New Horizons in Forensic Geoscience: The Bedrock of International Security in Minerals, Mining, Metals, Murders and the Missing

A forensic geology joint meeting between GSL-FGG and IUGS-IFG

The Geological Society of London, Burlington House, Piccadilly

London, 4-5 December 2023

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The Forensic Geoscience Group of the Geological Society of London (GSL-FGG) and the International Union of Geological Sciences, Initiative on Forensic Geology (IUGS-IFG) has provided a forum where contributors from the UK and internationally can present and debate the results of recent research and forensic case examples related to forensic geology, forensic soil science and the wider disciplines including forensic ecology. In addition, this event demonstrates examples of where forensic geology has delivered to policy and practice.

The event features minerals, mining and metal crimes, search operations, geological trace evidence, ecology and taphonomy. The event has attracted a range of international delegates from over 10 countries and represents an invaluable opportunity for practitioners to exchange information and case experiences about recent global developments in forensic geology. Operational case studies from industry and law enforcement have been discussed.

This meeting captured interest across the geological, forensic, law enforcement, environmental science, mining, minerals, and archaeological communities, including those working in the fields of serious crime investigation, search, law and mining crime. This book of abstracts will hopefully provide you with a valuable record of the presentations.

Programme

Monday 4 December 2023

13:00-14:00 Welcome. Drinks and light lunch reception and registration in lower library. Welcome to the day by GSL-FGG Chair, Prof Lorna Dawson. Launch of 'A Guide to Forensic Geology' (copies available for purchase) and an overview of the history and development of GSL-FGG and IUGS IFG by Dr Laurance Donnelly, Chair IUGS IFG.

14:00-15:30 Session 1. *Search Operations*. In conference auditorium.
Session Chairs: Dr Alastair Ruffell and Dr Jamie Pringle.
14:00-14:20 Guest speaker, Murray Haynes, National Crime Agency, UK National Search Adviser.
14:20-14:30 Matteo Barone. The Pareto Principle in Search and Rescue During Forensic Investigations.
14:30-14:40 Noriko Kawamura. Recent Studies of Magnetic Survey of Forensic Geology in Japan.
14:40-14:50 Carlos Molina. Applications of the GSS in Colombia, to Locate Homicide Graves.
14:50-15:00 Jamie Pringle. Optimising Aquatic Geophysics Search Strategies for Detection of Individuals.
15:00-15:10 Niamh McCullagh. Searching for Missing Homicide Victims: Development of a Data-Driven Model.
15:10-15:20 Benjamin Rocke. A history of aerial surveying to locate clandestine graves. By Remote link.
15:20-15:30 Grant Wach. Geoforensics in Atlantic Canada, application of GPR for cemetery and criminal investigations.
15:30-15:45 Questions and Discussion on Search.

15:45-16:00 Coffee break and poster session in lower library with networking.

16:00-17:10. Session 2. *Minerals, Mining and Metals Crimes*. In conference auditorium.
Session Chairs: Prof Duncan Pirrie and Dr Laurance Donnelly.
16:00-16:30 Guest speaker, Fabio Salvador, Brazilian Federal Police and The Clean Gold Programme.
16:30-16:40 Marcelo Tortolero. Forensic Geology Investigation of Mercury Associated with Crimes in Brazil.
16:40-16:50 Mariano Mercurio. Mineralogical Analysis Applied to Forensics.
16:50-17:00 Laurance Donnelly. Illegal Mining and the Trafficking of Illicit Minerals and Metals.
17:00-17:10 Questions and Discussion on Minerals, mining and metals crimes.
17:10-17:30 Comfort break.

17:30-18:45 Poster presentations, networking and drinks reception in the lower library. Three-minute presentation at every poster. Voting box for community assessment of poster prize.

18:45 Evening public guest presentation. Welcome and Introduction of guest speaker. In conference auditorium. Session Chair: FGG Chair, Prof Lorna Dawson.

19:00-20:00. Evening public guest presentation. Jodi Webb, Federal Bureau of Investigation, Ground Search and Geological Trace Evidence in the US system.
19:45-20:00 Questions and Answers.

Close 20:00 Close of day's events for the public at Burlington House by Chair Prof Lorna Dawson.

Tuesday 5 December 2023

08:45-09:00 Welcome with coffee and breakfast pastries in library.

9:00-10:45 Session 3. ***Human Taphonomy & Burials.*** In conference auditorium.

Chairs: Prof John Cassella and Prof Lorna Dawson.
9:00-9:30 Guest speaker: Prof Roelof-Jan Oostra, Amsterdam. The Netherland taphonomic facility.
9:30-9:40 Anna Williams. Why doesn't the UK have a Human Taphonomy Facility yet?
9:40-9:50 Inghild Økland. Suitable Soils for Coffin Graves, when the human remains are not missing.
9:50-10:00 Simon Cooper. Developing a chemical kinetic model to determine PMSI.
10:00-10:10 Federico Fanti. The Bone War is back: Fossil Frauds.
10:10-10:20 Questions and Discussion on Taphonomy and burials.

10:20 -10:45 'Any Questions' panel discussion on a human taphonomy facility in the UK. Panel Chair Prof John Cassella with guests Roelof-Jan Oostra and Anna Williams.

10:45-11:00 Coffee break and networking.

11:00-12:00 Session 4. ***Forensic geology contributing to the Criminal Justice System.*** In conference auditorium. Chairs: Prof Ruth Morgan and Dr Alastair Ruffell.

11:00-11:10 Matheus Silva. What is a 'match' in Forensic Soil Science? Questions based on murder case in Brazil.
11:10-11:20 Martin Lo. Applying machine learning methods to age estimation in forensic anthropology.
11:20-11:30 Hannah Dickson. Mineralogical and Color Variations observed in Surficial Soils.
11:30-11:40 Duncan Pirrie. Syria Soils and Conflicts.
11:40-11:50 Jennifer McKinley. Double Homicide by Arson.
11:50-12:00 Lorna Dawson. Search and Trace Evidence in the Recovery of a Long-Term Missing Person.
12:00-12:10 Questions and Discussion on Future Horizons.

12:10 Close of meeting by IUGS IFG Chair, Dr Laurance Donnelly, IUGS-IFG Award, thanks
and presentation of poster prizes.

Oral presentations

The Pareto Principle in Search and Rescue During Forensic Investigations: Balancing Efficiency and Accuracy

Pier Matteo Barone[1,2,3]*, and Rosa Maria Di Maggio[1]

[1] Geoscienze Forensi Italia®- Forensic Geoscience Italy (Italy); [2]American University of Rome (Italy); [3]ANCRIM (Associazione Nazionale Criminologi e Criminalisti)

Abstract: The Pareto Principle, often referred to as the "80/20 Rule," has been a guiding concept in various domains, including business and decision-making processes. In the context of forensic investigations and search and rescue operations, this principle finds intriguing applications that demand a delicate equilibrium between efficiency and accuracy. In the realm of forensic investigations, a dichotomy emerges. On one hand, providing a mere 20% of the available intelligence can inadvertently yield an overwhelming 80% of false positive outcomes, potentially leading investigations astray and misallocating valuable resources. Conversely, adopting an exhaustive approach by compromising 80% of the crime scene may yield only 20% of the forensic results deemed admissible and valuable during legal proceedings. This abstract explores the intricate dynamics of the Pareto Principle within the context of search and rescue operations during two forensic cases. It delves into the challenges faced by investigators when deciding on the extent of information to provide, recognizing that excess information can obscure pertinent evidence amidst the noise of false positives. Conversely, insufficient information can hinder effective investigations, potentially overlooking critical clues. Balancing these two facets requires a nuanced approach that leverages advanced techniques, technology, and expertise. Moreover, it calls for the development of innovative methodologies that optimize the allocation of resources, ensuring that the search for evidence aligns with the objective of delivering accurate, admissible results.

Biography of presenter: Criminalist, lecturer, and expert consultant in forensic geoarchaeology with a specific focus on geophysical surveys, remote sensing, and GIS applied to crime scene investigations, search for missing persons, and crimes against cultural heritage. Collaborates with various universities and law enforcement agencies and is a member of Forensic Geosciences Italy®, ANCRIM (National Association of Criminologists and Criminalists), and the Scene of Crime (SoC) working group within the ENFSI. Crime Scene Adviser for the IUGS Initiative of Forensic Geology, he is also a board member of the Italian Ground Penetrating Radar Association. Author of over 100 publications in high impact factor international and national journals.

Recent Studies of Magnetic Survey of Forensic Geology in Japan

Noriko Kawamura [1]*, Tadahiro Hatakeyama[2], Yu Kitahara[3], and Shinobu Kaneko[1]

[1] Japan Coast Guard Academy, Japan; [2] Okayama University of Science, Japan; [3] Kochi University

Abstract: A magnetic Survey is basic approach in forensic geology, consisting of two methods; field tests using magnetometers and measurements of soil and sediment in the laboratory. We will introduce the field investigations and the analytical results of soil, beach sediment, and seafloor. We tested magnetic susceptibility (MS) to detect the disturbed area on the soil surface. A survey line was assessed, a hole was dug on the line and backfilled using a soil mixture. The MS peak could be recognized from the hole, and it appeared one year later, although the hole was covered by weeds. The location of the disturbed area was able to be detected. In order to detect buried iron items in a natural sand beach, we conducted a magnetic survey with an Overhauser magnetometer. First, the survey line was laid at the beach. A steel can, a stainless-steel knife, and a plug-in multi-tap were buried. Magnetic field intensity (MFI) and MS were measured on the beach's surface, the values indicated a relatively higher value at the site where the steel can was buried. The peak of MFI was found at the burial depths of 10 cm to 40 cm while MS peak was not found. This implies that the MFI test with an Overhauser magnetometer is more effective than the MS measurement. We will introduce the successful examples of the hidden reinforcing iron bars, the metal fragments and unexploded ordnance detections which were used by the army before the end of the Second World War.

Biography of presenter: Forensic geologist, Associate Professor of Japan Coast Guard Academy, IUGS-IFG Regional officer of Japan.

Applications of the Geoforensic Search Strategy (GSS) in Colombia to Locate Homicide Graves

Carlos Molina[1]*, Alejandra Baena[2]*, Laurance Donnelly[3]*, Rosa Di Maggio[4], Matheus Silva[5]

*[1*2*] Officer for Latin America, IUGS-IFG, Iberoamerican Network of Forensic Researcher (RIIF_CYTED) and Universidad Antonio Nariño, Colombia. [3]Chair and Founder, IUGS-IFG. Founder and Inaugural Chair, GSL-FGG. Chief Geologist and Head of Technical Department, AHK International, UK. [4]Officer for Europe, IUGS-IFG and Geoscience Forensi, Italia. [5]Website Manager, IUGS-IFG and Paraná State Scientific Police, Brazil.*

Abstract: Colombia has around 250,000 formally recorded missing persons, of which 121,768 were forced disappearance between 1985 to 2016[1]. Research and operational investigations have been formally approved to search for and locate these graves, recover and identify the human remains, and return the bodies to the victims' families. Since 2007 to 2023, the judicial police have found and exhumed 8,385 corpses in 6,818 graves[2]. Four experimental forensic laboratories have been established to simulate the geological and environmental characteristics of suspected grave sites, to develop search methods. Here, the test targets include pigs, clothes and burned bones buried to variable depths and areas. The Geoforensic Search Strategy (GSS), developed over 25 years in the UK, combines conventional geological exploration and ground investigative techniques, with traditional police search methods. This blended approach has been adopted to suite the ground conditions in Colombia considering the geology, soil types, climate, topography, past land use, state of human decomposition or preservation, environmental conditions, and target size and depth. This has resulted in the application of GSS as a principal search strategy to locate shallow, unmarked graves. Operational case examples are provided from the municipalities at Codazzi in northern Colombia, Granada in eastern Colombia and Cali in western Colombia. In October 2022, GSS training was provided in Bogota, as part of *the '5th IberoAmerican Congress on Forensic Geology',* incorporating drones, geophysics and forensic recovery. Family members of victims were provided with separate demonstration on how the GSS could locate missing persons' graves to help bring closure.

Biography of presenter: Carlos is a doctor in geosciences and specialist in forensic anthropology. As a geologist, he has worked work with professionals in chemistry, biology, bacteriology, engineering and law as a principal investigator, director and co-director of university scientific projects at postgraduate and undergraduate levels. He has participated with the Human Rights Unit which belong to the Attorney General's Office in the search of mass graves. He has experience in trace evidence analyses. He is the Officer for Latin America, IUGS-IFG and Coordinator of IberoAmerican Network of Forensic Researcher (RIIF) with support from Ibero-American Program of Science and Technology for Development (CYTED).

[1]https://www.comisiondelaverdad.co/violaciones-de-derechos-humanos-infracciones-al-derecho-internacional-humanitario-y/desaparicion
[2]https://www.fiscalia.gov.co/colombia/wp-content/uploads/2023-08-31-REPORTE-ESTADISTICO-GRUBE.pdf

Optimising Aquatic Geophysics Search Strategies for Detection of Drowned and Missing Individuals

Jamie Pringle[1]*, Kris Wisniewski[1], Viv Heaton[1], Luke Hobson[2], Alastair Ruffell[3], Megan Stubbs[1], Amelia Fennell[1], Thomas Kulyk[1], Heidi Florian-Stargard[1], Michelle Preece[2], and Ben Davenward[2]

[1]School of Chemical & Physical Sciences, Keele University, Keele, Staffs, ST5 5BG, UK; [2]School of Geography, Geology & Environment, Keele University, Keele, Staffs, ST5 5BG, UK; [3]School of the Natural Built Environment, Queens University, Belfast BT7 1NN, UK

Abstract: The geoforensic search of water bodies for missing persons and drowned individuals pose significant challenges for search practitioners, not least including large search areas with varying water depths, geo-location of data, poor water visibility and varying salinities/organic matter, particularly in UK waters, obscuring vegetation, and varying basal sediment type[1]. Optimising aquatic geophysics search strategies is thus extremely challenging and case specific, but controlled site research and casework experience can help to aid practitioners in search. This involves both controlled test site research and active involvement in forensic casework. This presentation aims to showcase recent controlled and casework research to detect drowned and missing individuals in UK inland waters. A series of controlled test sitework will detail the advantages and limitations of a thorough desk study, reconnaissance and full aquatic surveys. Forensic search survey techniques, to detect both whole and body part mannequins, include the integration of differential dGPS-enabled high-frequency water sonar surveys, multi-frequency Water Penetrating Radar (WPR) surveys and 'live' water conductivity surveys in a variety of different water search environments. The resulting search strategy was then applied to two Staffordshire unsolved missing person aquatic search cases, with collected field data from one then analysed and high priority targeted areas then identified for aquatic search teams to determine their origin. Research implications will finally be presented to give aquatic search practitioners assistance when undertaken aquatic forensic searches in inland waters.

Biography of presenter: Dr Jamie Pringle is a Reader in Forensic Geoscience at Keele University, part of a collaborative group of staff and students at Keele University and beyond, looking to assist forensic search practitioners and researchers.

Searching for Missing Homicide Victims: The Development a Data-Driven Model

Dr Niamh Áine McCullagh*

University College Dublin/Office of the State Pathologist/Department of Justice Ireland

Abstract: The use of data in the search for missing persons has long been used when searching for those who are missing as result of their own actions; those who may be lost, wandering or have committed self-harm. Agencies around the world use data to inform their search decisions in a variety of land and water based contexts; for example the well-known Grampian data in the UK or the Search and Rescue Optimal Planning System (SAROPS) data in the US. A project ongoing in Ireland has been looking at the specific category of missing persons who have been the victims of homicide and how we can improve on the search planning decisions we make as practitioners for this particular case category.

The method at the core of this project is based on the analysis of primary data from previous cases contributing to the development of a decision support system in future cases. A database of primary source data has been created and collated through case file access provided by the Office of the State Pathologist Ireland and An Garda Síochána. The first stage of the project provided statistical evidence that certain case attributes distinguish behaviour and patterns of landscape use; for example, the sex of the victim and the offender (QUB 2015-2020). The second stage of the project will develop this data into a resource for case-based use in Ireland (UCD 2023-2025). This presentation will present a summary of results to date and provide insight to future developments.

Biography of presenter: Dr Niamh McCullagh (BA MA MSc) is a Forensic Archaeologist and Search Specialist with over 17 years casework experience working with An Garda Síochána (the Irish Police), the Independent Commission for the Location of Victims Remains, the Mother and Baby Home Commission of Investigation and the Police Service of Northern Ireland. Niamh is currently employed by the Department of Justice and University College Dublin to improve on the way in which we search for missing victims of homicide in Ireland. Niamh is recognised as Professional Member of the Chartered Society of Forensic Sciences, a qualified Expert Witness in Ireland and the UK and a Director of the Institute of Archaeologists in Ireland.

From Hot Air Balloons to Drones: A History of Aerial Surveying to Locate Clandestine Graves

Benjamin Rocke[1]

[1]Queen's University, Belfast

Abstract: It was almost exactly a century from the first aerial photograph, taken from hot air balloon in 1858, to the transmission of the first image of Earth from orbit. If the first century was dedicated to putting sensors higher and higher in the air for greater coverage, the last 13 years are seeing sensors coming closer to Earth and being mounted on drones to fill a sweet spot in the sky that balances both coverage and resolution. In 2010, the first ready-to-fly commercially available camera drone was released, the Parrot AR, which flew with a 0.3MP sensor at a maximum altitude of 6m. Modern drones fly at altitudes up to 7,000m with cameras up to 45MP capable of capturing 3 square kilometres in a single flight and can been deployed with a range sensors. As such, drones have become the go-to aerial surveying method of clandestine grave search, not only because of their coverage, resolution, and variety of available sensors, but accessible cost, lack of human footprint, and battery autonomy sufficient to cover hundreds of hectares in a day. The first study using a drone to locate clandestine graves was in 2018, where Evers and Masters used a modified GoPro camera on a DJI Phantom 1 to resolve burials up to seven years old. Subsequent studies have advanced the technology with drone-mounted multispectral, thermal, LiDAR, and hyperspectral sensors to locate graves over 100 years old. This presentation will cover the history of aerial photography, and how our obsession with capturing ourselves from the sky serendipitously showed us what was below ground. I will begin with early subterranean discoveries from primitive aerial flights, progress to fixed-wing aerial photography and satellite imagery, and eventually return to studies at lower altitude via drone, all with a focus on how our ability to locate clandestine graves aerially has changed. Finally, I will summarise this rapidly expanding technology in terms of use cases, latest developments, best practices, and limitations.

Biography of Presenter: Benjamin Rocke is a PhD student at Queen's University, Belfast studying how drones can detect clandestine graves. He has co-published 6 papers highlighting his research and is developing a protocol on the use of drones to narrow down search areas and help find clandestine graves in the UK, Ireland, Continental Europe, Kenya, the US and Colombia. Benjamin received his Master of Science degree in Geology from the University of Kansas in 2006 and worked in the oil industry for over 10 years before changing his career.

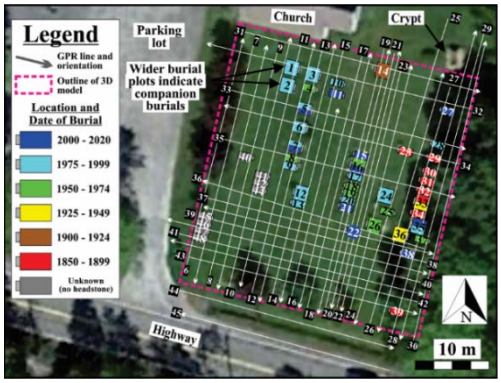
Dawson, Ruffell, Cassella & Donnelly

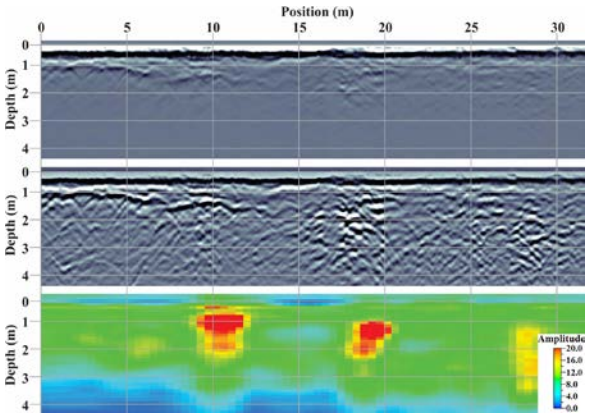
Geoforensics in Atlantic Canada-application of GPR for cemetery and criminal investigations

Grant Wach[1]

[1]*Basin and Reservoir Lab, Dalhousie University, Halifax, Canada*

Abstract: Ground Penetrating Radar (GPR) reconstructions have largely been presented as 2D vertical and horizontal planes, limiting visualization of subsurface 3D shapes and their spatial relationships. With the availability and integration of various software platforms, 3D modelling of GPR data is now emerging as the new standard. We conducted a geoforensic study in a mid-19th C. church graveyard near Halifax in 2019. Tombstones and plot plans indicated locations and ages of burial sites, as well as the types of burial sites and practices (single-casket, multi-casket, and urns) and several sites with no tombstones. A GPR grid survey was conducted in the graveyard to generate 2D and 3D model reconstructions of these unmarked sites. Data collection and processing was completed using a Sensors and Software Incorporated PulseEKKO™ Pro SmartCart GPR system and EKKO_Project™ software with modelling completed using a Schlumberger's Petrel™ software platform.





2D and 3D reconstructions closely matched the graveyard plot plan, validating our collection, processing, and modelling methods. The 2D model proved adequate for visualisation of reflection patterns at specific depth but the 3D model was superior with enhanced visualisation, identification of companion burial plots (stacked caskets) and possible leachate plumes at burial sites, not evident in the 2D model. We applied these techniques to aid law enforcement in criminal investigations in Nova Scotia (2018-2022).

Biography of Presenter: Professor Wach (D.Phil., FGS, P.Geo.) has led several geoforensic investigations in Nova Scotia and chaired the Geoforensics session at Halifax 2022 and led the Geoforensics workshop for law enforcement, the Crown and Medical Examiner's office in May 2022. He was the first AAPG Professor of the Year, recipient of the CSPG Slipper gold medal and is an Irish McGee Beacon fellow.

The Clean Gold Programme

Caio Tadao Joko[1], Erich Adam Moreira Lima[1], Fernanda Ronchi[1], Fábio Augusto Da Silva Salvador[1]*, Gustavo Caminoto Geiser[1], Ricardo Cordeiro Vitoria de Moraes[1], Wladimir Almeida[1]

[1]*Brazilian Federal Police, Technical-Scientific Directorate, The Clean Gold Programme, Brasília, Brazil*

Abstract: The Clean Gold Programme (also known as, Programa Ouro Alvo or POA) aims to create procedures and mechanisms against money laundering, financing of terrorism, and reduce the risks and vulnerabilities related to illegal gold mining and trading in Brazil and Latin America. It also intends to help the Brazilian Federal Police (BFP) so they can act proactively investigate associated crimes. The BFP's Forensics Directorate is developing the National Gold Profile Database (NGPD) to build a forensic knowledge base of Brazilian and South American gold, which will assist law enforcement authorities, prosecutors, and judges. The NGPD will contain mineralogical, geochemical, and isotopic data from reference samples collected at large and small-scale mining operations. These can be compared with questioned samples to identify the origin and traceability within the gold supply chain. The National Gold Repository consists of a physical collection of gold reference and questioned samples maintained by the National Institute of Criminalistics (NIC), in Brasilia. The BFP's research and protocols are being developed in partnership with academia, mining companies, research institutes and inspection bodies. The results aim to reflect the state of the art in combating transnational gold crime.

Biography of presenter: Fábio Augusto Da Silva Salvador is a geologist with a master's and doctorate in Mine Engineering and 40 years of experience in: mineral prospecting and research, forensic geology, forensic process management and criminal forensics and head of technical and operational teams. He was Forensics Director of the Brazilian Federal Police, promoting training, proposals and incentives for different areas of criminalistics in Brazil, mainly forensic geosciences, crime scene forensics, micro traces and cultural heritage. He coordinates the Clean Gold Programme, is currently a post-doctoral researcher in lead isotopy as a gold traceability tool and is the IUGS-IFG Regional Officer for Latin America.

Forensic Geology Investigation of Mercury Associated with Artisinal Small-Scale Gold Mining (ASGM) and Environmental Crimes in Amazonia, Brazil

Marcelo da Silveira Tortolero Araujo Lourenço[1]*, David Debruyne[2], Rosa Maria DiMaggio[4], Laurence Donnelly[6], Chiara Germinario[1], Celestino Grifa[1], Francesco Izzo[3], Alessio Langella[3], Fabio Augusto da Silva Salvador[5], Mariano Mercurio[1]

[1]Department of Science and Technology, University of Sannio, Italy; [2]Department of Geology and Natural Resources, State University of Campinas, Brazil; [3]Department of Earth Sciences, Environment and Resources, University of Naples Federico II, Italy; [4]Geoscienze Forensi Italia, Italy; [5]Brazilian Federal Police, Brazil; [6]Chair and Founder, IUGS-IFG. Founder and Inaugural Chair, GSL-FGG. Chief Geologist and Head of Technical Department, AHK International, UK.

Abstract: The geology of extensive expanses of the Amazon Rainforest is particularly known for its mineral deposits. Since the discovery of gold in Serra Pelada (Pará) during the 1980s, the artisinal small-scale gold mining (ASGM) have expanded, without following proper regulations and against the laws of Brazil. As a direct consequence, mercury contamination of the soils and groundwater is one of the principal concerns given its negative impacts on human, wildlife and the environment. Therefore, we aim to investigate the use of mercury by ASGM operations in the magmatic-hydrothermal Coringa gold-silver (Cu-Pb-Zn) deposit - Tapajós Mineral Province, Pará, Brazil. To carry out such an assessment, a multidisciplinary forensic geological team will be established to accurately collect soil samples and evaluate mercury contamination. During the field campaign, contaminated sites will be compared with unexplored mineral prospects and unmineralized sites. Changes in biome composition and diversity between these sites will be characterised to evaluate the environmental effect of ASGM. The soil matrix will be characterised through quantitative XRD and XRF analysis. Mercury concentrations will be measured initially through AAS combined with pyrolysis, followed by synchrotron X-ray absorption spectrometry to determine mercury compounds present and Hg isotope analysis with MC-ICP-MS to test its potential for tracing the source of the contamination. The obtained results will determine whether the levels of mercury exceed permissible standards. This presentation will also outline the practicable and associated logistical challenges for collecting forensic geology soil samples in a remote and hostile environment.

Biography of presenter: Marcelo is a PhD student in Science and Technology for the Environment and Health, at the Department of Science and Technology of the University of Sannio, in Italy. He is also responsible for the IUGS-IFG Geoforensic International Network (GIN). Marcelo also played a key role in the establishment of the IUGS-IFG Student Chapters. Currently, his PhD research involves the application of environmental and geological knowledge and techniques to forensics. Thus, Marcelo is investigating the illegal use of mercury as an environmental crime within the illegal artisinal, small-scale gold mining (ASGM) in the Tapajós Mineral Province, Pará, Brazil.

Mineralogical Analysis Applied to Forensics: A Guidance on Mineralogical Techniques and their application to the Forensic Field

Mariano Mercurio[1]*, Alessio Langella[2], Rosa Maria Di Maggio[3], Piergiulio Cappelletti[2]

[1]Department of Science and Technology, University of Sannio, Italy;[2]Department of Earth Sciences, Environment and Resources, University of Naples Federico II, Italy; [3]Geoscienze Forensi Italia, Italy

Abstract: In this work we will present the organization of a book published in the Springer series: soil forensics. The book[1] discusses relevant aspects of mineralogical analysis assuming that minerals and their synthetic counterparts are valuable evidence in forensics, and their examination, characterization and comparison are essential. It covers from the simplest to the best practices of the applied mineralogy involving the use of destructive and non-destructive analytical techniques. These approaches succeed, as shown in the text, in addressing forensic cases in a variety of contexts, such as: wildlife, art, ballistics, drug crime and environment. Analytical techniques illustrated are optical microscopy (OM), X-ray diffraction (XRD), scanning electron microscopy (SEM) combined with X-ray microanalysis, Infrared and Raman spectroscopy, inductively coupled plasma-mass spectrometry (ICP-MS), simultaneous thermal analysis (STA), X-ray fluorescence (XRF), isotopic analyses and digital image analysis. Case studies inherent to forensic investigation activities are presented for each technique. The text embraces various multidisciplinary expertise, never neglecting connections with the mineralogical characteristics of the investigated matrices. Finally, the book also paves the way toward an increasingly dense enrichment process of new analytical approaches, peculiar to mineralogy, aimed at ascertaining the evidence of crime. On this basis, the text can be used in academia, especially for courses pertaining to the earth sciences, but also in the service of legal practitioners who wish to better clarify their ideas toward mineralogical applications in forensics.

Biography of presenter: Mariano Mercurio: geologist, PhD and author of over 100 scientific papers in national and international high impact factor journals. He is associate professor at the University of Sannio. He has taught forensic geology and applications and is now Lecturer in mineralogy and georesources, while for years he worked on analytical mineropetrographic techniques applied to forensic cases. In addition, he is co-editor of two books on forensic applications of modern analytical techniques in mineralogy and consultant for forensic cases requiring the identification of geological traces at crime scenes.

[1] Mercurio, Mariano, et al., eds. *Mineralogical Analysis Applied to Forensics: A Guidance on Mineralogical Techniques and Their Application to the Forensic Field*. Springer, 2023.

Illegal Mining and the Trafficking of Illicit Minerals and Metals: Techniques for Provenance Determination and Traceability

Laurance Donnelly[1]*, Fábio Augusto Da Silva Salvador[2], Ricardo Cordeiro Vitoria de Moraes[3], Jodi Webb[4]

[1]Chair and Founder, IUGS-IFG. Founder and Inaugural Chair, GSL-FGG. Chief Geologist and Head of Technical Department, AHK International, UK. [2]IUGS-IFG Co-officer for Latin America, Brazilian Federal Police, Clean Gold Programme, [3]National Institute of Criminalistics, Brasilia, Brazil. IUGS-IFG Illegal Mining Adviser, INTERPOL, France (formerly, Brazilian Federal Police, Clean Gold Programme). [4]IUGS-IFG FBI Adviser, Federal bureau of Investigation Laboratory, Quantico, Virginia, USA.

Abstract: Crimes take place associated with illegal mining and the trafficking of minerals and metals. These are reported to have been increasing in recent years on a global scale. These crimes include, but are not limited to, document falsification, theft, substitution, adulteration, smuggling, environmental degradation, money laundering, corruption and human rights violations. The beneficiaries can be well-organised and highly resourced Transnational Organised Crime Groups (TOCG), cartels, criminal gangs and syndicates. Operational case examples and intelligence from law enforcement and commercial operations are provided, but anonymised, to demonstrate the apparent increase in such illegal activities. In 2019, the scope of activities of IUGS-IFG increased, from the conventional, 'scene', 'sample' and 'search' to include mining, minerals and metals crimes, and the role of geologists and geological techniques. This led to the establishment of an IUGS-IFG Special Project, which is outlined, and collaboration with the Brazilian Federal Police (Clean Gold Program), Colombian National Police and INTERPOL. Also provided in this presentation is an assessment of methods to mitigate associated risks including covert operational deployment, reform and legislation, national guidance, codes, due diligence audits, bagging and tagging schemes, chain of custody, elemental, mineralogical and isotope profiling, and the potential use of artificial microtaggant particles for traceability and provenance determination. Case examples are provided throughout for precious metals, base metals, conflict minerals and gemstones. There is an immediate need for continued international collaboration, for an inclusive, disciplined and structures strategic approach to crimes in the mining, minerals, and metals industries, with geological support.

Biography of presenter: Laurance is a chartered geologist with a first-class honour's degree and PhD in geology, and 34 years extensive international experience in: forensic geology, mineral exploration and mining, and engineering geology and geohazards. He is registered with the UK National Crime Agency as an Expert Adviser. He has provided operational support for the police and law enforcement including: crime scene examination and sample collection, geological trace evidence analysis, ground search burials, and mining, minerals and metals crimes.

Why Does the FBI Need a Geologist?

Jodi Blakely Webb[1]*, Ian Saginor[1], Libby Stern[1] *Federal Bureau of Investigation Laboratory, USA.*

Abstract: How can you solve crime with just a little dirt? Forensic geologists have worked at the FBI for over 100 years, helping to solve thousands of cases in all 50 states and over a dozen countries.

Soil evidence adhered to items (shoes, vehicles, garments, shovels) can be examined and compared to soil at a scene of a crime. Other geologically-derived materials such as bricks, cement, plaster, and even ceiling tiles can be examined for identification, comparison and potential end-use. Brittle materials can be examined for fractography or fracture fit. Forensic geologists can also assess the source of geological material for investigative and intelligence efforts. In that case, a forensic geologist can analyze the material and use maps to find areas with similar characteristics. FBI geoscientists contribute to "search" efforts by assessing: suitability of soils for clandestine burials or for geophysical methods, hydrology for potential erosion for cold case burials, and appearance of disturbed soil.

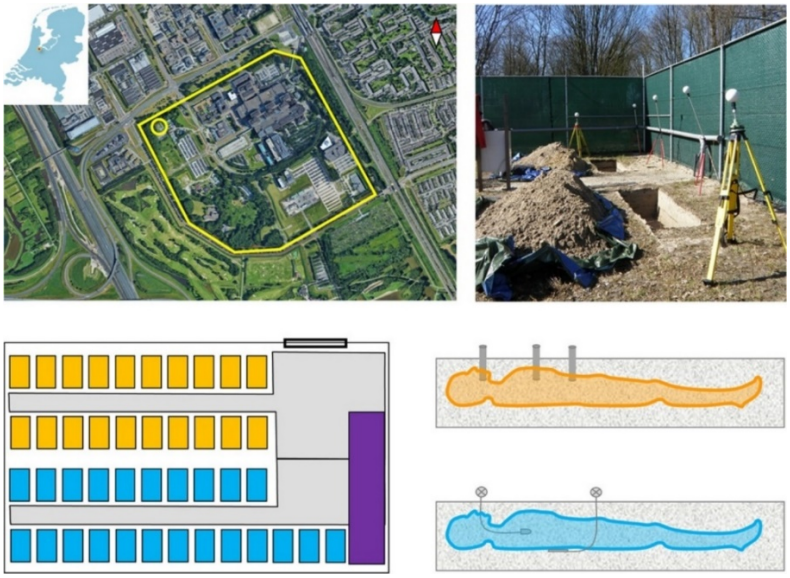
Biography of presenter: Jodi Webb earned her B.S. in Geology from Northern Arizona University and her M.S. in Geology from the University of North Carolina, Chapel Hill. She has worked as a Geologist/Forensic Examiner for the Federal Bureau of Investigation (FBI) Laboratory in Quantico, Virginia, USA since 1997. She examines geologically-derived materials for law enforcement agencies and provides expert testimony regarding her findings. Ms. Webb is involved in research and standards development for forensic geology, is a member of the Organization of Scientific Area Committees (OSAC), ASTM International, and is the FBI Adviser for International Union of Geological Sciences-Initiative on Forensic Geology (IUGS-IFG).

ARISTA: a human taphonomic research facility in the Netherlands

RoelofJan Oostra[1,4]*, Maurice Aalders[1,4], Gepke Uiterdijk[1,4], Mike Groen[2,4], Coen Nienaber[2,4], Mark Lüschen[3,4]

[1]Amsterdam University Medical Centers, The Netherlands; [2]Netherlands Forensic Institute, The Netherlands; [3]National Police, The Netherlands; [4]CLHC - Netherlands Center for Forensic Science and Medicine, The Netherlands

Abstract: A taphonomic research facility for the study of human remains was recently realized in Amsterdam, the Netherlands, to systematically investigate the decomposition of the human body under known and controlled conditions. This facility specifically allows for the study of buried bodies e.g. with the use of telemetry and remote sensing. Here, we discuss the concept of body donation in the Netherlands, its role in taphonomic research, and the sequence of events that preceded the realization of this facility, which is the first of its kind in Europe[1].



[1] Oostra RJ, Gelderman T, Groen WJM, et al. Amsterdam Research Initiative for Sub-surface Taphonomy and Anthropology (ARISTA) - A taphonomic research facility in the Netherlands for the study of human remains. Forensic Sci Int. 2020;317:110483. doi:10.1016/j.forsciint.2020.110483

Biography of presenter: R.J. Oostra, MD, PhD, is a Professor of Clinical and Comparative Morphology, in the Department of Medical Biology, and head of the section Clinical Anatomy and Embryology at the Amsterdam UMC. His core business is teaching anatomy and embryology in various (bio)medical curricula. His research presently focusses on clinical morphology and congenital malformations. He supervises eight PhD students.

Why doesn't the UK have a Human Taphonomy Facility yet?

Anna Williams[1]*, Chris Rogers[2], John Cassella[3]

[1] School of Law and Policing, University of Central Lancashire, Preston, UK; [2] University of Wolverhampton, Wolverhampton, UK; [3] Atlantic Technological University, Sligo, Republic of Ireland.

Abstract: Human Taphonomy Facilities (HTFs) are outdoor laboratories that use donated human cadavers to understand human decomposition in a variety of conditions. There are currently eight such facilities in the USA, one in Canada, one in Australia and a 'Forensic Cemetery' in mainland Europe. Currently in the UK, empirical decomposition research is carried out using animal analogues at university-based Animal Taphonomy Facilities (ATFs). However, concerns about the use of animal remains as human analogues in forensic research, and recognition that HTFs offer the chance to study the effect of certain human conditions and lifestyle choices on decomposition rate, mean that UK forensic scientists have started to ask 'Why doesn't the UK have a Human Taphonomy Facility yet?'.

The possibility of opening an HTF in the UK is controversial, as there are objections on scientific grounds, as well as ethical, moral, and religious opposition, and substantial legal obstacles to overcome. Media attention has both garnered support and provoked objections from the public.

This presentation will discuss the scientific, legal, ethical, and moral objections, and the cogent arguments for and against the establishment of a HTF in the UK. It will discuss the risks associated with the creation, delivery, and day-to-day running of a facility. It will show how the UK situation differs from other countries where HTFs exist, and whether the UK can learn from their experiences. It will also discuss current public opinion in the UK, based on the results a recent online survey conducted by the authors.

Biography of presenter: Anna Williams is Professor of Forensic Science at the University of Central Lancashire. She specializes in forensic taphonomy research. For approximately 12 years, she has been working with colleagues to overcome obstacles to the establishment of a UK Human Taphonomy Facility. She undertakes consultancy work for UK and international police forces, and has advised Locate International, the NCA and Home Office on decomposition and search cases. She has advised TV dramas including *Silent Witness*, and *Bones* and crime fiction. Simon Beckett's 2019 book *The Scent of Death* was inspired by her research into the gases given off by decomposing cadavers.

Suitable Soils for Coffin Graves – when the human remains are not missing

Inghild Økland[1]*, Trond Knapp Haraldsen[2], Monica Jayesingha[3] Attila Nemes[4] and Lorna Dawson[5]

[1,2,3]Norwegian Institute of Bioeconomy (NIBIO), Norway. [4]Norwegian University of Life Science, (NMBU) Ås & [5]James Hutton Institute and Robert Gordon University, Aberdeen.

Abstract: The project "Suitable Soil for Coffin Graves" (2020-2022) attempted to find the key factors influencing decomposition in cemeteries of Norway. The Norwegian law states that a grave can be reused after 20 years only if it is coarse bones and coffin fragments alone that remains in the grave. This condition for reuse is not met in many cemeteries, creating a requirement for finding 'good' soil for coffin graves. 73 graves were opened, the soil examined, and the rate of decomposition graded based on a visual inspection of the remains. The results of the survey were published[1] in a preliminary report, and the work forms the platform for a series of laboratory experiments underway looking at the factors which influence human decomposition in a burial environment in Norway.

Biography of presenter: Inghild Økland works for the Norwegian Institute of Bioeconomy (NIBIO) as a soil scientist. Her work spans across consultant for soil handling and translocation in construction projects, to scientific fieldwork and experimental studies on soil for cemeteries. She has started her PhD on the subject of cemetery soils, allowing her to disentangle the effects of the many factors in human decomposition in Norway.

[1] Økland I.H., Jayesingha, M., Skrutvold, J., Halvorsen, R. & Haraldsen, T. 2022. Egnet jord til kistegraver. *NIBIO Rapport* 8(97) 113s.

Developing a chemical kinetic model to determine PMSI

Simon Cooper[1]*, John Cassella[2], and Alison Davidson[1]

[1]*Staffordshire University, United Kingdom;* [2] *Atlantic Technological University, Ireland*

Abstract: When a cadaver is found in an aquatic environment, an important part of a forensic investigation is to estimate the postmortem submersion interval (PMSI). Current methods to estimate PMSI include the use of visual scoring systems but due to the complexity of each case, the prediction may not always be accurate due to the conditions in which the cadaver was found.

As the nitrogen cycle plays an important role in decomposition, this research followed the ammonification and nitrification pathways to select chemical biomarkers (amino acids, ammonium, nitrite, and nitrate ions) for analysis. As temperature is also known to affect the rate of decomposition and chemical reactions, chemical kinetics were taken into consideration and reaction orders were calculated, this offers the potential to produce a flexible model to predict PMSI from the relative concentrations of these biomarkers.

This research into the chemical kinetics of nitrogenous biomarkers has indicated that using liquid chromatography techniques can help determine PMSI during the early stages of decomposition.

Biography of presenter: I studied chemistry and graduated with a master's degree in 2010. I started my scientific career in industry as a chemistry analyst where I helped to design new materials while carrying out quality assurance testing on current products. I moved back into academia after 5 years where I joined Staffordshire University in 2017 as a Technical Specialist in Analytical Science carrying out work on a consultancy basis. After a few years, I had the opportunity to demonstrate practical sessions to undergraduate students at which point I embarked upon my postgraduate PhD studies in taphonomy part time.

The Bone War is back: fossil frauds

Federico Fanti[1,2]*

[1] *Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Via Zamboni 67, 40126 Bologna, Italia;*
[2] *Museo Geologico Giovanni Capellini, Via Zamboni 63, 40126 Bologna, Italia*

Abstract: Conflicts related to fossils, unquestionably a humanity heritage, did not end a century ago when newsboys gathered hundreds with stories about creatures hiding in the rocks and emerging scientists securing supremacy over a quarry with rifles. Decades of deceitful, unexpected, and most important unnoticed conflicts have led to a complex reality where the life of hundreds of people crosses with billions of dollars every year. If nowadays several countries represent a crucial target for fossil hunters (either scientists or poachers) powering collections and legal trade, others are recriminating decades of colonial impositions and claim their fossilized treasures back. A complex network where those trying to set a common ground to promote shared values on protection, promotion and legal trades must face unexpected but deeply interconnected facts and expertise. The black market, prominent auction houses, the business of fossil trading, tribunals, remote quarries, historical revenges, the most incredible scientific discoveries. In a global network that even lacks a shared, unequivocal definition of *fossil*, all modern conflicts related to Paleontology are remarkably rooted in an ineffective legislation. As a matter of facts, each country has adopted self-referenced laws, forcing all those involved in paleontology toward a real crisis. Pending effective and internationally shared enhancements, uncertainty unavoidably lays the path to frauds. Complex issues, such as frauds in paleontology need innovative and more effective partnerships. By 2030 professional paleontologists working for private or public institutions will have to share knowledge with, amongst others, lawyers, traders, FBI representatives, ministries, ethic experts and media.

Biography of presenter: Federico Fanti is Associate Professor in Paleontology at the University of Bologna and Scientific Director of the Museo G. Capellini. For ten year he has been involved in the delicate process of repatriating poached specimens, also working with international fossil traders, legal experts and cultural heritage ministries. Fanti's team developed an innovative scientific methodology to counter the black market of dinosaurs which was successfully applied in an FBI investigation.

What is a 'match' in Forensic Soil Science? Raising questions based on a murder case in Southern Brazil

Matheus P. N. e Silva[1]*, Fábio A. S. Salvador[2], Adriel F. S. Brito[1], Nicolas dos S. Rosa[1], Mariana Mazzari[1]

[1]Paraná State Scientific Police, Environmental Crimes Unit, Curitiba, Brazil; [2]Brazilian Federal Police, Technical and Scientific Section, Curitiba, Brazil

Abstract: Many authors have addressed statistical issues regarding the evaluation of forensic evidence in court. Reliable methods, such as Bayesian inference, has been applied to different types of trace evidence - however, when it comes to the heterogeneous and uncertain domain of earth materials, most forensic scientists are relying on multivariate statistical tools to compare questioned and control samples – the output, although may mislead the interpretation of evidence: does physical correspondence mean geographic provenance? How to define a *'match'* based on PCA and similarity measures? In order to appoint some of those issues, we present a Brazilian case where soil collected from suspects' trouser (*n=1*) and backyard (*n=1*) and the victim's vehicle (*n=2*) indicated a possible involvement in a murder incident. Aiming to determine its mineral, elemental and colorimetric attributes, samples were initially homogenized, subsampled, sieved (<63 μm), oven-dried, grinded and submitted to XRD, pXRF and colorimetry. Results indicated a common composition of quartz (>30%), kaolinite (>30%), rutile (10-30%) and gibbsite (<10%); a chemical compatibility in terms of Si, Fe, Al, Ti and Zr; and a similar colour index in the RGB/HSL spaces. A Bray Curtis similarity of 93.5% were obtained between soils from victim's vehicle and suspect trouser. Even though their compatibility were classified as strong to very strong, the inherent variability of soils raised concerns regarding the true provenance of the questioned evidence. Samples were defined as yellowish-brown Cambisols, consistent with weathered mudstones and sandstones existent in the region. Nonetheless, efforts to narrow down its origin are still needed.

Biography of presenter: Matheus is a B.Sc. and M.Sc. in Geology, currently working as a forensic geoscientist at the Paraná State Scientific Police in Curitiba, Brazil. He provides scientific support for law enforcement authorities by examining soils and earth materials collected at crime scenes and assists in the investigation of environmental crimes (deforestation, mining, pollution, and animal abuse). As a former intern at the Brazilian Federal Police, he provided GIS intel and assisted in drone surveys. Matheus is the co-founder of the IUGS-IFG Student Chapters and holds the position of web manager at the Committee.

Applying machine learning methods to age estimation in forensic anthropology

Martin Lo[1 2], Ruth M Morgan[1 2], Sherry Nakhaeizadeh[1 2], Enrico Mariconti[1]

[1]Department of Security and Crime Science, University College London, WC1H 9EZ; [2]UCL Centre for the Forensic Sciences, 35 Tavistock Square, London WC1H 9EZ

Abstract: The advancements in technology and big data are reshaping all fields of academia and industry with artificial intelligence (AI). There is a growing body of research in Forensic anthropology focussed on the potential for the current technological revolution to address critical questions. Gradual acceptance of newer technologies has led to the adaptation of virtual and three-dimensional modelling, and now the integration of machine learning (ML) methods with traditional estimation methods of population affinity, sex, and age. This work shows great promise, yet the long-standing challenges of utilising big data, and addressing the challenges inherent to experience-based methods still persist in Forensic Anthropology. In a move away from traditional methods of nonmetric estimations, this study explored the feasibility of utilising a large-scale (n = 3093) virtual, 3D, and healthcare dataset in conjunction with ML methods for age estimation. The trade-offs between different ML learning types in the context of complexity, interpretability, and explainability were explored. Classification models developed using decision trees, random forests, and 3D convolutional neural networks allowed inferences to be drawn regarding age estimation. Initial results indicate there is room for improvement with classification rates ranging from 0.400 to 0.600 depending on the algorithm type. There is potential to apply these methods to other forensic science fields. However, given resources are scarce, it is important to consider whether it is worthwhile to pursue ML and AI methods and it will be important to weigh the novelty factor over the value ML and AI can bring to specific forensic science questions and practice. As such, a foundational understanding of the underlying science must first be achieved to enable responsible applications to forensic science.

Biography of Presenter: Martin is a PhD candidate at UCL Department of Security and Crime Science, Centre for the Forensic Sciences. His work centers on applying machine learning and artificial intelligence techniques on forensic anthropology estimation methods, specifically age and sex estimation. His research primarily involves developing machine learning models using large scale healthcare medical imaging datasets. He has also conducted research in human anatomy, ethical issues in artificial intelligence, and human computer interactions involving cybersecurity and online safety.

Mineralogical and Color Variations observed in Surficial Soils

Hannah Dickson[1]*, Libby Stern[2], Jodi Webb[2], Kelly Meiklejohn[3], Jack Hietpas[4], Ian Saginor[2]

[1]Oak Ridge Institute for Science and Education, Visiting Scientist Program Oak Ridge, TN, [2]Federal Bureau of Investigation Quantico, VA, [3]North Carolina State University Raleigh, NC, [4]John Jay College of Criminal Justice, New York, NY

Abstract: To test the relative utility of new and existing methods in forensic soil comparisons, we are studying surface soils (~0-3 cm below litter layer) from 30 locations with paired sites of different vegetation cover at each location, collected in triplicate, 1 meter apart (180 samples). Commonly used methods of polarized light microscopy (PLM), X-ray diffraction (XRD), and soil color are being compared to automated SEM-EDS-based mineral counts and DNA-metabarcode analysis. This presentation covers the PLM and colorimetry portions of the research. Soil grains, washed of surficial coatings, were prepared for PLM using the 105-250 µm and ~50-105 µm size fractions with approximately 5000 and 15000 grains per slide for the respective size fractions (based on automated morphometric measurements). All grain types on each slide are identified and binned into the following categories based on their abundance: major (>~10%), minor (~1-10%), or trace (<~1%) components, recording grain counts for those categorized as trace. Triplicate samples are being assessed for the presence and absence of trace minerals (e.g., mineral dropout). Among sites assessed to date (44/60 sites), samples with at least 12 grains of a particular mineral per slide are found to be present in other triplicates at the site. However, samples with 1-3 grains of a particular mineral per slide may be absent in slides from soils collected 1 m away. This quantification of mineral dropout could be used to aid in the development of criteria for forensic soil comparisons of soils that contain minerals at the trace abundance level. The differences in bulk soil color in L*a*b* color space are reported as ΔE_{00} values, where “notable” differences are >10, and <3 is on the edge of human perception. We found that 20% of the means of paired sites had notable differences, where 12% of the triplicate soils from each site had notable differences. Colorimetry analysis of clay-sized fraction is currently being investigated.

Biography of presenter: Hannah Dickson is a Visiting Scientist with the Oak Ridge Institute of Science and Education at the FBI Laboratory, where she is completing research on forensic soil comparisons.

Conflict soils

Duncan Pirrie[1]*, Lorna Dawson[2], Jamie Pringle[3], Adam Jeffery[3], Kris Wisnewksi[3], John Cassella[4], Jonathan Bridge[5], Miassar Alhasan[6], Abdulkarim Lakmes[7], Mohammad Gazy Alobaidy[8], Safwan AlHaeek[6], Muhammed Assaf[9] & Ziad Abdeldayemh[10]

[1]Faculty of Computing, Engineering and Science, University of South Wales, UK; [2]Centre for Forensic Soil Science, James Hutton Institute, UK, [3]School of Geography, Geology & Environment, Keele University, UK, [4]School of Science, Institute of Technology Sligo, Ireland, [5]Department of the Natural and Built Environment, Sheffield Hallam University, UK, [6]Sham University, Syria, [7]Harran University, Turkey, [8]Van Yuzuncu Yil University, Turkey, [9]Kahramanmaras¸ Sütçü ˙Imam University, Turkey, [10]Liverpool John Moores University, UK

Abstract: A standard task for many environmental geologists, is the analysis of surface soils, contaminated as a result of the legacy of past industrial activity which may remain within soils for hundreds of years, if not considerably more. Contaminants may include organic or inorganic materials, either as discrete particles, or in solution, and subsequently fixed in place through either organic or mineralogical processes. These legacy contaminants may either be present in a stable form so that they are not available for uptake into the biosphere; or may be mobile - moving from the soils into plants and animals or migrating laterally as either sediment grains or within solution. Battlefields are degraded, scarred landscapes with warfare causing a significant impact on the surface environment. Heavy machinery can churn up the surface, whilst the detonation of ordnance introduces debris into the soil profile. Debris derived from explosions can be introduced and buried into the near surface environment, whilst materials derived from the armaments being used will also be present.

Post-conflict, landscapes may recover, ready to return to their previous use, and eventually, as in the WWI landscapes of France, bear little visual sign of past conflict. But do the soils retain an environmental memory of past conflict, a legacy which may, in time release contaminants into the biosphere? Based on data sets from recent conflict in Syria and historical conflict in France we aim to discuss how we may identify conflict soil contaminants as the first step in understanding and predicting their long-term fate.

Biography of presenter: Duncan Pirrie is Professor of Geology at the University of South Wales and a committee member for both the Forensic Geoscience Group of the GSL and the IUGS Initiative on Forensic Geology.

Double homicide by arson: Compositional soil analysis in a case with multiple suspects and locations

Jennifer McKinley[1]*, Mathijs Van Gijtenbeek[1], Duncan Pirrie[2] and Alastair Ruffell[1]

[1]*Geography, School of the Natural Built Environment, Queen's University Belfast, N.Ireland, UK BT7 1NN;*
[2] *School of applied Science, University of South Wales*

Abstract: The complex case involves a double homicide with two victims and three potential scenes of crime (SOCs): (Location 1) the victim's house, a scene of arson; (Location 2) a road junction, approximately 230 m from the victim's house, and (Location 3) a limestone quarry approximately 7km from the victim's house, where a vehicle was abandoned that was connected to one of the accused. The SOCs were all sampled by a crime scenes police officer in the presence or under guidance of one of the authors. In total eighty-six scene samples were collected comprising: ten from the quarry (SOC 3); seven from roadway Y junction (SOC 1): 15 from plaster-casts (footwear and vehicle tread); 54 from road margins and field entrance/egress points. From differing footwear tread patterns, these could represent places where at least three different persons and/or vehicles contacted the ground. Following screening of the items in terms of visual characteristics, x-ray diffraction and volume of material a total of 18 samples were selected for further analysis by QEMSCAN, an automated scanning electron microscope system, providing rapid quantitative mineral analyses. Since the results from QEMSCAN are compositional in nature in that they convey relative information, compositional data analysis (CoDA) [2], using log-ratios, was used to investigate whether of the materials on questioned items could be excluded or compared to SOCs 1 and 2, or 3 effectively a control location.

Biography of presenter: Professor Jennifer McKinley, Director of the Centre for GIS and Geomatics, in Geography, Queen's University Belfast, is the 2023 International Association of Mathematical Geoscience (IAMG) Distinguished Lecturer. Her research interests include the development and application of spatial analysis techniques, geostatistics and compositional data analysis in ground and remotely sensed earth processes, health and the environmental impacts from natural and anthropogenic sources, criminal and environmental forensics. Jennifer is a Council member of the International Union of Geosciences (IUGS 2020-2024).

[1] Egozcue and Pawlowsky-Glahn, 2011 Compositional data analysis: theory and applications. Wiley, Chichester

Search and Trace Evidence in the Recovery of a Long-Term Missing Person

Lorna Dawson[1,2]*, Gaille MacKinnon[3,4], Steve Litherland[4], Kristina Lee[4] & Alex Allardyce[5]

[1]James Hutton Institute, Aberdeen; [2] Robert Gordon University, Aberdeen; [3]University of Kent, [4]Alecto Forensics; [5]Police Scotland

Abstract: Three years after a male cyclist was reported missing, intelligence was received by Police Scotland that two men had confessed to knocking a cyclist down with their vehicle and disposing of his body in a clandestine grave in a remote upland location in Scotland. An area of interest was identified in an upland peat bog by a witness which subsequently allowed the Police search team, the forensic soil scientist, and forensic archaeologists to identify the location of a clandestine grave. The archaeological excavation of the grave took three days, after which the man's body was carefully recovered. The grave fill was excavated by archaeological context and was carefully wet-sieved under the direction of a forensic archaeologist and anthropologist and important trace evidence was recovered. Subsequent laboratory work on this trace evidence by the forensic soil scientist and botanist identified fragments of vegetation and soil material which provided important evidential links between a primary surface deposition site and the clandestine grave. This evidence was subsequently presented to the court to illustrate what had happened to the man after he went missing. One of the accused admitted to culpable homicide and both accused were found guilty of defeating the ends of justice. This case illustrates the many difficulties associated with the search, location and recovery of a body clandestinely buried in remote upland terrain, and the importance of effective collaboration and teamwork between the investigating authorities and a team of experienced and accredited forensic scientists.

Biography of Presenter: Lorna Dawson, Professor at RGU and Head of Centre of Forensic Soil Science at James Hutton Institute, CBE, 2018, FRSE, 2019, FRSA, 2016, and the RSE Medal for earth sciences, 2023. She is treasurer of the IUGS IFG and Chair of the GSL-FGG, and on council of the ENFSI, APST working group. She is a registered Expert Advisor with the NCA and has worked with numerous police forces over the last 20 years. She provided written evidence in the House of Lords Inquiry in 2019 and oral evidence to the Westminster inquiry into Forensic Science, 2023.

Poster presentations

Please note not all will be presented as posters, but authors will be available for discussion throughout the meeting

Poster Author & Co-Authors	**Poster Title**
*Bennett, Morgan, Santini, Poolman	The biogeography of soil bacteria and archaea in relation to soil depth and distance: Applications for Forensic Science
Dawson, Sacchi, Reckel, Rēpele, Hellman, Perotti, Kuiper	The European Network Forensic Science Institutes–Animal Plant Soil Trace Working Group
Donnelly, Pirrie, Harrison, Ruffell Dawson	A Guide to Forensic Geology
Donnelly, Harrison, Webb	The Initiation, Development and Applications of the Geoforensic Search Strategy (GSS)
*Ferguson, Cassella	Locating homicide victim deposition sites associated with Souterrains in the Republic of Ireland.
*Jhalani, Morgan, Cassella, Shooter	An evaluation of key Governmental and Parliamentary Inquiries into Forensic Science 2000-2023 – where to now?
Mercurio, Di Maggio, Barone	Forensic Analysis Reveals Discrepancies in Quarry Remediation Case
*Økland, Nemes, Haraldsen, Dawson	Soils for Decomposition – how to ensure that human remains disappear
*Proulx, Stern, Parrish	Questionnaires on the Application of Near Surface Geophysics for Criminal Investigations
Stern, Webb, Dickson, Saginor, Ruffell	Forensic Geology Standards Development Activities in OSAC
Sugita	Analysis of rock-like materials recovered from an assault on cars
Sugita, Kawamura	Overview of Recent Forensic Geology in Japan

*Student poster presentations

The Biogeography of Soil Bacteria and Archaea in relation to Soil depth and distance: Applications for Forensic Science

Nicola Bennett *, Professor Ruth Morgan, Professor Jo Santini, and Dr Toryn Poolman

Address: Department of Security and Crime Science, UCL Jill Dando Institute, 35 Tavistock Square, London, WC1H 9EZ.

Abstract: Soil is a common trace in criminal investigations, but the use of soil microbes in forensic settings has been limited. As the potential of soil traces in forensic science has grown, research is making inroads to interpret the geographical distribution of soil microbial communities so that this biological trace can assist in crime reconstructions.

In this study, we explored the use of soil microbial communities as an exclusionary tool. Using a metagenetic approach, an initial assessment of microbial prokaryote communities at different locations and at different depths at the same location showed different driving factors, depending on scale. Sequencing of the V4 region of the 16S rRNA gene of a single site identified dominant bacterial phyla, including Proteobacteria, Bacteroidetes, and Actinobacteria, with variations in their relative abundances across soil contexts, yet showing a cosmopolitan distribution. In contrast, rarer and low-abundance phyla, such as Fibrobacteres, Verrucomicrobia, Gemmatimonadetes, and GAL-15, made up less than 5% of their respective cores. The archaea, Crenarchaeota, Euryarchaeota, and Thaumarchaeota were also detected with varying degrees of abundance. Beta diversity analysis suggested that depth was a stronger factor influencing microbial community composition than geographical location, although the limited distance between cores may have obscured location-based patterns. On a broader scale, Proteobacteria, Acidobacteria, and Actinobacteria became the dominant phyla, with further analysis showing that distance was the main driver. However, clustering based on depth could still be observed within the dataset. Overall, this study provides insights into soil microbial diversity, with implications for understanding soil microbiota in similar environments. As such, there is promise for the potential for applying an understanding of soil microbial diversity to differentiate traces from different sources in crime reconstructions.

Biography of presenter: Nicola Bennett is an EPSRC-funded PhD student at the Department of Security and Crime Science and the Division of Biosciences at UCL. Her research is examining the potential applications of microbes in forensic science and crime reconstruction endeavours. She holds a BSc in Archaeology from the University of Reading and an MPhil in Archaeological Science from the University of Cambridge. Nicola now hopes to take an interdisciplinary approach to further the field of Forensic Microbiomics.

The European Network Forensic Science Institutes–Animal Plant Soil Trace Working Group

Lorna Dawson[1,2]* Eva Sacchi[3], Frank Reckel[4], Māra Rēpele[5], Andreas Hellmann[6], Alejandra[7] Perotti[7] and Irene Kuiper[8]

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Abstract: The European Network of Forensic Science Institutes (ENFSI) was founded in 1995 with the purpose of improving the mutual exchange of information in the field of forensic science. This, as well as improving the quality of forensic science delivery in Europe have become the main issues of the network. ENFSI has been recognized as the monopoly organization in the field of forensic science by the European Commission. In addition to work in the fields of quality and competence management, research and development and education and training, different forensic disciplines are dealt with by 17 different Expert Working Groups. The Animal Plant & Soil Trace Expert Working Group (APST) meets at least once a year at a member laboratory in Europe to discuss and share case examples and method development. A Best Practice Manual has been written to cover several areas, including soil[3] and molecular methods for non-human DNA traces[4]. The group manage quality assurance tests in soil, plant and animal traces. The APST supports the aims and objectives of the ENFSI in the area of casework analysis of soil traces and all kinds of biological traces of non-human origin. The activities of APST offers a scientific platform to exchange experiences, to discuss analytical issues concerning morphological and molecular aspects, to plan collaborations and to generate a network of forensic experts. It provides a forum for the validation, introduction and improvement of morphological, chemical, physical and molecular biological analysis in casework.

Biography of Presenter: Lorna Dawson, Professor at RGU and Head of Centre of Forensic Soil Science at James Hutton Institute, CBE, 2018, FRSE, 2019, FRSA, 2016, and the RSE Medal for earth sciences, 2023. She is treasurer of the IUGS IFG and Chair of the Geol Soc, London, FGG and on council of the ENFSI, APST working group. She is on the steering committee of the ENFSI APST working group. She is a registered Expert Advisor with the NCA and has worked with numerous police forces over the last 20 years. She provided written evidence in the House of Lords Inquiry in 2019 and oral evidence to the Westminster inquiry into Forensic Science, October 2023.

[3] Best Practice Manual for the Forensic Comparison of Soil Traces (enfsi.eu)

[4] Application of molecular methods for the forensic examination of non-human biological traces 0.pdf (enfsi.eu)

A Guide to Forensic Geology

Laurance Donnelly[1]*, Duncan Pirrie[2], Mark Harrison[3], Alastair Ruffell[4], Lorna Dawson[5]

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Abstract: *'A Guide to Forensic Geology'* was written by the International Union of Geological Sciences, Initiative on Forensic Geology (IUGS-IFG) and published by the Geological Society of London (GSL). This provides for the first time, guidance for the practicable applications of geology to aid the investigation of crime. The historical development of forensic geology is reviewed from the middle of the nineteenth century to present day. The Geoforensic Search Stagey (GSS) is included, which developed over twenty-five years, on how to design, and implement searches for burials related to homicide, serious and organised crime, and counter terrorism. Based on expertise from over 300 operational case investigations, information is contained on the examination of crimes scenes for the collection, recovery and recording of geological trace evidence, and its subsequent analysis. The judicial system is also considered and the reporting requirements for presenting geological evidence in court. In addition, forensic geology applications are considered for crimes associated with illegal mining, illicit minerals, conflict minerals, water searches, oil and gas, fossils, art and archaeology, forensic geotechnical, geohazards and environmental crimes. This presentation also briefly introduces and draws attention to a second book published almost simultaneously, called, *'Forensic Soil Science and Geology'*. Also written by IUGS-IFG and published by GSL, which provides new and sophisticated field and laboratory methods and operational case work. Although written primarily for forensic geologist, it is envisaged these two books could also be of practicable use to police officers, law enforcement agents and other co-professionals.

Biography of presenter: Laurance is a chartered geologist with a first-class honour's degree and PhD in geology, and 34 years extensive international experience in: forensic geology, mineral exploration and mining, and engineering geology and geohazards. He is registered with the UK National Crime Agency as an Expert Adviser. He has provided operational support for the police and law enforcement including: crime scene examination and sample collection, geological trace evidence analysis, ground search burials, and mining, minerals and metals crimes.

The Initiation, Development and Applications of the Geoforensic Search Strategy (GSS)

Laurance Donnelly[1]*, Mark Harrison[2], Jodi Webb[3]

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[3]IUGS-IFG FBI Adviser, Federal bureau of Investigation Laboratory, Quantico, Virginia, USA

Abstract: The Geoforensic Search Strategy (GSS), offers a new and pioneering methodology to search the ground for items buried as part of a criminal act, such as; graves, firearms, drugs and items of evidential value. The GSS enables the delivery of a High Assurance Search (HAS) to determine the presence or absence of a suspected buried target resulting from a criminal act, including for example a shallow, unmarked homicide grave, firearms and other weapons, drugs, items of evidential value or objects related to terrorism. The objective of this presentation is to document the initiation and development of GSS and its international applications to search. The concept to apply geological methods to search initiated in 1991, following the discovery of human remains in the English Midlands. This preliminary GSS model was implemented in 1994 during a search on Saddleworth Moor, a relatively remote location in the Pennine Hills, in northern England. For approximately a decade this focused on a Conceptual Geological Model (CGM), geomorphological and hydrogeological evaluations, an assessment of diggability and target detectability, and the application of mineral exploration and ground investigation techniques, including geological mapping, remote sending and geophysics. From the mid 2000's onwards, this early model was complemented by law enforcement search methods, including; search strategic planning, behaviour profiling, victimology assessments and the use of detector dogs. Examples of operational cases and training are provided to demonstrate the applications of GSS for high-profile detective and protective searches throughout Europe, Australia, New Zealand, South America, Mexico, Canada and USA.

Biography of presenter: Laurance is a chartered geologist with a first-class honour's degree and PhD in geology, and 34 years extensive international experience in: forensic geology, mineral exploration and mining, and engineering geology and geohazards. He is registered with the UK National Crime Agency as an Expert Adviser. He has provided operational support for the police and law enforcement including: crime scene examination and sample collection, geological trace evidence analysis, ground search burials, and mining, minerals and metals crimes.

Locating homicide victim deposition sites associated with Souterrains in the Republic of Ireland

Grace Ferguson* and Professor John P. Cassella

Forensic Science, Department of Life Sciences, Atlantic Technological University, County Sligo, F91 YW50, Republic of Ireland

Abstract: Souterrains are ancient underground passages or chambers ubiquitous across Ireland, constructed by tunnelling in clay or rock, or drystone, timber construction. Ranging in length from 5m to 100m, these semi-hidden underground environments offer the potential to be criminalised as many are not archeologically recorded. They could be used to store; drugs, ballistic weapons, ammunition and potentially homicide victims. To assist location of such clandestine environments, the possibility that temperature differentials between the souterrain interior and the outside environment was investigated. This would offer a potential rapid, non-invasive method of location. Two experiments were conducted concurrently. An experimental manmade souterrain was constructed to develop a model and a publicly accessible historic souterrain in Cashelgarran was investigated offering a larger, longer standing real-world structure to compare to the model.

Temperature, humidity, Vapour Pressure Deficit and Dew Point were monitored over some weeks. Internal souterrain temperature in the experimental site was obtained using a Bluetooth 'Govee H7075 Indoor Thermometer'. *Forward Looking InfraRed,* thermal imaging cameras were also employed. Temperature data demonstrated the temperature outside and inside the experimental souterrain aligned closely, but with a difference of a few degrees Celsius. Thermal imaging studies at the Cashelgarran souterrain showed, a visible difference between the internal and external temperatures was detectable. This study has identified that the souterrains, which may currently be used for the deposition of homicide victims has to be carefully selected by perpetrators in which specific parameters are sought. This offers further discriminating inclusion/exclusion criteria for police when searching areas of interest.

Biography of Presenter: Grace completed a BSc honours degree in Forensic Investigation and Analysis from Atlantic Technological University in 2023 and is currently undertaking a Masters degree in forensic Archaeology and Anthropology at Cranfield University.

An evaluation of key Governmental and Parliamentary inquiries into Forensic Science 2000-2023 – where to now?

Shrey Jhalani[1], Ruth Morgan[1], John P. Cassella[2], Amelia Shooter[3]

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Forensic Geoscience provision as with other fields of forensic science underpins scientific insights that can potentially assist criminal inquiries. The quality and presentation of all scientific investigation with its impact upon the Criminal Justice System (CJS) has been scrutinised over three decades by various government committees. The outcomes and recommendations were disseminated to the diverse stakeholders within the CJS, however, many recommendations have yet to be adequately addressed, and the challenges identified in these reports remain.

This study analysed the findings and recommendations of seven key forensic science reports from UK parliamentary committees. Grounded Theory and Thematic Analysis identified and synthesis key themes and outcomes of these reports, and to identify the main recommendations. An assessment was also carried out to identify the recommendations that were or were not operationalised.

Despite significant parliamentary scrutiny over the last 23 years, the perception is that little has improved or developed, particularly around communication and strategy pathways between stakeholders in the CJS. This study suggests that key stakeholders (including the police services, forensic service providers and criminal justice) are often siloed and continue to operate as broadly independent entities. Considering how to adopt a 'whole system' design could facilitate the creation of a more interactive network, bridging existing gaps between stakeholders and allowing diverse perspectives to feed into identifying strategies for the development of the future CJS ecosystem.

It is hoped that these findings can contribute to articulating how to achieve and support an effective, excellent, impactive and sustainable Criminal Justice System.

Biography of presenter: Shrey Jhalani holds an MSc in Forensic Science and is currently completing his PhD research in Forensic Science and Policing at University College London (UCL). He is a Forensic Scientist working for a police force within the UK and is currently seconded to a Home Office funded national policing 'Digital Forensics Programme'. He has over 15 years' experience working with or supporting police forces in the field of Forensic Science amongst other areas.

Forensic Analysis Reveals Discrepancies in Quarry Remediation Case

Mariano Mercurio[1], Rosa Maria Di Maggio[2]* and Pier Matteo Barone[2,3,4]*

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Abstract: The case presents a study conducted on a quarry in Italy as a counter-deduction to a technical report within a potential criminal environmental case and regarding an alleged failure to remediate through morphological remodeling between the years 2011 and 2022. Following a series of forensic geological and geoarchaeological appraisals, i) the comparison of scientific and documentary data produced from 2011 to 2022, along with ii) new scientific data related to the actual terrain conditions observed through the comparison of high-resolution stereoscopic satellite images acquired in 2011 and 2022, has been demonstrate that the topography in the quarry area has not substantially changed from 2011 to the present, except in the areas of the site that were seized in 2015 and 2016. It has been established therefore that the backfill materials have been deposited with a thickness ranging from less than 1m to less than 2m, certainly not the 20m or more indicated in the previous technical report. Furthermore, it has also been demonstrated that the dumping of such massive amounts of materials would have required complex logistics with exceptional human resources far beyond what the company itself possesses (designated as criminal). Moreover, from an environmental standpoint, the failure to conduct a study on the plant, flora, and fauna, an incorrect attribution of knowledge of the investigated environmental matrices, the absence of scientific rationale, a clear manifestation of methodological illogicality, an improper assessment of the so-called natural background value, and a disjointed application of the Italian legislation, render the conclusions drawn from the previous technical consultation unsuitable for any purpose. For legal purposes the results are not yet officially published but they will be published soon.

Biography of presenter(s) Rosa Maria DI MAGGIO: Forensic geologist with over twenty years of experience, eleven of them spent at the Italian Forensic Science Police Department. Published scientific articles in national and international journals, contributed to several books on forensic sciences and she is co-author of the first Italian book on Forensic geology. Currently holds the position of a member of the Committee of the IUGS Initiative on Forensic Geology, with responsibilities as Officer for Europe. Pier Matteo BARONE: Criminalist, lecturer, and expert consultant in forensic geoarchaeology with a specific focus on geophysical surveys (specifically ground-penetrating radar), remote sensing, and GIS applied to crime scene investigations, search for missing persons, and crimes against cultural heritage. Collaborates with various universities and law enforcement agencies and is a member of ANCRIM (National Association of Criminologists and Criminalists), and the ENFSI Scene of Crime (SoC) working group. Crime Scene Adviser for the IUGS Initiative of Forensic Geology and member of the Italian GPR Association. Author of over 100 publications.

Soils for Decomposition – how to ensure that human remains disappear

Inghild Økland[1]*, Attila Nemes[2], Trond Knapp Haraldsen[3], and Lorna Dawson[4]

[1,3]Norwegian Institute of Bioeconomy (NIBIO), Ås, [2]Norwegian University of Life Science, (NMBU), Ås, and [4]James Hutton Institute, and Robert Gordon University, Aberdeen.

Abstract: Human remains do not disappear from the Norwegian cemeteries as they should. To alleviate this, a deeper understanding of the decomposition process and its relation to soil is needed. The experimental study of pig remains decomposing in soils in a semi-controlled environment within a lysimeter facility attempts to rectify this. Four soils of theoretical good quality (of the appropriate texture) and four mixes are tested for their cadaver decomposition potential, while relevant properties such as hydraulic conductivity, aeration, pH, and moisture are measured, and soil and water samples are collected for subsequent analysis. The results will yield information as to which soil or mixture is best suited to cemeteries in Norwegian conditions, and why.

Biography of presenter: Inghild Økland works for the Norwegian Institute of Bioeconomy (NIBIO) as a soil scientist. Her work spans across consultant for soil handling and translocation in construction projects, to scientific fieldwork and experimental studies on soil for cemeteries. She has commenced her PhD on the subject of cemetery soils, in which the current study will be included.

Questionnaires on the Application of Near Surface Geophysics for Criminal Investigations

Michelle Proulx[1]*, Libby Stern[2], Jason Parrish[2]

Affiliation(s): [1]Oak Ridge Institute for Science and Education (ORISE), USA, [2]Federal Bureau of Investigation, USA

Abstract:
To learn how law enforcement personnel are applying geophysical technology, three questionnaires have been created to gather details on (1) the application of metal detectors at crime scenes and (2 & 3) the application of advanced geophysical methods (e.g., ground penetrating radar (GPR)) for criminal investigations. (2) One questionnaire is created for those providing geophysical services to law enforcement and another (3) seeks participation from law enforcement personnel requesting geophysical services. Each questionnaire asks participants to provide information about the technologies which were deployed (e.g., metal detector, GPR, electrical resistivity, magnetometer), the suspected targets (e.g. weapons, drugs, human remains), the survey environment (e.g. residential home, lake, commercial building), the concealment material (e.g., soil type, fresh water, concrete/basement soil) surrounding a suspected target, and the effectiveness of the method(s) under case specific conditions. Preliminary results from all three questionnaires will be presented at the time of the presentation. Total number of participants for all three surveys stand at 73 submissions as of August 2023. Links to participate in these surveys may be found at: https://le.fbi.gov/science-and-lab/fbi-laboratory-surveys. The deadline for participation in the questionnaires is February 14th, 2024.

Biography of presenter: Michelle is a visiting scientist working at the FBI Laboratory with the primary focus of conducting research on the application of geophysical methods to search for hidden or buried targets in law enforcement investigations. Her research interests are applied geophysics in archaeology, paleontology, and forensics science.

Forensic Geology Standards Development Activities in OSAC

Libby Stern[1]*, Jodi B. Webb[1], Hannah F. Dickson[1], Ian Saginor, and Alastair Ruffell[2]

Affiliations [1]FBI Laboratory, USA, [2]The Queens University, Belfast UK

Abstract: What criteria should be used in forensic soil comparisons that are applicable to all cases? What are the minimum requirements for a forensic soil examination? Establishing standards in forensic geology to address these types of questions is quite challenging because soil is among the most complex type of trace evidence and case circumstances affect evidence interpretation. The US Organization of Scientific Area Committees for Forensic Science (OSAC) fosters the development of high-quality, technically sound forensic science standards. An OSAC task group on geological materials (GEO) is developing methodology-specific standards to complement the more general GSL-FGG's "A Guide to Forensic Geology" and ENFSI-APST's "Best Practice Manual for the Forensic Comparison of Soil Traces". OSAC-GEO has produced three consensus ASTM-International standards, to date, on evidence collection, soil color and powder XRD. These standards are publicly readable at the OSAC web site. Other standard under development cover PLM, SEM-EDS and eamination schemes. Consensus standards provide Examiners with scientific support for their methodology, improve the overall quality of forensic soil examinations, and serve as a framework for the development and training of new practitioners of forensic geology. In addition to standards development, OSAC-GEO has identified research needs that will support standards in forensic geology. See https://www.nist.gov/organization-scientific-area-committees-forensic-science

This presentation on the OSAC-GEO activities aims to engage interested geoscientists and forensic scientists, FGG, IFG, and APST on concerns and interests in OSAC-GEO products and priorities. OSAC-GEO needs your help to improve published standards and develop new standards. This assistance could be as: affiliates or members of the OSAC-GEO subcommittee; member of technical review panel of a draft document; providing input to OSAC-GEO on a specific topic; or commenting during several public comment periods.

Biography of presenter: Libby Stern is a research scientist in the FBI Laboratory supporting methods development in forensic science. She has a background in geology, soils and chemistry.

Analysis of Rock-like materials recovered from an Assault on Cars

Ritsuko Sugita*

National Research Institute of Police Science, Japan

Abstract: This presentation reports unfamiliar stone-like materials recovered from an assault on cars and the destruction of properties. Police headquarters were alerted of four separate incidents of cars in 2008 that were struck by rocks on the highway. In all these reports, the approximate area and time of day were similar. One driver suffered a minor injury; however, no serious accidents or injuries were reported.

The police found rock-like materials inside two of the cars and recovered two more from the road of the incidents. A suspicious-looking truck was noticed to be driving along the opposite direction on the highway. The company owning the truck was visited, and the parking area of the company was found to be paved with materials that looked similar to the evidence.

The evidence found in the car, on the road and the samples found in the parking area were analysed. Observations were conducted using naked eye and polarised microscopy, X-ray fluorescence analysis (XRF) and X-ray diffraction (XRD). The results indicated that all the rock-like materials had similar features that were not common in natural rocks.

Minerals indicating very high temperatures such as merwinite and gehlenite were identified by XRD. The elemental compositions identified by XRF were rich in Ca, Mn and Ba, and poor in Si compared to the common rocks in Japan. These results indicated that the materials were blast furnace slag, obtained from the same source.

Biography of presenter: Forensic geologist, Director of Identification Center of NRIPS, IUGS-IFG Regional officer of Japan.

Overview of Recent Forensic Geology in Japan

Ritsuko Sugita[1]* and Noriko Kawamura[2]

[1]National Research Institute of Police Science, Japan; [2]Japan Coast Guard Academy, Japan

Abstract: This presentation will provide an overview of recent developments in forensic geology in Japan. The Geological Society of Japan held a special session on forensic geology in 2015, and research papers for a special issue were called. The publication of a special issue on forensic geology in the Journal of the Geological Society of Japan in 2020 was one of the most influential events. It impacted people working in science-related occupations who lacked knowledge of forensic geology. After the publication, there was an increase in outreach publications and lectures, as well as rapid academic recognition. Furthermore, the special issues have been utilised as class materials.

The fact that a session on forensic geology was held at the Japan Geoscience Union Meeting 2022 could also be considered a fruit of the publication. Due to the COVID-19 pandemic, a hybrid format (face-to-face and online) was required, allowing researchers worldwide to participate.

The Forensic Geology Committee of the Geological Society of Japan was established in 2022. The group's mission is to promote and disseminate scholarly research on forensic geology in Japan. The Committee published a book review of 'A Guide to Forensic Geology' and presented global examples of forensic geology. The details of the activities will be described.

Biography of presenter: Forensic geologist, Director of Identification Center of NRIPS, IUGS-IFG Regional officer of Japan.

We hope that you have enjoyed this event and we thank you for engaging in this conference. We would particularly like to thank all the speakers and poster presenters for their brilliant insights into forensic geology, case examples and future innovations and research. Thank you also to our session chairs and GSL-FGG and IUGS-IFG members for assistance in making this event a great success.

Many thanks to the Geological Society, London for hosting this event at Burlington House, London. Thank you to the Geological Society, London FGG and the IUGS, IFG for providing the funds to allow this exchange event to take place.

Conference convenors

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