive and often high profile nature of the crimes investigated and supported by geologists many cases cannot be published and my only be referred to anonymously. This includes the search for missing persons', the detection of a dismembered murder victim found in northern England following the geomorphological analysis of air photos. The grave of another victim was found in a remote location following the analysis of sand found on a suspect's vehicle, and by the subsequent deployment of geophysics and detector dog survey. A geological search strategy also assisted the Police locate the grave of a murder victim's who went missing well over a decade earlier.

The UK Police National Search Adviser, National Crime Agency, commented, '*Geology in support of the search for a concealed murder victim is a relatively new and largely overlooked 'tool in the box'.* A Major serving in the, British Army, Royal Engineers, stated, '*I have been actively involved in the world of search for 27 years and find it staggering that we (the British Army) remain oblivious to the assistance that geologists can deliver to any search*

task, let alone the strategy associated to it. I believe that a geologist must now be considered a critical asset to any search adviser during the planning phase of any search task'.

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Further reading

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