



INTERNATIONAL UNION OF GEOLOGICAL SCIENCES (IUGS)

INITIATIVE ON FORENSIC GEOLOGY (IFG)

ANNUAL REPORT FOR 2019

DR LAURANCE DONNELLY, CHAIR, IUGS-IFG



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Annual Report 2019**

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**INTERNATIONAL UNION OF GEOLOGICAL SCIENCES (IUGS)
INITIATIVE ON FORENSIC GEOLOGY (IFG)
ANNUAL REPORT FOR 2019**

1 TITLE OF CONSTITUENT BODY

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

1.1 Report Objective

This document is the IUGS-IFG Annual Report for 2019. It has been produced by the IUGS-IFG Chair, with support from the IUGS-IFG Committee, following the request of the IUGS Executive Committee. This report provides a summary of the IUGS-IFG events, activities and progress throughout 2019. A financial summary of the IFG accounts is also included and a forecasted and estimated budget for 2020.

2 AIM

2.1 Mission Statement

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

2.2 IUGS-IFG Objectives

The objectives of the IUGS-IFG are to:

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

3 ROLE WITHIN IUGS SCIENCE POLICY

3.1 Background

The documented history of forensic geology can be traced to the latter half of the 19th Century. However, in recent years there has been renewed interests and developments in the multidisciplinary fields of forensic geology throughout the world.

Since about 2000 numerous international meetings, conferences, seminars and training on different aspects of forensic geology has taken place. Furthermore, several text books have been published and there are technical papers in peer reviewed scientific and geological journals, conference proceedings, police and law enforcement magazines.

Since 2011, IFG has formally represented the global interests of IUGS in forensic geology. As such, IUGS-IFG provides training, knowledge transfer, capacity building and outreach events. These advocate the IUGS-IFG aim, *'to develop forensic geology internationally and promote its applications'*. The members of the IUGS-IFG committee are senior representatives of their respected organisations and include geologists, geoscientists, police officers, forensic scientists and law enforcement agencies.

3.2 Main Approach

IUGS-IFG aims to raise the global awareness of forensic geology by holding meetings and conferences, promoting research, teaching, training and the operational deployment of forensic geologists. This will be consistent with the broad objectives of IUGS Executive Committee, and includes the following:

- **Knowledge transfer and capacity building:** This raises the levels of awareness and knowledge, and provides information about forensic geology;
- **Technology transfer and training:** This improvement in skill sets both for the IUGS-IFG members to enable their operational capability worldwide, and the training of non-geologists and non-forensic geologists in the methods of geoforensic search, crime scene examination and geological trace evidence collection, handling, analysis and reporting;
- **Outreach:** This provides education and information to a range of stake holders that includes; geologists, geoscientists, forensic scientists, police officers, law enforcement agencies, engineers, minerals traders, lawyers, politicians, schools, universities, learned societies, public, journalists and the media.

4 ORGANIZATION

The IUGS-IFG Committee comprises representatives from major geographical regions of the world and includes specialists from; academia, industry, consultancy, operationally based forensic geologists, the police, law enforcement agencies and forensic organisations, as shown in Figure 4.1 and Table 4.1.

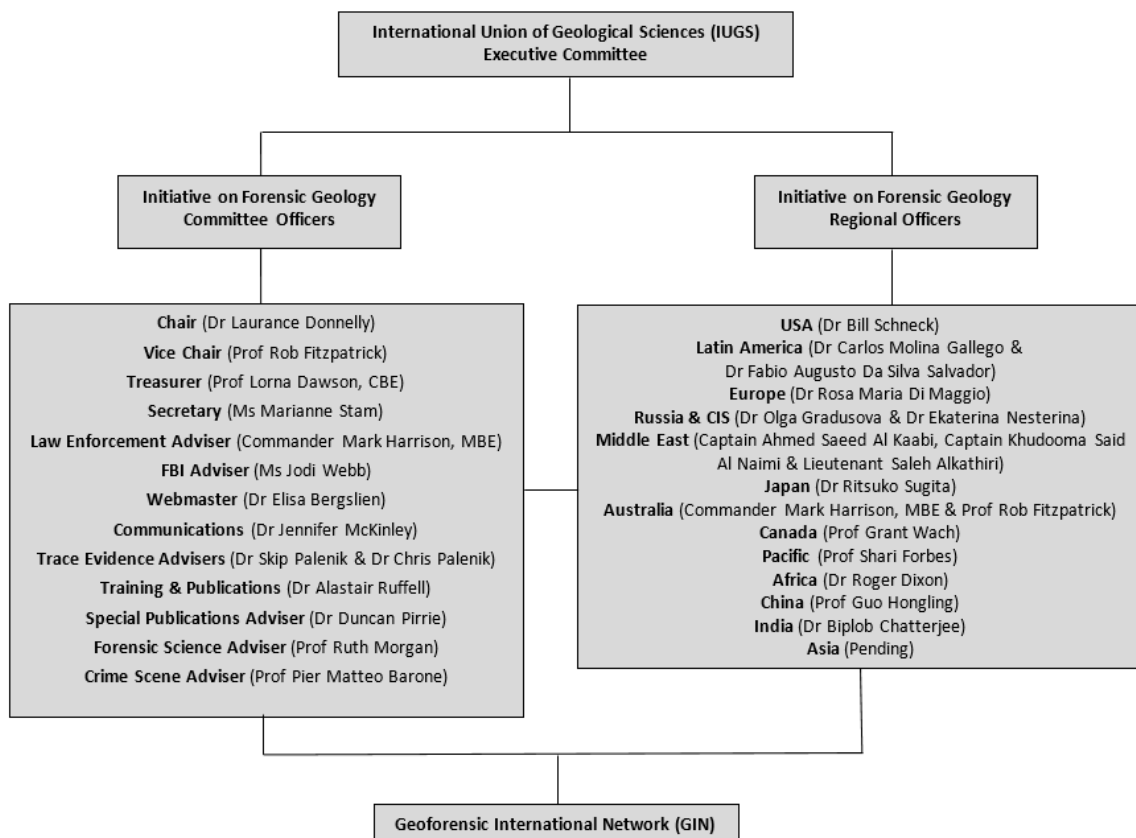


Figure 4.1. Structure of the IUGS-IFG Committee in 2019.

4.1 IFG Committee Changes and Position Changes

In February 2019, Prof Pier Matteo Barone, based at the American University of Rome, became formally assigned to the IFG Committee as the, 'Crime Scene Adviser'.



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POSITION	NAME	COUNTRY	AFFILIATION
Chair	Dr Laurance Donnelly	England	IUGS-IFG, Lancashire, England, UK
Vice Chair	Prof Rob Fitzpatrick	Australia	CSIRO and University of Adelaide, Australia
Treasurer	Prof Lorna Dawson CBE	Scotland	The James Hutton Institute, Aberdeen, Scotland, UK
Secretary	Ms Marianne Stam	USA	California Department of Justice, Riverside, USA
Webmaster/Information Officer	Dr Elisa Bergslien	USA	SUNY Buffalo State, New York, USA
Geoforensic Law Enforcement Adviser	Commander Mark Harrison MBE	Australia	Australian Intelligence Agency (formerly Australia Federal Police and UK Police National Search Adviser)
FBI Adviser	Ms Jodi Webb	USA	Federal Bureau of Investigation (FBI), Quantico, Washington DC, USA
Training and Publications	Dr Alastair Ruffell	Northern Ireland	Queens University Belfast, Northern Ireland
Communications	Dr Jennifer McKinley	Northern Ireland	Queens University, Belfast, Northern Ireland
Special Publications Adviser	Dr Duncan Pirrie	England	Helford Geoscience LLP and University of South Wales, Cornwall, UK
Forensic Science Adviser	Prof Ruth Morgan	England	University College London, JDI Centre for the Forensic Sciences, London, UK
Geological (Trace) Evidence Advisers	Dr Skip Palenik Dr Chris Palenik	USA	Microtrace LLC, Illinois, USA
Crime Scene Adviser	Prof Pier Matteo Barone	Italy	The American University of Rome, Italy
Officer, USA	Dr Bill Schneck	USA	Microvision Northwest Forensic Consulting Inc (formerly Washington State Patrol Crime Lab)
Officer, Latin America	Prof Carlos Molina Gallego Dr Fábio Augusto Da Silva Salvador	Colombia Brazil	The Universidad Antonio Nariño, Instituto Nacional de Medicina Legal y Ciencias Forense, Bogota, Colombia Perito Criminal Federal, Chefe do Setor Técnico-Científico, Superintendência da Polícia Federal no Paraná Brazilian Federal Police, Curitiba, Brazil
Officer, Europe	Dr Rosa Maria Di Maggio	Italy	Geoscienze Forensi Italia (Formerly Servizio Polizia Scientifica), Rome, Italy
Officer, Russia & CIS	Dr Olga Gradusva Dr Ekaterina Nesterina	Russia	Russian Federal Centre of Forensic Science and Soil Trace Evidence Experts, Moscow, Russia
Officer, Middle East	Captain Ahmed Saeed Al Kaabi Captain Khudooma Said Al Naimi Lieutenant Saleh Ali Al Katheeri	UAE	Abu Dhabi Police, Forensic Evidence, United Arab Emirates
Officer, Japan	Dr Ritsuko Sugita	Japan	National Research Institute of Police Science, Japan
Officer, Pacific	Prof Shari Forbes	Australia	Université du Québec à Trois Rivières, Canada and University of Technology Sydney, Australia.
Officer, Australia	Prof Rob Fitzpatrick and Commander Mark Harrison		CSIRO and University of Adelaide and Australian Intelligence Agency
Officer, Canada	Prof Grant Wach	Canada	Basin and Reservoir Lab, Dalhousie University, Halifax, Nova Scotia, Canada
Officer, Africa	Dr Roger Dixon	South Africa	University of Pretoria (Formerly, Forensic Science Laboratory, South African Police Service), South Africa
Officer, China	Dr Guo Hongling	China	Institute of Forensic Science, Ministry of Public Security, Division of Trace Evidence Analysis, China
Officer, India	Dr Biplob Chatterjee	India	Geovale Services, West Bengal, India

Table 4.1. IUGS-IFG committee in 2019.



5 NATIONAL, REGIONAL & GLOBAL SUPPORT FROM SOURCES OTHER THAN IUGS

IUGS-IFG has estimated, throughout 2019 the committee and/or their organisations provided at least **372 person days**. The value of this in-kind support is difficult to quantify, however a commercial value to the time spent on the IUGS-IFG (based on an average and estimated cost rate of \$100/per hour) would possibly be in excess of approximately **USD(\$)** 298,000. In addition, participation in the various IUGS-IFG events during the year has also been supported directly by committee members employers and via research funding of an estimated value of approximately **USD(\$)** 15,000.

6 ACKNOWLEDGEMENTS

Throughout 2019, IUGS-IFG received support and collaboration from numerous individuals and organisations, which IUGS-IFG greatly acknowledges and this include the following:

- **IUGS Executive Committee.**
- **Commercial companies:** Alfred Knight International; Helford Geoscience LLP (UK); Microtrace LLC; James Hutton Limited; Geoscienze Forensi Italia; Geovale Services, West Bengal, India.
- **Police Forces, Law Enforcement, Federal Agencies and Government Organisations:** California Department of Justice; Australian Federal Police; Australian Criminal Intelligence Commission; Brazil National Police Academy; Washington State Patrol Crime Lab; Abu Dhabi Police; Russian Federal Centre of Forensic Science of the Ministry of Justice of Russia; National Research Institute of Police Science of Japan; Brazilian Federal Police, National Crime Agency (NCA); Police National Search Centre (PNSC); Home Office Centre for Applied and Scientific Research (CAST); Police Service of Northern Ireland; An Garda Siochana; Defence Science and Technology Laboratory (Dstl); Ministry of Defence, Defence College of Policing and Guarding; Federal Police of Argentina; Federal Bureau of Investigation (FBI) Laboratory, Quantico, Washington DC (Jodi Webb, Maureen Bottrell, Libby Stern, Ian Saginor, Gene Peters, Craig Schultz, Wynn Warren), Independent Commission on the Location of Victim's Remains (ICLVR: Jon Hill/Geoff Knupfer); Danish National Police, Sweden National Police, Netherlands National Police, Germany National Police, Guardia Civil Spain.
- **Universities, Research Institutes and Professional Societies:** Geological Society of America (GSA); Geological Society of London, Forensic Geosciences Group (FGG) and Near Surface Geophysics Group (NSGG); Geological Society of Japan; Geological Survey of Colombia; The American University of Rome; Institute of Forensic Science in China; University of Pretoria; University College London JDI Centre for the Forensic Sciences; University of Ontario Institute of Technology; University of Canberra; Basin and Reservoir Lab, Dalhousie University; University of Huddersfield (Dr Anna Williams); CSIRO Australia; Centre for Australian Forensic Soil Science (CAFSS); British Society of Soil Science (BSSS); International Soil Science Society (ISSS); Buffalo State College; Queens University Belfast; The James Hutton Institute; University of Technology Sydney; University of Keele, Department of Earth Sciences; University of Pretoria; University of Wales; Nacional Institute of Criminalistics in Brazil; Universidad Antonio Narino, Bogota, Colombia; Australian Facility for Taphonomic Experimental Research (AFTER); European Network of Forensic Science Institutes (ENFSI); Animal, Plant and Soil Traces (ASPT); Forensic Canine Detection, Staffordshire University Department of Criminal Justice and Forensic Science, School of Law, Policing and Forensics; International Geoscience Education Organization, Brazil; Brazilian Geological Congress; International Association for Promoting Geoethics (IAPG); National Police Academy of Brazil; University of Amsterdam Taphonomy Faculty; House of Lords Science and Technology Committee; European Meeting on Forensic Archaeology (EMFA); University of Texas, Soil Science Australia, Organisation of Scientific Areas Committee (OSAC), ARISTA, Human Taphonomy Facility, Amsterdam; TRACES, University of Central Lancashire; BBC UK; CBC Canada; International Commission of the Red Cross (ICRC), African Society of Forensic Medicine (ASFM); International Association of Mathematical Geoscience (IAMG); Reunion Anual de la Unión Geofísica Mexicana, (RAUGM); Chartered Institute of Forensic Archaeologists Geophysics Group (GeoSiG); Near Surface



Geophysics Group (NSGG); Engineering and Technology Magazine; University of Warsaw and Central Forensic Laboratory, Poland; Organizations of Scientific Areas Committees (OSAC); the National Institute of Standards and Technology (NIST); Graduate School of Science and Technology, Kumamoto University, Tokyo, Japan; University of Adelaide (School of Biological Sciences; TeTRIS, Guard Civil, Spain; The Japanese Society of Geo-Pollution Science, Medical Geology and Urban Geology; Basin and Reservoir Lab, Dalhousie University (Grant Wach, O'Connor, Angel' Kelly); University of Kentucky College of Agriculture Food and Environment, (Dr Brad Lee, Suzette Walling, Brian Volland); Rossendale and Pendle Mountain Rescue Team (RPMT), Burnley, Lancashire, United Kingdom (Alan Pepper, Peter Goble, Andy Simpson);



7 INTERACTION WITH OTHER INTERNATIONAL PROJECTS & ORGANISATIONS

Throughout 2019, IUGS-IFG interacted and collaborated with the organisations and projects that included those listed in Table 7.1. This excludes operational support for police and law enforcement casework, which is confidential.

ORGANISATION	TYPE OF INTERACTION	ROLE/EVENT
January		
Organisation of Scientific Areas Committee (OSAC), Texas	Knowledge exchange capacity building	Developing guidance and best practice
ARISTA, Human Taphonomy Facility, Amsterdam	Knowledge exchange and capacity building	Research
Brazilian Federal Police	Training	Organisers and trainers
TRACES, University of Central Lancashire	Knowledge exchange and capacity building	Research
BBC	Outreach	Interviewee
February		
European Training in the Location and Excavation of Graves, UCLAN and European Police	Training	Invited guests and trainers
Confidential (law enforcement)	Research	Soil analysis
International Commission of the Red Cross (ICRC), African Society of Forensic Medicine (ASFM)	Outreach	Opportunities for collaboration
IUGS Executive Committee and International Association of Mathematical Geoscience (IAMG)	Outreach	Update of 2018 events
March		
Federal Bureau of Investigation (FBI), Washington DC, USA	Knowledge exchange and capacity building	Meeting organisers and participants
Royal Society of Edinburgh	Outreach	Award
Brazilian Federal Police	Outreach	Web site
American University of Rome, Italy	Strategic	Appointment to IUGS-IFG Committee
Meeting with Photojournalist	Outreach	Interviewee



April		
Reunion Anual de la Unión Geofísica Mexicana, (RAUGM)	Conference, knowledge exchange, capacity building and training	Co-organisers and workshop lead
36 th International Geological Congress Organising Committee	Conference, knowledge exchange, capacity building and training	Co-organisers and workshop lead
House of Lords Science and Technology Committee Inquiry into Forensic Science	Government	Advisory
Queens University Belfast	Strategic	New web site
IFG committee members	Strategic	Guidance
Countering fraud and corruption in minerals and mining, Chile, Bolivia, Peru, Brazil, Mexico	Strategic	Advisory
May		
House of Lords Science and Technology Committee Inquiry into Forensic Science	Government	Advisory
Countering Minerals and Mining Fraud and Corruption, United Kingdom	Strategic	Research
Silk Roads Disaster Risk Reduction and Sustainable Conference (SiDRR)	Conference, knowledge exchange, capacity building and training	Invited speaker
CBC Canada	Outreach	Interviewee
Confidential (forensic cemetery)	Operational	Advisory
Chartered Institute of Forensic Archaeologists Geophysics Group (GeoSiG) and Near Surface Geophysics group (NSGG)	Training	Invited guests and trainers
Confidential (search for graves in Lithuania)	Knowledge exchange, capacity building	Advisory
Countering fraud and corruption in minerals and mining, in Zambia and South Africa	Strategic	Advisory
June		
Confidential (search of water in Cyprus)	Operational	Advisory
Engineering and Technology Magazine	Outreach	Publications
July		
University of Warsaw and Central Forensic Laboratory, Poland	Knowledge exchange, capacity building	Advisory



Organizations of Scientific Areas Committees (OSAC) and the National Institute of Standards and Technology (NIST)	Strategic	Standards and best practice
IUGS-IFG sub-committee meeting and FBI	Strategic	Meeting
Analisi Mineralogiche in Ambito Forense	Outreach	Publications
House of Lords Science and Technology Committee Inquiry into Forensic Science	Government	Advisory
August		
Confidential (countering fraud and corruption in minerals and Mining)	Operational	Advisory
Danish National Police and the European Network of Forensic Science Institutes (ENFSI).	Knowledge exchange, capacity building and training	Advisory
European Network of Forensic Science Institutes (ENFSI) and Animal Plant Soil Trace (APST)	Strategic	Standards and best practice
FBI and others (training video)	Training	Standards and best practice
Outreach Event to Senior Citizens, Chiba, Japan	Outreach	Guest speaker
Future Governance of the Centre for Australian Forensic Soil Science (CAFSS)	Strategic	Advisory
Confidential (Romania)	Operational	Advisory
TeTRIS, Guard Civil, Spain	Grant submission	Contributory
September		
Geological Society of London (A Guide to Forensic Geology)	Publication	Lead authors and editors
Geological Society of London (Forensic Soil Science and Geology)	Publication	Lead authors and editors
Confidential	Operational support	Advisory
European Association of Geoscientists and Engineers (EAGE)	Knowledge exchange, capacity building	Invited guest speakers and collaborators
Confidential (Geoforensic Search Strategy (GSS) and mining, minerals and metals Fraud)	Strategic	Standards and best practice
University of Nottingham, Department of Chemistry and Forensic Science, for the MSc course on Forensic Science	Knowledge exchange, capacity building	Invited guest speakers
October		
FBI and others (training video)	Training	Standards and best practice



Reunion Anual de la Unión Geofísica Mexicana (RAUGM)	Conference, knowledge exchange, capacity building and training	Co-organisers, keynote guest speaker and workshop lead
IUGS-IFG Sub Committee Meeting, Puerto Vallarta, Mexico	Strategic	Organisers
Geovale Services, West Bengal, India	Strategic	Initiation of forensic geology
The Sherlock Holmes Society of London	Outreach	Invited guest speaker
International Police and Crime Scene Investigation, South Korea	Conference and knowledge exchange	Invited guest speaker
November		
Confidential (microtaggants and mineral and mining crime)	Operational	Advisory
The Japanese Society of Geo-Pollution Science, Medical Geology and Urban Geology	Conference, knowledge exchange, capacity building	Co-organisers and guest speaker
Fraud, corruption and Conflict Minerals in the Democratic Republic of the Congo (DRC)	Operational	Advisory
American Academy of Forensic Science (AAFS) Project in Colombia	Research and operational	Advisory
December		
Kumamoto University, Japan	Outreach	Invited speaker
Forensic Geology in Warsaw, Poland	Planning	Invited speakers and trainers
Rossendale and Pendle Mountain Rescue Team (RPMT), UK	Outreach	Invited speaker

Table 7.1. Selected examples of IUGS-IFG collaboration with other projects and organisations during 2019.

8 MAIN ACCOMPLISHMENTS

8.1 JANUARY

8.1.1 Organisation of Scientific Areas Committee (OSAC), Texas

IUGS-IFG attended a NIST, OSAC meeting in Houston, Texas, to discuss how the Geological Materials Group of OSAC were progressing with their guidance documents on analytical methods.

8.1.2 Opening of ARISTA, Human Taphonomy Facility, Amsterdam

IUGS-IFG was present for the opening of the ARISTA, a human taphonomy facility, at the Amsterdam Medical School in the Netherlands. This facility provides the opportunity for research in human decomposition and ground searches for buried homicide victims.

<https://www.sciencemag.org/news/2017/01/amsterdam-host-europes-first-forensic-cemetery>

8.1.3 Training with the Brazilian Federal Police

IUGS-IFG supported and endorsed training with the Brazilian Federal Police on forensic geology and microscopy. The course was held by the Brazilian National Police Academy of the Federal Police for forensic experts and academic researchers.

8.1.4 TRACES Taphonomy Burial Site Research

IUGS-IFG were invited to the Taphonomic Research in Anthropology Centre for Experimental Studies (TRACES), an animal decomposition burial research site, located in the Pennine Hills, in Burnley, Lancashire, UK. This provided the opportunity to discuss the influence of geology on decomposition, the generation of leachate plumes, volatile organic compounds and how their detection may be potentially used for open area searches to find unknown homicide graves.

<https://www.uclan.ac.uk/research/explore/groups/traces.php>

8.1.5 Interview with BBC

IUGS-IFG Chair gave an interview to BBC Radio Lancashire, in the UK. The items discussed included the background and objectives of IUGS-IFG and how forensic geology may be used by police and law enforcement to locate graves and other burials.

8.2 FEBRUARY

8.2.1 European Training in the Location and Excavation of Graves, UCLAN and Police

IUGS-IFG contributed to a three-day European training event held in Lancashire, UK. This was organised by the University of Central Lancashire (CLAN) in conjunction with the European Network of Forensic Science Institutes (ENFSI), European Meeting on Forensic Archaeology (EMFA). Practical training was provided for the archaeology working group and a multi-disciplinary team investigating a simulated major incident involving human remains. Delegates participated to understand the respective roles of specialist involved in search and excavation of clandestine graves. The subject matter experts included; forensic archaeologists, forensic anthropologists, forensic taphonomists, forensic geologists, crime scene photographers, exhibits managers and search specialists. It was attended by police and law enforcement from several European countries, including England, Scotland, Sweden, Germany, and the Netherlands.

8.2.2 Soil Collection from Beneath a Homicide Grave

IUGS-IFG were provided with soil samples taken from beneath a homicide grave. These are to be analysed to detect the presence of volatile organic compounds and leachate associated with human decomposition. The results will support an ongoing IUGS-IFG project involving the geochemical and mineralogical analysis of soils in the vicinity of homicide graves to facilitate searches.



8.2.3 ICRC and ASFM

IUGS-IFG engaged with International Commission of the Red Cross (ICRC) and African Society of Forensic Medicine (ASFM) to discuss synergies and opportunities for future collaboration and the advancement of forensic geology in Africa.

8.2.4 73rd Executive Committee Meeting

On 27 February 2019, IUGS-IFG Chair, Communications Officer and Office for China attended the 73rd IUGS Executive Committee meeting, held at the Fragrant Hill Hotel, Beijing, China. A summary was presented of IUGS-IFG events throughout 2018 including a financial summary and an overview of global forensic geology events in 2019 and beyond.

8.3 MARCH

8.3.1 Federal Bureau of Investigation (FBI), Washington DC, USA

Following a visit to the FBI by IUGS-IFG Chair, in December 2018, a meeting was arranged at FBI headquarters in Washington DC. This was attended by the IUGS-IFG FBI Adviser and IUGS-IFG Law Enforcement Adviser and the FBI Geospatial Working Group. The focus of the meeting was to discuss ground searches for burials.

8.3.2 Fellow of the Royal Society of Edinburgh

IUGS-IFG Treasurer was awarded a fellowship of the Royal Society of Edinburgh (FRSE).

8.3.3 Brazilian Federal Police Forensic Geology Web Site Link

IUGS-IFG Officer for Latin America and the Brazilian Federal Police created the first online site on Forensic Geology in Brazil.

geoforenses.com

8.3.4 IUGS Initiative on Forensic Geology, Crime Scene Adviser

IUGS-IFG appointed Prof Pier Matteo Barone to the IUGS-IFG Committee as the Crime Scene Adviser. He is adjunct professor in the Bachelor of Archaeology and in the Master of Sustainable Cultural Heritage at the American University of Rome, and he is also an adjunct professor in the Bachelor of Law and in the Master in Crime Scene & Investigation at the Link Campus University in Rome. He is a member of the Scene of Crime (SoC) group of the European Network of Forensic Science Institutes (ENFSI) and associate member of the Italian Academy of Forensic Sciences (AcISF). He is also a member of the Board of Trustees in the Italian Association of GPR (GPR Italia).

8.3.5 Meeting with Photojournalist

On 22 March 2019, IUGS-IFG Chair met a freelance photojournalist to discuss the production of an article to help promote forensic geology in a major UK national newspaper. This might further develop in 2020.

8.4 APRIL

8.4.1 IUGS-IFG, Mexico, 2019

IUGS-IFG advanced planning for the '4th Iberoamerican Seminar on Forensic Geosciences', in Puerto Vallarta, Mexico, in October 2019 in association with the 'Reunion Anual de la Unión Geofísica Mexicana, (RAUGM)'. IUGS-IFG has been a key participant and co-organiser of previous Iberoamerican seminars on forensic geosciences, held in Colombia, Brazil and Argentina.

<https://www.raugm.mx/>

8.4.2 Forensic Geology at the 36th IGC, Delhi, 2020

Approval was given for the 36th IGC, in Delhi, March 2020, to include a session on forensic geology. This will include forensic geology in police & law enforcement, fraud, theft and corruption in minerals,

mining and metals, geoenvironmental forensics, geotechnical forensics and geohazards forensics. An interactive workshop is also proposed on search and crime scene examination.

8.4.3 House of Lords Science and Technology Committee Inquiry into Forensic Science

IUGS-IFG provided written evidence, on forensic geology, for the UK House of Lords Science and Technology Committee Inquiry into Forensic Science. Ahead of the report being available, the UK Forensic Science Regulator published an annual report. This outlines areas within the quality standard and service provision of forensic science at a high level and broad scale. This also notes there are gaps in forensic science research, which is a common theme from previous years.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/786137/FSRAnnual_Report_2018_v1.0.pdf

8.4.4 IUGS-IFG Web Site

IUGS-IFG committee agreed for the web site to be upgraded and hosted by Queens University Belfast, Northern Ireland.

8.4.5 Soil Sampling, Standard Operating Procedure (SOP) (Version 3.0)

IUGS-IFG Chair produced version 3.0 of an SOP on, '*Soil Sampling (Auguring) and Collection for the Detection of Volatile Organic Compounds (VOC) and Leachate Associated with Human Decomposition from a Shallow, Unmarked, Homicide Grave*'. This was made available to ensure soils samples are collected in a consistent and agreed methodology as part of an open area search for homicide graves.

8.4.6 Countering Fraud and corruption; Chile, Bolivia, Peru, Brazil, Mexico

IUGS-IFG Chair attended a meeting in Santiago, Chile, with representatives from Chile, Bolivia, Peru, Mexico and Bolivia. This included geological methods to investigate, manage and mitigate fraud and corruption in the mining and minerals industry, including theft and the adulteration or substitution of mineral concentrates and precious metals.

8.5 MAY

8.5.1 House of Lords Inquiry into Forensic Science

A report was issued by the UK Parliament, House of Lords Inquiry into Forensic Science. IUGS-IFG submitted evidence for this inquiry, and the IUGS-IFG Forensic Science Adviser served as the Specialist Adviser to the Committee.

<https://www.parliament.uk/business/committees/committees-a-z/lords-select/science-and-technology-committee/>

<https://www.ruth-morgan.com/blog/house-of-lords-science-and-technology-committee-inquiry>

8.5.2 Countering Minerals and Mining Fraud and Corruption, United Kingdom

IUGS-IFG attended meetings in the UK that included geological methods for the mitigation of risks associated with ore and mineral concentrate fraud, theft, substitution and adulteration.

8.5.3 Environmental Geoforensics, Silk Roads Disasters, Beijing, China

IUGS-IFG was represented at the, '*Silk Roads Disaster Risk Reduction and Sustainable Conference (SIDRR)*' and presented on the applications of Interferometric synthetic aperture radar (INSAR) and unmanned aerial vehicle UAV for disaster monitoring.

<http://sdg.iisd.org/events/sidrr-conference-2019/>

8.5.4 Interview on CBC in Canada

IUGS-IFG Officer for Pacific gave two interview for CBC regarding the first body farm (human decomposition research facility) in Canada.

<https://nationalpost.com/news/canada/canadas-first-body-farm-to-open-in-quebec-and-people-are-already-signing-up-to-be-donors>

8.5.5 Forensic Cemetery

IUGS-IFG provided confidential advice and recommendations for a baseline geological investigation for a new forensic cemetery and human decomposition research facility.

8.5.6 NSGG and GeoSiG Field Exhibition, Leicester, UK

On 16 May 2019, IUGS-IFG supported the Chartered Institute of Forensic Archaeologists Geophysics Group (GeoSiG) and Near Surface Geophysics group (NSGG) field exhibition, in Leicester, UK. Several geophysical techniques were demonstrated at a test site. This was followed by a postgraduate research symposium on 17 May 2019.

<http://www.nsgg.org.uk/2018/2019/05/16/nsgg-field-exhibition-2019/>

8.5.7 Searching for Holocaust Mass Jewish Graves, Lithuania

IUGS-IFG provided UK based advice for searches aimed at locating mass graves in Lithuania. These were believed to be related to the Holocaust in Second World War, with at least one grave was related to the Soviet occupation. The graves were reported to vary from a few tens of victims to 50,000 or more. The search strategy included the 3D mapping and imaging of mass gravesites. The principal geophysical techniques were resistivity, radar, electromagnetic, magnetics, and resistance. The use of a drone included photogrammetry, multispectral imaging, high-resolution photography and thermal methods. Archival US military air photos were also used from 1944. The data acquired was visualised in 3D using a geological 3D visualization and modelling package. However, it is unlikely that any future invasive digging will take place especially the Jewish burials from the Holocaust. However, at two of the largest mass graves, about 50,000 each, there are records of some Soviet test pitting from the 1960s.

8.5.8 Countering Fraud and Corruption, Zambia and South Africa

IUGS-IFG Chair attended a meeting in Zambia, with representatives from Zambia and South Africa. This included geological methods to investigate, manage and mitigate fraud and corruption in the mining and minerals industry, including theft and the adulteration or substitution of mineral concentrates and precious metals.

8.6 JUNE

8.6.1 Water Search in Cyprus

An IUGS-IFG committee member was invited to conduct a search of a water body in Cyprus, with positive results and the recovery of a missing person. Seven victims were eventually found, one using geophysics and two remain missing.

8.6.2 Solving Crimes with Geology in Engineering and Technology

An article was published by IUGS-IFG committee members on, *'Solving Crimes with Geology'*, in Engineering and Technology.

<https://www.EandTmagazine.com>

8.7 JULY

8.7.1 University of Warsaw and Central Forensic Laboratory, Poland

IUGS-IFG provided UK based support for a meeting that took place in Poland between the Department of Geology, University of Warsaw and the Central Forensic Laboratory. This included the establishment

of a new undergraduate courses on forensic geology and help develop a search strategy to locate graves associated with the Second World War.

8.7.2 NIST-OSAC, Orlando, Florida

On 9-12 July 2019, the Organizations of Scientific Areas Committees (OSAC) held its annual Forensic Science meetings in Orlando, Florida. OSAC works in conjunction with the National Institute of Standards and Technology (NIST) to coordinate the development of standards and guidelines in order to improve the quality and consistency of the forensic science community's work. Members of IUGS-IFG were invited to attend this OSAC-NIST meeting with regards to geological trace evidence collection and analysis.

8.7.3 IUGS-IFG Sub Committee Meeting, Orlando, Florida, USA

On 10 July 2019, IUGS-IFG held a sub-committee meeting in Orlando Florida. Forensic geologists working with the Federal Bureau of Investigation (FBI) were invited as guests. The meeting minutes are available on request.

8.7.4 Analisi Mineralogiche in Ambito Forense, Italy

Dr Rosa Maria Di Maggio (IUGS-IFG Officer for Europe) co-authored a book, in Italian language, with Professors Alessio Langella and Mariano Mercurio (Sannio University) and Piergiulio Cappelletti (from University Federico II of Naples). The title of the book is, '*Analisi Mineralogiche in Ambito Forense*' (Mineralogical Analysis Applied to Forensics). This book illustrates the main modern theoretical and practical mineralogical analytical procedures that can be applied for forensic purposes on various materials and substances. On 4 July 2019, the book was presented at Sannio University for the inauguration of the new Department of Science and Technology.

8.7.5 UK Government Response to House of Lords Inquiry into Forensic Science

The UK Government published their response to the House of Lords inquiry into forensic science by the Lords Science & Technology Committee. IUGS-IFG provided written evidence for this inquiry.

<https://www.parliament.uk/documents/lords-committees/science-technology/forensic-science/Govt-response-forensic-science.pdf>

8.8 AUGUST

8.8.1 Countering Fraud and Corruption in Minerals and Mining

IUGS-IFG investigated geological methods to manage and mitigate criminal activities associated with mineral, mining and meals. This includes conflict minerals, sample adulteration, substitution and the theft of metals and refinery products. The results will be considered at the 36th IGC in Delhi, in March 2020.

8.8.2 Forensic Geology & Forensic Archaeology Collaboration, Denmark

On 22-23 August 2019, IUGS-IFG was represented at the 8th European Meeting on Forensic Archaeology European Meeting on Forensic Archaeology, held at, Moesgaard Museum, Højbjerg, Denmark. This event was arranged with the support of the Danish National Police and the European Network of Forensic Science Institutes (ENFSI). Of particular relevance to forensic geology were discussions on; the preliminary results from an experimental study of human taphonomy in voids, excavation and identification of buried human remains, SoilTracker (Integration of multiple analysis techniques for soil matching), crimes in the past and archaeological and anthropological evidence, search for hidden corpses in Poland, searches using dogs, search of hidden objects and criminal burials in different environments, concealed homicides in Denmark and interpretation of open water search by detector dogs.

8.8.3 ENFSI and APST

IUGS-IFG Treasurer is a member of the European Network of Forensic Science Institutes (ENFSI) and the Animal Plant Soil Trace (APST) Working Group, and is one of the authors of the European Best

Practice Manual. This widens the lineages with other established networks and associations to assist in promoting, developing and standardising forensic geology around the world. This will be published at the end of 2019 and will be published in April 2020.

8.8.4 FBI Forensic Geology Training Video, Kentucky, USA

IUGS-IFG endorsed and supported the production of a professionally produced training video on the forensic collection of soil samples, initiated by the FBI. This is aimed at raising skills levels and the standardisation of soil collection at crime scenes. The video was filmed at the University of Kentucky College of Agriculture Food and Environment, in association with Dr Brad Lee, Suzette Walling (Extension Associate) and Brian Volland (Videographer). The soil collection video (aimed at crime scene personnel) was posted on the University of Kentucky YouTube channel.

<https://youtu.be/o9dWZOj1U5A>

8.8.5 Outreach Event to Senior Citizens, Chiba, Japan

IUGS-IFG organised a half-day outreach event on forensic geology, to senior citizens, in Chiba, Japan.

8.8.6 Future Governance of the Centre for Australian Forensic Soil Science (CAFSS)

The CAFSS transferred from CSIRO to the University of Adelaide (School of Biological Sciences), which will also facilitate succession planning for the IUGS-IFG in Australia.

8.8.7 Homicide Case, Romania

IUGS-IFG provided general recommendations for a homicide case in Romania, which required a ground search for a suspected burial.

8.8.8 Technologies for Trace Qualification in Real-time In-Situ Forensic Investigations

IUGS-IFG provided a letter of support and endorsement for the Technologies for Trace Qualification in Real-time In-Situ Forensic Investigations (TeTRIS) project application, led by the Guardia Civil, in Spain.

8.9 SEPTEMBER

8.9.1 Guide to Forensic Geology

IUGS-IFG submitted to the Geological Society of London (GSL), the draft manuscript for, '*A Guide to Forensic Geology*'. This has taken over 10 years to write and the search section has evolved over the past 25 years. The publication is expected in 2020.

8.9.2 Forensic Soil Science and Geology

IUGS-IFG submitted to the Geological Society of London (GSL), the draft manuscript for, '*Forensic Soil Science and Geology*'. This is a Geological Society of London Special Publication, which provides information and support to help police and law enforcement with criminal investigations. These include collection and analysis of earth-materials and other items from crime scenes, and searches associated with homicide graves, counter-terrorism and organised crime. This volume includes new field and laboratory methods and operational casework from around the world. This is also expected to be published in 2020. Some of the papers are available on-line.

<https://sp.lyellcollection.org/online-first/492>

8.9.3 Police & Law Enforcement Operational Support

IUGS-IFG committee members continued to provide forensic geology advice and consultancy to police and law enforcement worldwide. This includes crime scene examination, the collection and analysis of soils and other geological or geological derived materials and searches for burials or concealed items. In September 2019, this included a search for a child missing for over 35 years.

8.9.4 EAGE, Near Surface Geophysics Workshop, The Hague, Netherlands

On 8-12 September 2019, IUGS-IFG was represented at the European Association of Geoscientists and Engineers (EAGE), Near Surface Geophysics Workshop, in The Hague, Netherlands, the theme focussed on forensic geophysics for burials.

<https://eage.eventsair.com/near-surface-geoscience-2019/>

8.9.5 Geoforensic Search Strategy (GSS) and Mining, Minerals and Metals Fraud

On 27-28 September 2019, a series of meetings were held in Burnley, Lancashire, UK, to discuss the Geoforensic Search Strategy (GSS). This is a new and innovative method to provide law enforcement with a high assurance search, combining geological and law enforcement methods. The GSS will be published in 2020 as a chapter in, 'A Guide to Forensic Geology'. At this meeting, existing and innovative methods to mitigate risks associated with crimes that take place in the mining, minerals and metals industry were also considered.

8.9.6 MSc in Forensic Science, Nottingham, UK

On 9 September 2019, IUGS-IFG Chair was invited to give a two hours guest presentation at Nottingham Trent University, Department of Chemistry and Forensic Science, for the MSc Course on Forensic Science. This included; the history of forensic geology, crime scene examination, sample collection, sample analysis and evaluation, the provision of geological trace evidence, ground searches for burials, water searches, operational case examples and the role of IUGS-IFG in the global development of forensic geology.

<https://www.ntu.ac.uk/study-and-courses/courses/find-your-course/science-technology/pg/2019-20/forensic-science>

8.10 OCTOBER

8.10.1 FBI Training Video on Soil Collection

IUGS-IFG worked with law enforcement in the USA to produce a training video on the collection of soil evidence from crime scenes. This included; personal protective equipment and evidence protection, digging tools, collection tools, packaging materials, scales and evidence documentation.

8.10.2 4th IberoAmerican Congress on Forensic Geology, Puerto Vallarta, Mexico

On 28-29 October 2018, the '4th IberoAmerican Congress on Forensic Geology', was held in Puerto Vallarta, Mexico, in association with Reunion Anual de la Unión Geofísica Mexicana (RAUGM). The congress focussed on; ground searches for burials using geophysics, the investigation of tailings dam failures in Brazil, searches for missing persons and graves in Colombia, processes of human decomposition and preservation, geological methods to support criminal investigations associated with mining, minerals and metals including theft, adulteration, substitution, mineral smuggling and conflict minerals. A keynote presentation was given by IUGS-IFG Chair. Training was provided to the conference delegates, comprising; academics, researchers and students, on ground search techniques, crime scene examination and the recovery and analysis of geological trace evidence from a car.

<https://www.raugm.org.mx/>

8.10.3 IUGS-IFG Sub Committee Meeting, Puerto Vallarta, Mexico

On 28 November 2019, IUGS-IFG held a sub-committee meeting in Puerto Vallarta, Mexico. The meeting minutes are available on request.

8.10.4 Forensic Geology in India

IUGS-IFG supported geologists in India working towards the establishment of a sub-group on Forensic Geology that will be affiliated to IUGS-IFG.

8.10.5 European Network of Forensic Science Institutes (ENFSI), The Hague, Netherlands

IUGS-IFG supported and advised ENFSI in The Netherlands, with regards to forensic soil science and ground search for burials.

8.10.6 The Sherlock Holmes Society of London

On 17 October 2019, IUGS-IFG Chair was invited by the Sherlock Holmes Society of London to give the 2019 Richard Lancelyn Green Lecture. This event was preceded by an annual dinner, held at the National Liberal Club, in Whitehall, London. The presentation was entitled, *'The Applications of Geology to Police and Law Enforcement'*. As well as providing an overview of forensic geology, this presentation analysed the use of geology by Sir Arthur Conan Doyle in his Sherlock Holmes stories. This presentation also considered whether Sherlock Holmes would have made a good geologist. Furthermore, the similarities between operational geologists and detectives were discussed and debated!

<http://www.sherlock-holmes.org.uk/event/forensic-geology/>

8.10.7 International Police and Crime Scene Investigation, South Korea

On 20-23 October, the IUGS-IFG Forensic Science Adviser visited, Incheon, Seoul, South Korea to speak at an International Police and Crime Scene Investigation (CSI) conference.

8.11 NOVEMBER

8.11.1 Microtagging of Minerals

The theft, adulteration and substitution of base metal mineral concentrates, precious metals, smelter and refinery products takes place throughout the world, in particularly in Mexico, South America, Africa and Asia. Following successful laboratory trials, IUGS-IFG proposes to introduce microtaggants into mineral products to aid tracking and verification of a mineral cargo's authenticity and identification. This may potential compliment conventional mineralogical profiling techniques.

8.11.2 29th Symposium on Geo-Environments and Geo-Technics, Tokyo, Japan

On 29-30 November 2019, IUGS-IFG supported and participated in the, *'29th Symposium on Geo-Environments and Geo-Technics'*, organised by The Japanese Society of Geo-Pollution Science, Medical Geology and Urban Geology, at the Oval Hall of Nippon University, in Tokyo, Japan. An overview of IUGS-IFG events and activities for 2016-2019 was also provided.

https://www.jspmug.org/envgeo_sympto/29th_sympto/29th_sympto_en.html

8.11.3 Conflict Minerals, Substitution, Adulteration and Theft, DRC

IUGS-IFG Chair attended meetings in the Democratic Republic of Congo to better understand crimes that take place in minerals and mining and how these may be geologically investigated.

8.11.4 American Academy of Forensic Science (AAFS) Project in Colombia

AAFS approved a two years long project in Colombia, which will run from 2020-2022, regarding mass graves at the Universidad Antonio de Nariño. This will be supported by the IUGS-IFG Officer for Latin America, based on Bogota, Colombia.

8.12 DECEMBER

8.12.1 Graduate School of Science and Technology, Kumamoto University, Japan

IUGS-IFG organised a course on forensic geology, to graduate students, at the Graduate School of Science and Technology, Kumamoto University, in Kumamoto, Japan. It is the first credit course on forensic geology in Japan.



8.12.2 Forensic Geology in Warsaw, Poland

IUGS-IFG agreed to visit Poland in February 2020 to deliver a series of lectures and training for a new course at the Department of Geology, University of Warsaw. This will include the provision of advice on searches for war graves associated with the Second World War.

8.12.3 Rossendale and Pendle Mountain Rescue Team (RPMT), UK

On 11 December 2019, IUGS-IFG Chair gave a guest presentation to RPMT, in Burnley, Lancashire, UK on, '*Forensic Geology: Searches Related to Missing Persons, Homicide Graves, Counter Terrorism and Serious and Organised Crime*'. This included ideas for collaboration and future training in search and rescue.

9 MAIN PRODUCTS AND OTHER ACTIVITIES IN 2019

9.1 Operational Support

Whilst IUGS-IFG was not specifically established to provide operation support for police and law enforcement, and consistent with previous years, members of the IUGS-IFG committee were invited to provide operational support for casework, including crime scene examination, geological trace evidence and searches (water and ground). The details of these investigations are confidential due to their sensitive, often high profile nature or some are ongoing cases.

9.2 Confidential Documents

IUGS-IFG produced technical and scientific reports, guidance and standard operational procedures (SOP), however, due to their status being either secret, confidential or restricted these also remain confidential.

9.3 National Crime Agency (NCA)

Members of IUGS-IFG were retained by the UK Police, National Crime Agency (NCA) listed as '*Expert Advisers*' (forensic geologists).

9.4 Training Documents

IUGS-IFG produced presentations and documents for geologists, students, conference delegates, police and law enforcement.

9.5 Soil Training Video

The soil collection video (aimed at crime scene personnel) was posted on the University of Kentucky YouTube channel.

9.6 Documents

IUGS-IFG certificates were issued to delegates that attended formal courses and training.

9.7 Website

The upgrade of IUGS-IFG web site continued and is expected to become operational in 2020, hosted by Queens University Belfast (QUB), Northern Ireland.

9.8 Flyer

A flyer was issued giving an overview of the aim, objectives and achievements of IUGS-IFG. This can also be downloaded on the IUGS-IFG web site in an electronic format.

9.9 Newsletter

In June 2018, the IUGS-IFG newsletter became replaced by the provision of monthly updates on forensic geology for the IUGS E-Bulletin.

9.10 IUGS E-Bulletin

IUGS-IFG provided a monthly contribution for the IUGS E-Bulletin.



9.11 Media

IUGS-IFG provided a limited number of interviews to respected and professional journalists and the media to help promote and draw attention to forensic geology including, the BBC in the UK and CBC in Canada.

9.12 Awards, Recognition, Promotion & New Positions

IUGS-IFG Treasurer, Prof Lorna Dawson, CBE was awarded a Fellowship of the Royal Society of Edinburgh (FRSE). Prof Lorna Dawson was also awarded the INTL Global Awards, UK Soil Forensics Expert Witness of the Year.

Prof Carlos Martin Molina Gallego, IUGS-IFG Officer for Latin America (The Universidad Antonio Nariño, Instituto Nacional de Medicina Legal y Ciencias Forense, Bogota, Colombia) was awarded the, '*IFG Award in Recognition of Outstanding International Contributions to Forensic Geology*', and for his pioneering efforts in developing and promoting forensic geology throughout Latin America. This was presented by the IUGS-IFG Chair, in Puerto Vallarta, Mexico.

Dr Rosa Maria Di Maggio, IUGS-IFG Officer for Europe, was awarded the Italian Forensic Award for Excellence in Forensic Geoscience, in Rome, Italy.

Dr Laurance Donnelly, IUGS-IFG Chair, was awarded as a Complimentary Member of The Sherlock Holmes Society of London.

9.13 Geological Society of London, Forensic Geoscience Group

IUGS-IFG collaborated closely with GSL-FGG, including the completion of the manuscript for two major publications (expected to be available 2020) and the House of Lords enquiry into forensic science.

9.14 Geoforensic International Network (GIN)

GIN brings together forensic geologists, geoscientists, police and law enforcement officers from around the world to develop and promote forensic geology.

In 2019, those countries that became included in were; Bolivia, Ecuador, Democratic Republic of Congo (DRC), Vietnam and Zambia.

Those countries now represented in GIN include; Australia, Argentina, Belize, Belgium, Bolivia, Brasil, Canada, China, Chile, Colombia, Democratic Republic of Congo (DRC), Denmark, Ecuador, Egypt, England, France, Finland, Germany, Hungary, India, Iran, Ireland, Israel, Italy, Japan, Malta, Mexico, Namibia, Netherlands, New Zealand, Nigeria, Northern Ireland, Poland, Portugal, Russia, Scotland, South Africa, South Korea, Singapore, Spain, Sweden, Switzerland, Taiwan, Netherlands, United Arab Emirates, Vietnam, United States of America, Wales and the West Indies (Caribbean), Zambia.

Targeted countries for potential membership are Belarus, Kazakhstan, Kyrgyzstan, Kuwait, Mongolia, Oman, Qatar, South and Central American Counties, Malaysia and African Countries.

10 PUBLICATIONS

There are numerous journal publications by IUGS-IFG committee members and these can be provided on request.

10.1 A Guide to Forensic Geology

In 2019, the final manuscript for, '*A Guide to Forensic Geology*' was submitted to the Geological Society of London, the publication is expected in 2020. The editors of the publication are Laurance Donnelly, Duncan Pirrie, Mark Harrison, Alastair Ruffell and Lorna Dawson. The contents are as follows:

- Acknowledgements
- List of Abbreviations and Acronyms
- Preface (Laurance Donnelly)
- Chapter 1: Introduction (Laurance Donnelly)

- Chapter 2: A Historical Overview of Forensic Geology (Laurance Donnelly, Raymond Murray)
- Chapter 3: Geoforensic Search Strategy (GSS): Ground Searches Related to Homicide Graves, Counter Terrorism and Serious and Organised Crime (Laurance Donnelly, Mark Harrison)
- Chapter 4: Crime Scenes: Geoforensic Assessment, Sampling and Examination (Duncan Pirrie, Alastair Ruffell, Lorna Dawson, Jennifer McKinley)
- Chapter 5: Geological Evidence Recovery from Exhibits (Duncan Pirrie, Alastair Ruffell, Lorna Dawson)
- Chapter 6: Geological Evidence Analysis (Alastair Ruffell, Duncan Pirrie, Lorna Dawson)
- Chapter 7: The Judicial System, Reporting and Giving Evidence in Court (Lorna Dawson, Derek Auchie, David Parratt)
- Chapter 8: Emerging Applications of Forensic Geology (Laurance Donnelly, Alastair Ruffell)
- References

10.2 Special Publication on Forensic Soil Science and Geology (GSLSpecPub17-125)

In 2019, the final draft of, *'Forensic Soil Science and Geology'* was submitted to the Geological Society of London. Publication is expected to be in 2020, as a *'Special Publication'* series. The majority of the papers were presented at the, *'Symposium of Forensic Soil Science and Geology'* and International Conference on, *'Criminal and Environmental Soil Forensics,'* held at the 35th IGC, in Cape Town, South Africa, in 2016. This special publication provides information and support to police and law enforcement with criminal investigations. These include; collection and analysis of earth-materials and other items from crime scenes, and searches associated with homicide graves, counter-terrorism and organized crime. This volume includes new field and laboratory methods and operational casework from around the world. Some of the papers are available online at the following link:

10.3 Geological Society of Japan

The Geological Society of Japan (GSJ) is planning to publish special issue of the Journal of GSJ on forensic geology, which has an anticipated publication in 2020. IUGS-IFG submitted papers for the publication. IUGS-IFG Officer for Japan, Ritsuko Sugita, is serving as a guest editor of the issue.

10.4 House of Lords Inquiry into Forensic Science

Information is available on line in relation to the House of Lords Inquiry into Forensic Science, which IUGS-IFG were invited to submitted written evidence.

<https://www.parliament.uk/business/committees/committees-a-z/lords-select/science-and-technology-committee/>

<https://www.ruth-morgan.com/blog/house-of-lords-science-and-technology-committee-inquiry>

<https://www.parliament.uk/documents/lords-committees/science-technology/forensic-science/Govt-response-forensic-science.pdf>

10.5 Engineering and Technology Magazine

An article on forensic geology was published in Engineering and Technology Magazine.

11 MAIN PROBLEMS ENCOUNTERED IN 2019

11.1 Funding

The funding received from IUGS is essential for IFG. This also provides the basis to attract co-funding to enable IFG to advance and develop forensic geology around the world.

11.2 Increasing Conference and Congress Costs

The increasing costs to attend conferences, and in particular conference registration, has a negative impact on the attendance of potential forensic geology delegates, and in particular students.

11.3 Accreditation and Regulation in Forensic Geology

IFG continues to discuss the need for the accreditation and regulation of forensic geologists. There remains a challenge concerning the authoritative body that should be responsible for accreditation and regulation.

11.4 Forensic Awareness and Operational Case Work

Whilst IUGS-IFG seeks to publish and promote forensic geology, this has to be balanced with the need to protect some of the forensic geology capabilities and ongoing operational casework. A reasonable amount of work conducted each year by IUGS-IFG therefore has to remain confidential.

11.5 Security

Due to the nature and culture of some police forces around the world, it is unlikely forensic geology can become initiated in those countries.

12 WORK PLAN FOR 2020

The IUGS-IFG work plan for 2020 includes the following:

12.1 IUGS ARC Recommendations

IUGS-IFG has made significant progress in implementing the recommendations of the IUGS ARC conducted in 2016, and these will continue throughout 2020.

12.2 Publications

The following publications are anticipated during 2020:

- Publication of, *'A Guide to Forensic Geology'* (IUGS & The Geological Society of London).
- Publication of, *'Forensic Soil Science and Geology'* (IUGS & The Geological Society of London, Special Publication).
- Publication of a special issue on *'Forensic Geology'*, (Geological Society of Japan).
- Publication of an IUGS-IFG supported FBI led training video on soil collection at crime scenes.
- Publication of, *'Geoethics in Forensic Geology'*, in association with the International Association for Promoting white. This also includes the publication of a white paper and an article in *'Episodes'*.
- Publication of the European Network of Forensic Science Institutes (ENFSI) and the Animal Plant Soil Trace (APST) Working Group, European Best Practice Manual (co-authored and contributions from IUGS-IFG).

12.3 Outreach, Knowledge Exchange, Capacity Building & Training

- Attendance at the 74th IUGS Executive Committee meeting, South Korea, January 2020.
- Workshop on money laundering and terrorist financing and gold trafficking, in Boa Vista, the capital of the state of Roraima, Brazil, with the Brazilian Federal Police, February 2020.
- Lectures and training for the establishment of a new MSc at the University of Warsaw and Central Forensic Laboratory, in Poland, and the provision of training on ground searches to locate genocide graves from the Second World War, February 2020.
- Establish a working group on Forensic Geology in India, affiliated to IUGS-IFG, March 2020.
- Implement a Session on Forensic Geology, at the 36th International Geological Congress, in 2020, Delhi, India, March 2020.
- Provide a workshop and training on forensic geology in India, for students, forensic scientists, police and law enforcement, March 2020.

- IUGS-IFG collaboration with the, 22nd Triennial Meeting of the International Association of Forensic Science (IAFS), in conjunction with the 25th Symposium of the Australian & New Zealand Forensic Science Society (ANZFSS), Sydney, Australia, Sydney, Australia, September 2020.
- Joint Conference with Geological Society of London Forensic Geoscience Group and Near Surface Geophysics Group, December 2020.
- Joint training with the Geological Society of London Forensic Geoscience Group, for practitioners, on the collection of soil and rock at crime scenes (UK), December 2020.
- The IUGS-IFG Treasurer is hosting in the Animal, Plant and Soil Traces (APST meeting in Aberdeen, Scotland, April 2020.
- Support to colleagues in the USA, on ground searches for burials associated with homicide, counter terrorism and organised crime in USA.
- Initiation of an IUGS-IFG supported training video on ground searches for burials.
- Meetings and events in Africa, South America and Asia to promote forensic geology and its application to the mining, minerals and metals industry.

12.4 Actions in 2020 for Events in 2021-2022

- 10th anniversary of IUGS-IFG, hosted by The American University of Rome and National Institute of Geophysics and Volcanology (INGV), in Rome, Italy, 2021.
- Planning for the 5th Iberoamerican Congress on Forensic Geology, to be held at the Universidad Antonio of Nariño, Colombia, 2021.
- Translation of the Geoforensic Search Strategy (GSS) into non-English languages, 2021.
- Session on forensic geology at the Geological Association of Canada (GAC MAC), in Halifax, Canada, May 2022.
- World Congress of Soil Science, which will be held in Glasgow. This is organised by the IUSS (International Union of Soil Science). IUGS-IFG Treasurer is one of the vice chairs of a division that deals with soil and society, 2022.
<https://www.soils.org.uk/wcss2022>

12.5 Committee & Governance

- Continue with the development and upgrade of the IUGS-IFG web site.
- Attract audiences in harder to reach communities in developing nations.
- Attract young people and the next generation into forensic geology.
- Support the teaching of forensic geology to students.
- Enhance the accessibility of information on forensic geology by the translations of key documents.
- Engagement with forensic science regulators to align forensic geology with forensic science and following the publication of the UK House of Lords, Inquiry on Forensic Science, and their recommendations.
- Assist police and law enforcement to develop guidance and best practise in forensic geology, globally.
- Develop the applications of forensic geology in mining, minerals and metals industry. In particular theft, fakery, smuggling, conflict minerals, adulteration and substitution.

13 CRITICAL MILESTONES

Critical milestones for 2020 included the following:

- The provisional formation of a sub-group on of forensic geology in India. This working group is proposed to become formally launched at the 36th International Geological Congress in Delhi, India, in March 2020.
- Submission of the final draft of, '*A Guide to Forensic Geology*' to be published by The Geological Society of London.
- Submission of the final draft of, '*Forensic Soil Science and Geology*' to be published by The Geological Society of London.
- Ongoing collaboration with the FBI forensic geologists including; (a) the transfer of knowledge on ground searches for burials, (b) the production of a training video on the collection of soil samples from crime scenes, (c) a meeting held in Washington DC to discuss the advancement of search and (d) the formalisation of search and successful operational deployment.
- Delivery of the '*4th Iberoamerican Congress on Forensic Geology*', including training in search, crime scene examination and geological trace evidence analysis, at Puerto Vallarta, Mexico.
- Ongoing collaboration with ENFSI working groups, Archeology and Animal, Plant and Soil trace working groups.
- Ongoing collaboration following the submission of evidence to the UK Government, House of Lords, Science and Technology Committee, Inquiry on Forensic Science.
- The provision of support and advice for the possible initiation of forensic geology in Poland, and the search for mass graves associated with genocide during the Second World War.

14 ANTICIPATED OUTPUTS TO BE ACHIEVED FOR 2020

The main outputs expected for 2020 include the following:

- Publication of '*A Guide to Forensic Geology*' with the Geological Society of London, endorsed by IUGS.
- Publication of '*Forensic Soil Science and Geology*', with the Geological Society of London, endorsed by IUGS.
- Publication on, '*Forensic Geology*' with the Geological Society of Japan.
- Publication of a white paper on, '*Geoethics and Forensic Geology*' and an article in '*Episodes*.'
- Publication of booklet of abstracts following the, '*4th Ibero-American Congress on Forensic Geology*', in Mexico.
- Upgrade and launch of a new IUGS-IFG web site.
- Regular contributions to the IUGS E-Bulletin.

15 FINANCIAL

15.1 Bank Account and Financial Management

The IUGS-IFG bank account remains in Aberdeen, Scotland. This is managed by the IUGS-IFG Treasurer, Prof Lorna Dawson, CBE. The accounts are verified by the IUGS-IFG Chair, Dr Laurance Donnelly and the IUGS-IFG Committee.

15.2 IUGS Award Payment for 2019

IUGS-EC kindly agreed to award a 2019 budget for IFG amounting to USD \$8000.

80% of the 2019 award (USD \$6,400) was paid in July 2019.

The remaining 20% (USD \$1,600) was agreed by IUGS to be paid after the 2019 IUGS EC meeting in South Korea.

15.3 Summary of Expenditure and Accounts for 2018

The income and expenditure on the account for 2019 is summarised in Table 15.1.

As the IUGS-IFG bank account is held in the UK, the income and expenditure is shown in GBP (£) sterling and USD (\$) equivalent, where relevant.

15.1 Estimated Budget for 2020

In 2019, IUGS-IFG was successful in attracting additional financial support and support in-kind to assist with international events.

IUGS-IFG propose to request and obtain contributory funding and funding services in-kind. For these additional financial resources and support, this relies on the core funding and 'seed money' that is gifted by IUGS.

In addition, in-kind contributions by IUGS IFG staff time and the organisation they work in has allowed the many and varied contributions to have been achieved.

In 2020, IUGS-IFG proposes to generate a small surplus or to break even.

IUGS-IFG would request that we can 'roll forward' the projected balance of USD **\$2,209.11** to support the forensic geology programme for 2020 and beyond.

To deliver the 2020 programme and IUGS Executive Committee recommendations following the ARC review, IUGS-IFG kindly requests the maximum available budget of USD \$15,000 funding from the IUGS Executive Committee for 2020.

An estimated breakdown of this budgetary request is provided in Table 15.2

Table 15.1. Summary of budget and projected accounts for the calendar year 2019.

EVENT/COST IN 2019	CREDIT (£)	CREDIT (\$)	DEBIT (£)	DEBIT (\$)	BALANCE (£)	BALANCE (\$)
Projected balance and carry over to 2020	-	-	-	-	1,677.71	2,209.11
20% IUGS funding	(1,213.59)	(1,600.00)	-	-		-
Upgrade web site*	-	-	1,524.69	2,000.00	464.12	-
74th IUGS Executive EC meeting, South Korea, January 2020*	-	-	1,143.12	1,500.00		-
Search, crime scene and trace evidence translation costs*	-	-	761.61	1,000		-
Copyright and publication costs*	-	-	1,524.69	2,000		-
Training video of soil collection at crime scenes with the FBI and other colleagues in USA*	-	-	190.52	250.00		-
36th IGC, Forensic Geology Session and Training, India, March 2020*	-	-	5,334.57	7000.00		-
IFG business cards (5.12.2019)	-	-	18.99	-	-	-
IFG award (5.12.2019)	-	-	23.24	-	-	-
Mexico congress and training 5.12.2019	-	-	4,642.10	-	-	-
ENFSI APST Working Group, Netherlands 5.12.2019	-	-	80.00	-	-	-
London FGG meeting 15.01.2019	-	-	458.78	-	-	-



Bank account balance with 2019 carry over 7.07.2019	-	-	-	-	16,166.43	-
80% IUGS funding 7.07.2019	11,319.10	13,400.00	-	-	-	-

Notes:

1. USD \$8,000 awarded to IFG in July 2019.
2. 80% (USD \$6,400) paid in July 2019.
3. The remaining 20% (USD \$1,6000) to be paid after the 74th IUGS EC in South Korea, in January 2019.
4. The above includes but does not show bank charges and charges international transactions.
5. (*) Denotes anticipated transactions in the last quarter of 2019 first quarter of 2020.
6. Dates given are transaction dates.
7. 1 GBP = 1.31838 USD. 1 USD = 0.758508 GBP (11 December 2019, xe.com).



Table 15.2 Estimated and provisional budget request for 2020.

PROPOSED EVENTS IN 2020	BUDGET COST (\$) (USD)
India Forensic Geology Working Group	2,000
Upgrade of the IFG web site	2,000
Planning meeting in Rome, Italy for 10th anniversary meeting of IFG, in 2021	2,000
Joint Conference with Geological Society of London Forensic Geoscience Group and Near Surface Geophysics Group	2,000
Joint training with the with Geological Society of London Forensic Geoscience Group, for practitioners, on the collection of soil and rock at crime scenes (UK)	1,000
Minerals, mining and metals fraud (meeting in Africa, Asia or South America)	1,000
Meeting in Poland to initiate forensic geology and develop searches for war graves associated with the Second World War	1,000
ENFSI Animal Plant and Soil Trace Working Group	1,000
IAFS/NZFSS, Sydney, Australia	1,000
Support for students and harder to reach communities	500
Training video on forensic geology	500
Implementation of advice following UK Government review of Forensic Science (House of Lords)	500
IFG medal conversion to Raymond Murray medal for Forensic Geology and production of a medal	500
Budget request for 2020	15,000
Notes: <ol style="list-style-type: none"> 1. Request for \$ USD 15,000 including allocated spend on strategic initiatives. 2. Request for \$ USD 15,000 excludes carryover from 2019. 3. Funding may be diverted to events unknown in December 2019, but become apparent during 2020. 	

APPENDIX I: SPECIAL PUBLICATION ON FORENSIC SOIL SCIENCE AND GEOLOGY

In 2019, the final draft of, '*Forensic Soil Science and Geology*' was submitted to the Geological Society of London. Publication is expected to be in 2020, as a '*Special Publication*' series. Some of the papers are available online at the following link: <https://sp.lyellcollection.org/online-first/492>

- The application of forensic geology to investigate the substitution of zinc ingots between China and Brazil
Fábio Augusto da Silva Salvador, Matheus Pereira Nogueira e Silva, Ricardo de Oliveira Mascarenhas and Anelize Manuela Bahniuk Rumbelsperger)
Geological Society, London, Special Publications, 492, 4 November 2019
<https://doi.org/10.1144/SP492-2018-83>
- Analysis of soil following a police-led open area search and the recovery of a cold-case homicide grave
L. J. Donnelly, J. Cassella, D. Pirrie, L. Dawson, G. Blom, A. Davidson, P. Arnold, M. Harrison and C. Hope
Geological Society, London, Special Publications, 492, 29 October 2019
<https://doi.org/10.1144/SP492-2017-337>
- Automated mineralogical profiling of soils as an indicator of local bedrock lithology: a tool for predictive forensic geolocation
Duncan Pirrie, Daniel E. Crean, Allan J. Pidduck, Timothy M. Nicholls, Roy P. Awbery and Robin K. Shail
Geological Society, London, Special Publications, 492, 25 October 2019
<https://doi.org/10.1144/SP492-2019-42>
- The forensic comparison of trace amounts of soil on a pyjama top with hypersulphidic subaqueous soil from a river as evidence in a homicide cold case
Robert W. Fitzpatrick and Mark D. Raven
Geological Society, London, Special Publications, 492, 28 August 2019,
<https://doi.org/10.1144/SP492-2019-59>
- Trace evidence examination using laboratory and synchrotron X-ray diffraction techniques
Mark D. Raven, Robert W. Fitzpatrick and Peter G. Self
Geological Society, London, Special Publications, 492, 28 August 2019
<https://doi.org/10.1144/SP492-2019-36>
- Evaluation of forensic soil traces from a crime scene: robbery of a safety deposit box in Brazil
S. A. Testoni, V. F. Melo, L. A. Dawson, F. A. S. Salvador and L. V. Prandel
Geological Society, London, Special Publications, 492, 28 August 2019
<https://doi.org/10.1144/SP492-2019-35>
- Comparison of geophysical and botanical results in simulated clandestine graves in rural and tropical environments in Colombia, South America
Carlos Martin Molina and Jamie K. Pringle
Geological Society, London, Special Publications, 492, 22 August 2019
<https://doi.org/10.1144/SP492-2017-290>
- The forensic application of ground-penetrating radar, Tekoha Jevy indigenous village, Paraná, Brazil
Rafael E. Canata, Fábio A. S. Salvador, Welitom R. Borges, Francisco J. F. Ferreira, Eduardo X. Seimetz, Ivan Pinto and Eduardo O. Barros

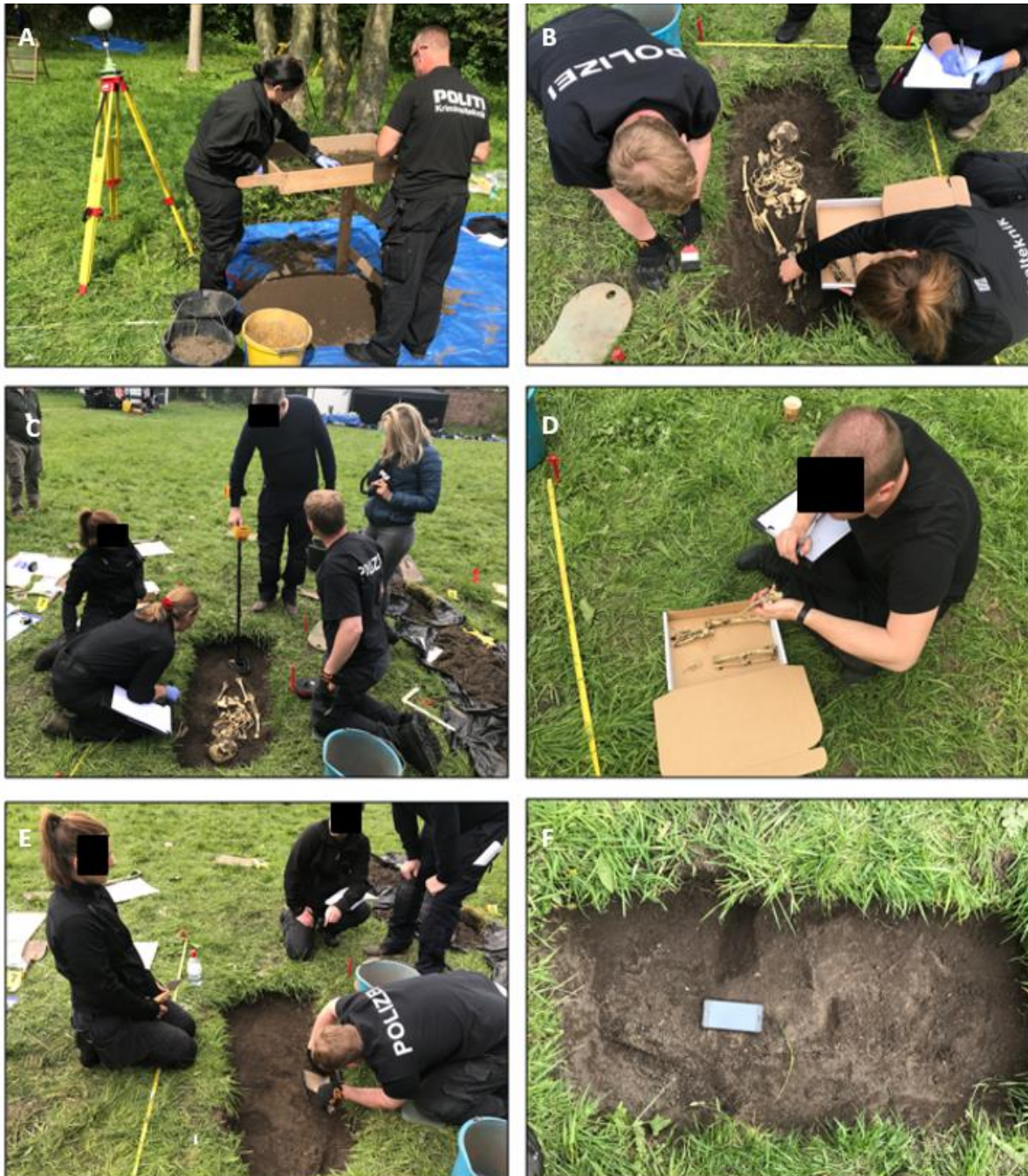
Geological Society, London, Special Publications, 492, 22 August 2019,
<https://doi.org/10.1144/SP492-2017-329>

- A case study in forensic soil examination from China
Hongling Guo, Ping Wang, Can Hu, Jun Zhu, XueYing Yang, Yangke Quan, HongCheng Mei and JinFeng Li
Geological Society, London, Special Publications, 492, 30 July 2019
<https://doi.org/10.1144/SP492-2017-307>
- The importance of forensic soil science and geology being connected to mainstream forensic science
Hilton Kobus and James Robertson
Geological Society, London, Special Publications, 492, 30 July 2019,
<https://doi.org/10.1144/SP492-2017-314>
- Dealing with different forensic targets: geoscientists at crime scenes
P. M. Barone and R. M. Di Maggio
Geological Society, London, Special Publications, 492, 23 July 2019
<https://doi.org/10.1144/SP492-2017-274>
- Plant wax compounds and soil microbial DNA profiles to ascertain urban land use type
L. A. Dawson, L. M. Macdonald and K. Ritz
Geological Society, London, Special Publications, 492, 17 July 2019
<https://doi.org/10.1144/SP492-2018-65>
- Portable X-ray fluorescence (PXRF) spectrometry of earth materials: considerations for forensic analysis
Elisa Bergslien
Geological Society, London, Special Publications, 492, 11 July 2019
<https://doi.org/10.1144/SP492-2017-346>
- The desktop study – an essential element of geoforensic search: homicide and environmental cases (west Belfast, Northern Ireland, UK)
Alastair Ruffell and Lorraine Barry
Geological Society, London, Special Publications, 492, 11 July 2019
<https://doi.org/10.1144/SP492-2017-333>
- Geoforensics in Italy: education and research standards
R. M. Di Maggio and P. M. Barone
Geological Society, London, Special Publications, 492, 9 July 2019
<https://doi.org/10.1144/SP492-2017-273>
- Soil DNA: advances in DNA technology offers a powerful new tool for forensic science
Jennifer M. Young, Denice Higgins and Jeremy J. Austin
Geological Society, London, Special Publications, 492, 4 July 2019
<https://doi.org/10.1144/SP492-2017-351>
- Geographical Information Science (GIS), spatial sampling and sediment variability examined using a case of manslaughter
Jennifer McKinley and Alastair Ruffell
Geological Society, London, Special Publications, 492, 17 June 2019
<https://doi.org/10.1144/SP492-2018-16>

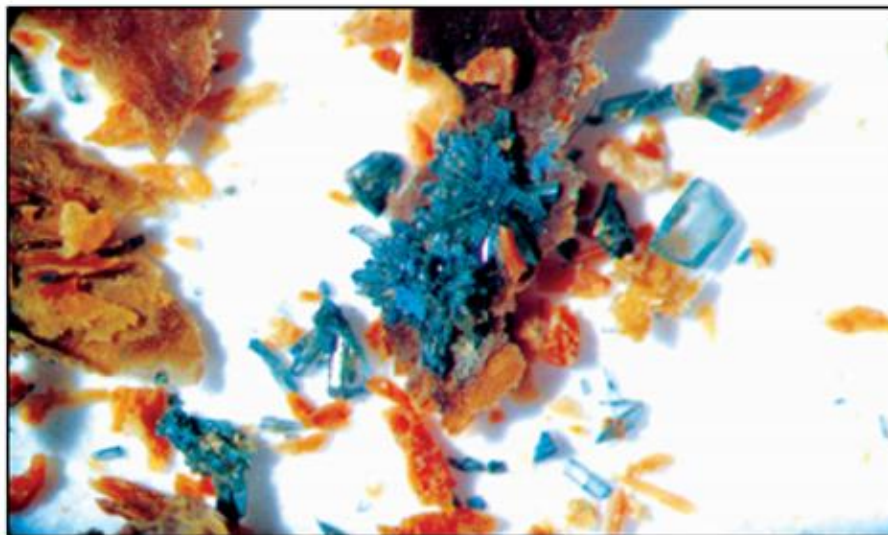


- Identifying the source of illicit gold from South America
Roger D. Dixon and Roland K. W. Merkle
Geological Society, London, Special Publications, 492, 14 June 2019
<https://doi.org/10.1144/SP492-2018-15>

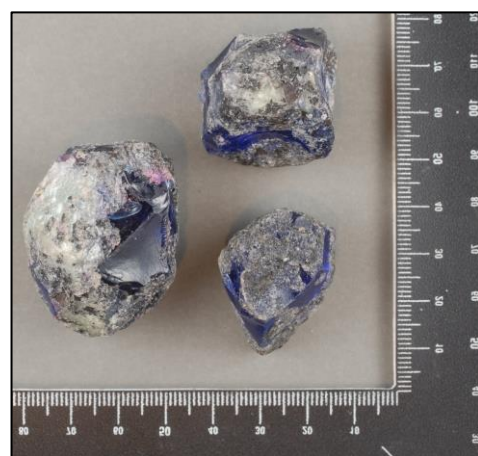
APPENDIX II: SELECTED IUGS-IFG PHOTOGRAPHS FOR 2019



Forensic recovery of a shallow grave including; (A) the sieving of soil, (B) removal of grave contents, (C) systematic geophysical survey of grave base, (D) identification of human remains by a forensic anthropologist, (E) examination of the grave base and side walls, and (F) the investigation of tool markings, probably by a spade, on the grave floor and walls. European training on search and the excavation and recovery of graves. Organised by UCLAN in association with ENFSI, EMFA and supported by IUGS-IFG (Photos: Laurance Donnelly, in Donnelly et al., 2020, pending).



Blue vivianite occurs in crystal form, a hydrated iron phosphate mineral, which can be found on human bone and has also been identified on human remains found in peat bogs (Photos: Monica Muñeton Carlos Molina, in Donnelly et al., 2020, pending).



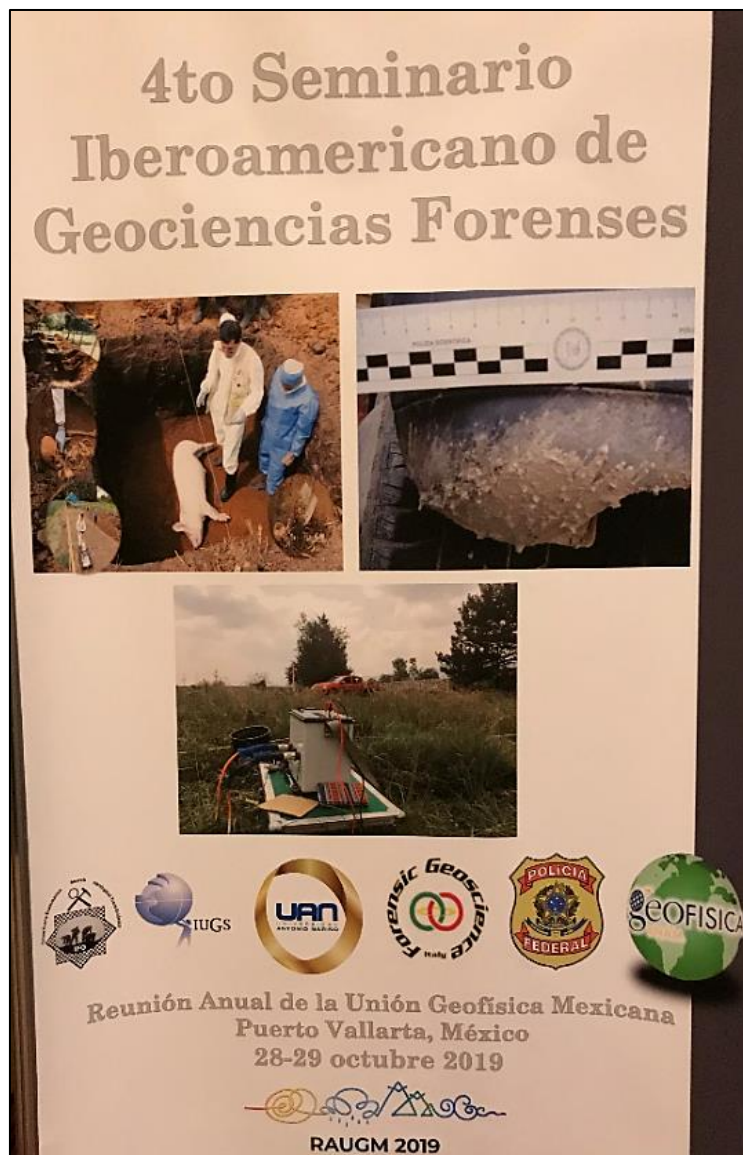
Fake 'sapphires' made using glass, blue dye and micaceous material mixed with glue coating the exterior, in an attempt to imitate blue sapphires in the rough. (Photos. Roger Dixon, in Donnelly et al., 2020, pending).



Forensic geology training in crime scene examination, geological trace evidence recovery and search, Puerto Vallarta, Mexico (Photos: Laurance Donnelly, Pier Matteo Barone, Rosa Maria Di Maggio).



IUGS-IFG Chair and keynote Speaker (Laurance Donnelly) presents the IUGS-IFG Officer for Latin America (Carlos Molina) with the IFG Award for Forensic Geology, accompanied by IUGS-IFG Officer for China (Dr Guo Hongling), 4th Iberoamerican Congress on Forensic Geology, Puerto Vallarta, Mexico (Photos: Laurance Donnelly and Carlos Molina).



4th Iberoamerican Congress on Forensic Geology, Puerto Vallarta, Mexico (Photos: Laurance Donnelly).



Soil samples for a baseline geochemical survey, for a potential research facility and forensic cemetery (confidential) (Photos: Laurance Donnelly).



Laurance Donnelly (IUGS-IFG Chair) presenting on forensic geology and ground search techniques to the Pendle and Rosendale Mountain Rescue, Burnley, Lancashire, United Kingdom (Photo: Laurance Donnelly).



Dr Rosa Maria Di Maggio, (IUGS-IFG Officer for Europe), awarded the Italian Forensic Award for Excellence in Forensic Geoscience, Rome, Italy, (Photo: Rosa Maria Di Maggio).



IUGS-IFG Crime Scene Adviser, Prof Pier Matteo Barone, using Ground Penetrating Radar as part of a ground search (Photos: Pier Matteo Barone)

A04

Analisi mineralogiche in ambito forense

Il volume rappresenta un approfondimento delle principali tecniche analitiche usate diffusamente in mineralogia e petrografia, le cui potenzialità forensi sono ancora inesprese. Lo studio dei minerali riveste un interesse legale per le geoscienze, ma anche per tutte quelle scienze criminalistiche che hanno come fine l'identificazione di un materiale di qualsiasi natura. Per tale motivo, *Analisi mineralogiche in ambito forense* è fruibile dai professionisti delle geoscienze impegnati nel contenzioso giudiziario di vario genere e rappresenta un utile compendio per magistrati, avvocati e specialisti delle materie forensi, nonché opera da guida per gli studenti dei vari corsi di studio attinenti le geoscienze.

Contributi di Pasquale Acquafredda, Ilenia Arienza, Giuseppina Balassone, Donatella Barca, Fabio Bellatreccia, David L. Bish, Piergiulio Cappelletti, Sandro Conticelli, Ciro Cucciniello, Massimo D'Antonio, Roberto de Gennaro, Rosa Maria Di Maggio, Valeria Di Renzo, Lorenzo Fedele, Luciano Garofano, G. Diego Gatta, Chiara Germinario, Francesco Graziano, Sossio Fabio Graziano, Celestino Grifa, Francesco Izzo, Mauro F. La Russa, Alessio Langella, Rocco Laviano, Luciana Mantovani, Mariano Mercurio, Nicola Mondillo, Vincenzo Morra, Paola Petrosino, Silvestro A. Ruffolo, Mario Tribaudino.

Mariano Mercurio è ricercatore di Georisorse ed applicazioni presso il Dipartimento di Scienze e Tecnologie dell'Università degli Studi del Sannio di Benevento e docente di Analisi mineralografiche per l'ambiente e i beni culturali. Il suo interesse scientifico è rivolto agli studi di mineralogia applicata per la valorizzazione di materie prime.

Alessio Langella è professore ordinario di Georisorse dal 2007 presso il Dipartimento di Scienze e Tecnologie dell'Università degli Studi del Sannio di Benevento. La sua attività scientifica è principalmente rivolta alla caratterizzazione e alle applicazioni tecnologiche dei minerali industriali, con particolare riferimento ai materiali microporosi.

Rosa Maria Di Maggio è libero professionista e si occupa di geologia forense dal 2001. Ha lavorato per undici anni come geologo forense presso il Servizio di polizia scientifica della Polizia di Stato. È co-autrice del primo libro italiano sulla geologia forense ed è membro della IUGS Initiative on Forensic Geology.

Piergiulio Cappelletti è professore ordinario di Georisorse presso il Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse dell'Università degli Studi di Napoli Federico II dal 2014. È presidente della Società Italiana di Mineralogia e Petrologia. La sua ricerca riguarda lo studio, la caratterizzazione e le applicazioni tecnologiche di geomateriali naturali e sintetici.

Je copertina (da sinistra verso destra)

Ritrovamento di una sepoltura clandestina: microcattino osservato in sezione sottile al microscopio polarizzatore (foto di tipo submicroscopica osservata al SEM a 1000x); banco di lavoro per il campionamento di terreno prelevato dalle calzature di un sospettato di omicidio (fotografie di Rosa Maria Di Maggio, Vincenzo Morra, Paola Petrosino).

37,00 euro

ISBN 978-88-255-2235-8

ANALISI MINERALOGICHE IN AMBITO FORENSE

a cura di
Mariano Mercurio, Alessio Langella
Rosa Maria Di Maggio, Piergiulio Cappelletti

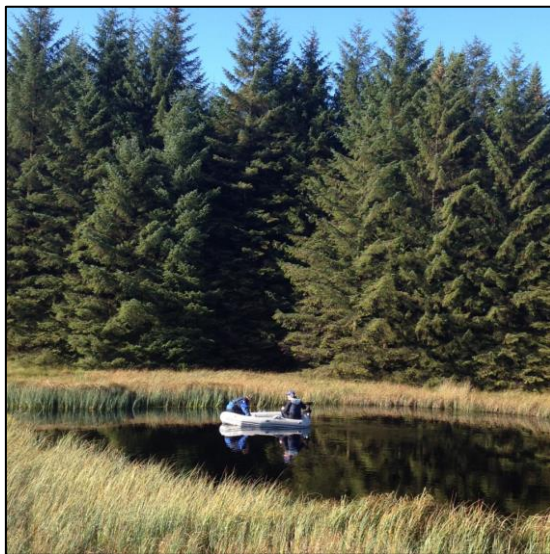
Prefazioni di
Luciano Garofano, Francesco Graziano
Sandro Conticelli

Analisi mineralogiche in ambito forense - a cura di M. Mercurio, A. Langella, R.M. Di Maggio, P. Cappelletti
ARACNE

Analisi Mineralogiche in Ambito Forense (Mineralogical Analysis Applied to Forensics), by Dr Rosa Maria Di Maggio (IUGS-IFG Officer for Europe) Professors Alessio Langella and Mariano Mercurio (Sannio University) and Piergiulio Cappelletti (from University Federico II of Naples). Dr Di Maggio's affiliation to IUGS Initiative on Forensic Geology is noted on the back cover of this book (Source: Rosa Maria Di Maggio).



Ground searches of two sites in Poland, using ground penetrating radar, for suspected Second World War mass graves related to genocide (Photos: Michal Pisz).





Forensic search of a pond (left) and peat bog (right) in Northern Ireland (Photos: Alastair Ruffell)



A grave search in Europe (Photo: Alastair Ruffell)





IUGS-IFG supporting the IUGS-IFG FBI Adviser during the filming for a training video on soil selection from crimes scenes. The video was filmed at the University of Kentucky College of Agriculture Food and Environment, in association with Dr Brad Lee, Suzette Walling (Extension Associate, holding the sun filter) and Brian Volland (videographer, behind the camera), IUGS-IFG FBI Adviser (Jodi Webb, being filmed) (Photos: Jodi Webb and Brad Lee)

Strategic Plan

Centre for Australian Forensic Soil Science (CAFSS)

The University of Adelaide
School of Biological Sciences
(with support from Environment Institute)

Strategic Plan (v5) – August 2019

Cover Photograph: Photographer, Rob Fitzpatrick © 2011 CSIRO

CAFSS Strategic Plan (Source: IUGS-IFG Vice Chair, Prof Robert Fitzpatrick.)



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- Inquiries
- Parliament 2017
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Science and Technology Committee (Lords)

Forensic science inquiry

Inquiry status **concluded** Contact us

Report published on 1 May 2019. Government Response published 5 July 2019. Awaiting debate.

Report published

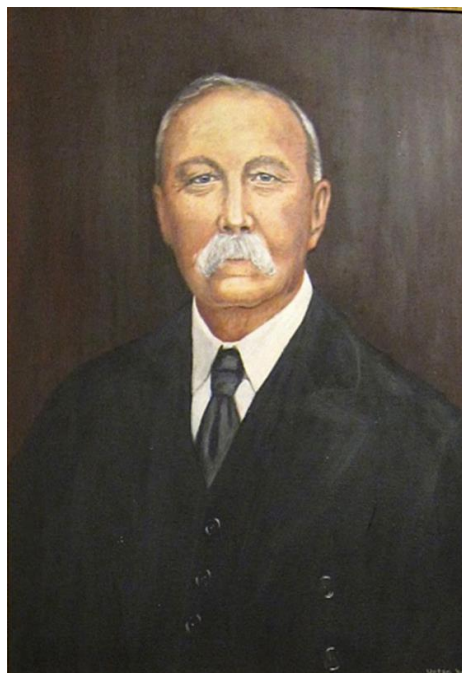
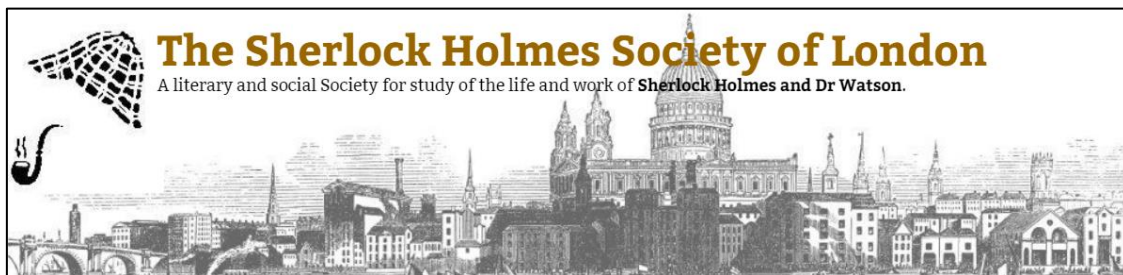
- Report - Forensic science and the criminal justice system: a blueprint for change
- Report - Forensic science and the criminal justice system: a blueprint for change
- Government Response: Forensic science and the criminal justice system: a blueprint for change (PDF 489 KB)

The UK was once regarded as world-leading in forensic science but an absence of high-level leadership, a lack of funding and an insufficient level of research and development now means the UK is lagging behind others. The forensic science market is not properly regulated creating a state of crisis and a threat to the criminal justice system.

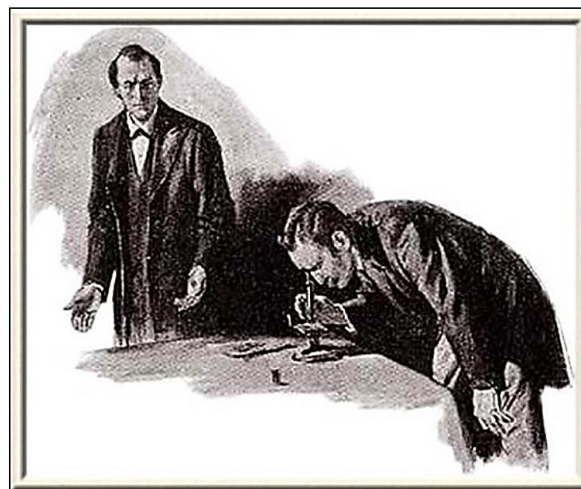
- All Forensic science and the criminal justice system: a blueprint for change publications



Web site portal for UK Parliament forensic science inquiry. Written evidence was provided by IUGS-IFG (Source: www.parliament.uk)



Forensic Geology
October 17 @ 6:00 pm - 9:30 pm
 £46.00



The Applications of Geology to Police and Law Enforcement



The Sherlock Holmes Society of London invited IUGS-IF Chair, Laurance Donnelly, to give the 2019 Richard Lancelyn Green Lecture, following an Annual Dinner, at the National Liberal Club, in Whitehall, London, on 17 October 2019 (Source: The Sherlock Holmes Society of London. Portrait of Sir Arthur Conan Doyle by Jean Upton). Laurance Donnelly was awarded a Complimentary member of this society.

The 29th Symposium on Geo-Environments and Geo-Technics	
The Japanese page, please click here	
use this window update 2019/10/14 Twitter Facebook	
Date	29-30, November 2019
Presented by	The Japanese Society of Geo-Pollution Science, Medical Geology and Urban Geology
Co-presented by	(NPO) The Geo-pollution Control Agency, JAPAN Japan chapter of International Medical Geology Association(IMGA) Japan Society of Geoinformatics Japan Association for Quaternary Research Japan Association of Mineralogical Sciences The Geological Society of Japan
Under the auspice of	IUGS-IFG
Topics of interests	Geo-pollution, Hazardous geology, Waste sediments, Medical geology, physiography, Forensic geology, Urban geology, Environment and transition of geology of water district, hydrogeology and groundwater basin management, Geo-microbiology and its utilization, geology and earthquake, Geo-hazard, Conservation of diversity of geo-environment and utilization, Agrogeology, Pedology, Long-term stability of geo-environment, Green geology, Geo-indicators, Hazard map, Database on Geo-environmental information, Anthropogenic sediments, Exploration methods of geo-environment, Education of Geo-environment, transition of geo- and earth environment, Geo-ethics, and other topics on widely related to geo-environment
Venue	The College of Humanities and Sciences, Nihon University 29-30, November - The Ovalhall, 3rd floor of Library

The 29th Symposium of Geo-Environmental and Geo-Technics, including forensic geology provided by IUGS-IFG, held in Tokyo, Japan, 29-30 November 2019 (Source: Dr Ritsuko Sugita and Dr Laurance Donnelly)

SiDRR Conference 2019 11-12th May 2019, Beijing




International Conference on Silk-roads Disaster Risk Reduction and Sustainable Development
Session 20: Disaster Monitoring and Risk Assessment

Monitoring of Ground Instability Using Spatial Data Analysis From Satellite Interferometric Synthetic Aperture Radar (Insar) and UAV Acquisition

Jennifer McKinley¹, David Hughes¹, Shane Donohue¹, Conor Graham¹, Francesca Cigna³, Kieran Parker², Alex Donald², Vanessa Banks³ and Luke Bateman³

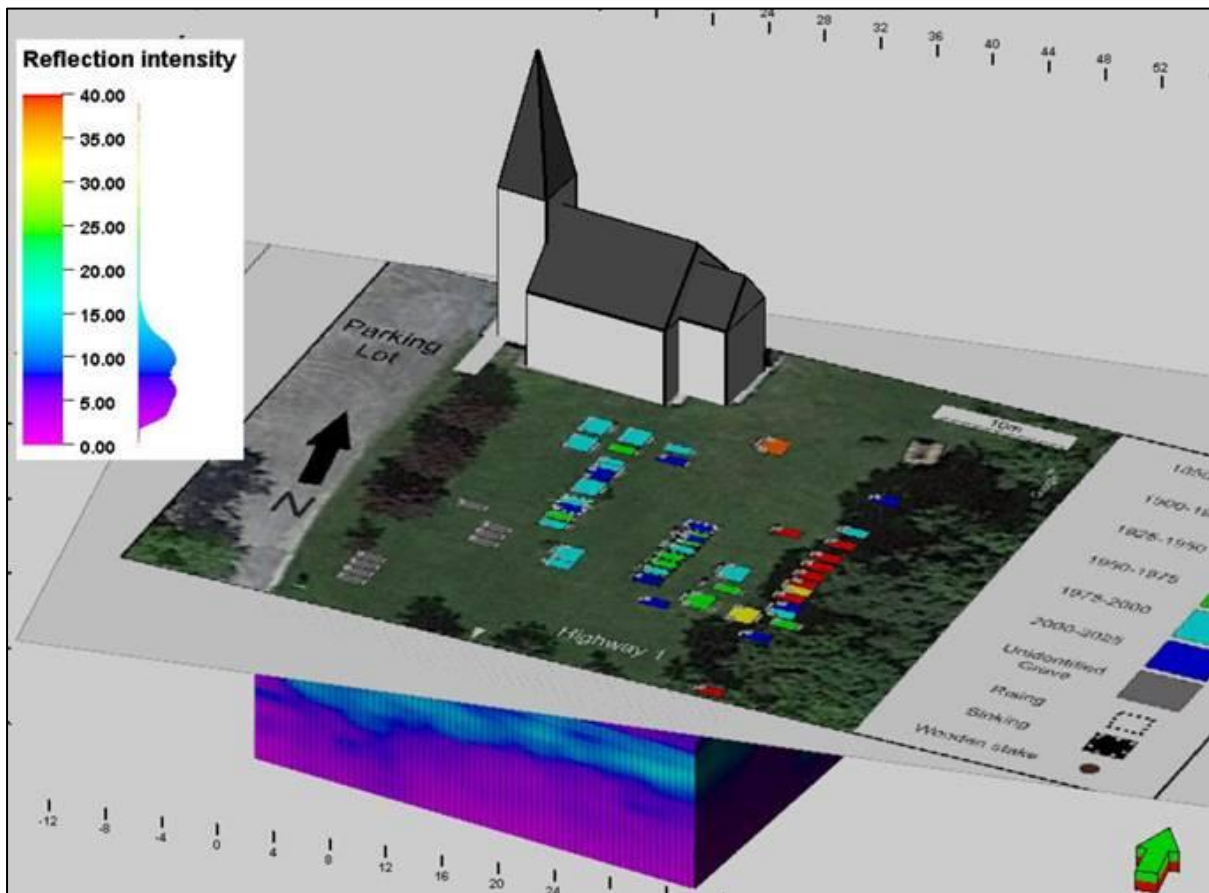
¹School of Natural and Built Environment, Queen's University Belfast, Belfast BT7 1NN, United Kingdom
²Geological Survey Northern Ireland (GSNI), Department for the Economy, Dundonald House, Belfast, BT4 3SB, United Kingdom
³British Geological Survey (BGS), Keyworth, NG12 5GG, United Kingdom

IUGS-IFG Communications Officer, Dr Jennifer McKinley, represented IUGS-IFG at the International Conference on Silk-roads Disasters Risk Reduction and Sustainable Development (SIDDR), in Beijing, China, May 2019 Source: SIDDR)

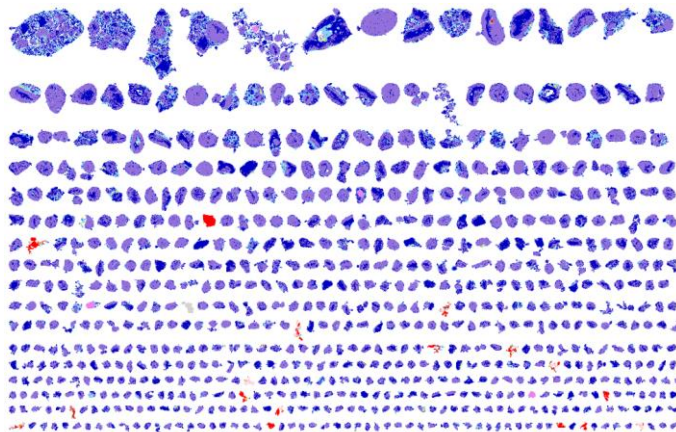


IUGS-IFG and other delegates at the International Conference on Silk-roads Disasters Risk Reduction and Sustainable Development (SIDDR), in Beijing, China, May 2019 (Photo: Jennufer McKinley).



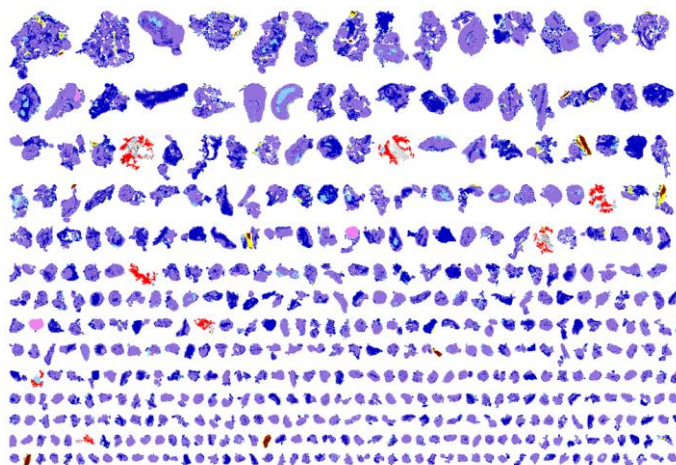
Stacked Caskets
(Confirmed)

Forensic geophysical work undertaken to help identify the boundaries of a 19th Century pioneer church in Nova Scotia, Canada. Ground penetrating radar (GPR) worked well in identifying the burial sites, particularly if caskets were present. It was also possible to image the presence of stacked caskets at some burial sites (husband and wife) (Source: Prof Grant Wach, O'Connor, Angel' Kelly and Wach, Basin and Reservoir Lab, Dalhousie University).



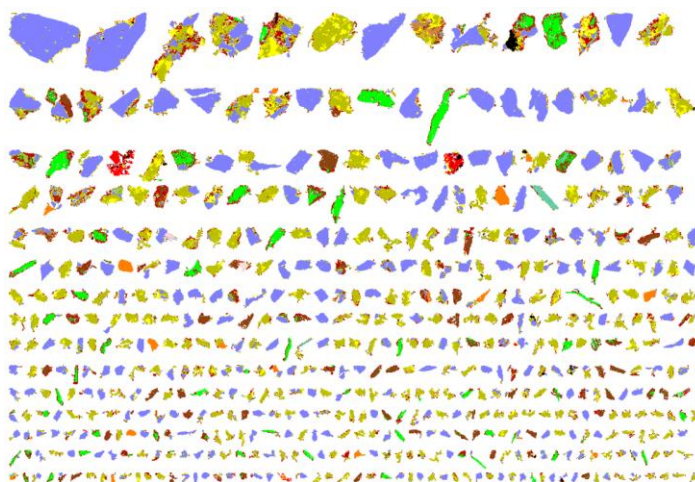
Sample HG1861 Ni concentrate 537869-11
QEMSCAN image arranged by area

1 1.5 µm
H 100.0 µm
1000.0 µm



Sample HG1863 Ni concentrate 540219-1
QEMSCAN image arranged by area

1 1.5 µm
H 100.0 µm
1000.0 µm



Sample HG1862 Ni concentrate 538560-1
QEMSCAN image arranged by area

1 1.5 µm
H 100.0 µm
1000.0 µm

Mineral Name	
	Background
	NiS
	NiFeS
	FeNiS
	NiS(Al,Fe)
	Zn(Ni)S
	Al (Ni) oxides
	NiFeSMg(Si)
	FeSAI phase
	FeSMg(Si)
	FeS
	CuFeS
	Fe-Ox/CO ₃
	Si phase
	Mg silicates
	MgFe silicates
	Ca Mg silicates
	Ca Mg Fe silicates
	Ca Fe Al silicates
	CaS
	Others

QEMSCAN mineralogical analysis of three samples reported to be nickel concentrates. However, the lower sample is more consistent with mineralised rock (ore) (Source: Laurance Donnelly and Duncan Pirrie).

54 FORENSICS GEOLOGY

Geoforensics is a method the police and forensic scientists use to help solve murder-related crimes. Here we uncover cases where the innovative approach of analysing soil evidence proved successful.

By Louise Murray

SOILING THE TIMES GEOLOGY

TWENTY-TWO SERIES and 200 episodes of the BBC CSI drama 'Silent Witness' testify to the enduring appeal of forensic investigation. Real CSI (crime scene investigation) is somewhat different – less intuitive, more scientific, but just as fascinating, perhaps more so. Forensic geology also borrows as preferences, in the analysis of soil evidence to help police solve. Such evidence found at a crime scene can be definitively re-examination in the hands of experts. Soil samples, from footwear or vehicle tyres, can demonstrate a clear timeline of the movement of suspects and their vehicles, making a line of their stated alibis, locations and travel times into a crime scene. Mud recovered from a killer's vehicle can direct a search for a missing body and help to secure a murder conviction, and geophysical techniques, commonly used in archaeology, can be deployed to reveal clandestine burials. At 70 metres three global experts in forensic geology we have on the track, through careful analysis of soil evidence, to identify criminals and find bodies.

In Italian soil
Dr Pier Matteo Barone, an archaeologist and geologist expert based at the American University of Rome, was called in by police in central Italy in 2011, six months after the disappearance of an unnamed missing person. He was asked to check police intelligence to help to locate a body. During the investigation, the police had two brothers. The first suspected that the body had been buried under a concrete road surface that was easily approved by a geological time-lapse satellite imagery of the area to pinpoint where the road had been laid. Its construction post-dated the person's disappearance. Other intelligence stated that the body had been buried in a nearby volcanic area known to contain many shallow subsurface caves. In response to the hypothesis, Barone decided to use a ground-penetrating radar (GPR – see box, Geophysics) to survey an area of about one hectare with real-time results. The GPR was equipped with 90MHz antennas to create a sub-surface, and depth slices that showed the subsurface to about

3m below. It was possible to see a large cave about 2m underground and 3-4m in diameter. Something lay inside that needed investigation. "GPR isn't an X-ray device, but we could see an anomaly something in a corner of the cave." Barone explains. "I directed police to go around the hillside before where they found an area of disturbed soil that had been dug over and hidden under branches and bushes, concealing the entrance to a cave." After carefully removing the soil following archaeological excavation standards, layer by layer to preserve any evidence, it was clear that there was a partially decomposed body inside the cave. "Once forensic pathologists had a body to work with, that was obviously an enormous help to the police. The case has yet to go to trial, so I cannot be more specific with any other details," says Barone.

The Smith brothers
In Northern Ireland in 2006, Queen's University Belfast forensic geologist Alastair Ruffell was called into a complex double homicide case. Four brothers were accused of causing the death of a couple at their remote country cottage in Strathmore, Scotland. The couple had died in a configuration following the explosion of combustible vapour inside their home; two of the suspects were also badly burned at the time and ended up in hospital in the Irish Republic. One brother had allegedly been abused by the deceased in a case years previously. The four Smith brothers initially all had alibis for the evening in question. "My first job was to collect and examine over 70 soil samples from the brothers' homes, around the murder scene, and a quarry where one of four vehicles used had been damaged," says Ruffell. "We were looking for key samples from footwear or cars that would tell the story of the movements of the owners in areas geographically layered soil deposits. While trench in a spatial distribution to represent the direction on the ground, and this helps me with an initial visual sorting of the samples," Ruffell adds.

The soils analysed were mineral-rich, so Fourier transform infrared spectroscopy (FTIR) measurements and an X-ray diffraction (XRD) were taken. With FTIR, the sample was irradiated with infrared light so that the IR structure of the molecules in the soil sample are revealed as a spectrum. "The results from suspects' boots or cars can then be compared to results from the known sampling sites," Ruffell says. XRD was used to categorise the mineral composition of the soil samples. Both techniques are non-destructive and served the purpose of helping to zoom in on the most helpful of samples, excluding others. "Of the original 70 samples, we identified about 25 that from the chemical analysis of the soil from boots and vehicles, tell the story of where the suspects had been on that night, initially or entering their alibis, and directly linking them to the crime scene," Ruffell concludes. "These samples were submitted for GeoScan analysis, which uses energy-dispersive X-ray analysis of individual particles under the scanning electron microscope to map elemental contents, further confirming the other results. Moreover, two of the four cars owned by the brothers had super-b evidence linking the vehicles to the track on the way into the scene of the crime and layered over that was the distinct geological signature of the quarry where one of the cars was damaged on the way out of the crime scene. These distinct layers also had unique sample numbers."

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GEOPHYSICS

From nuclear weapon searches to clandestine graves, geophysical search techniques can reveal secrets hidden under the soil or underneath. They can also augment or replace highly expensive traditional searches, which are dependent on manpower resources to cover large areas of ground searching for signs of ground disturbance. As well as being expensive in terms of labour and time, these searches can be restricted to the ground penetrating radar, or GPR, is commonly used in forensic search and often in conjunction with cadaver dogs to narrow down a search area. Up to four antennas of varying frequencies can be mounted on the device, which looks a little like a lawnmower on large wheels. GPR is a mounted radar system that sends out pulses of radio waves into the ground to detect the subsurface. The greater the frequency and resolution, the higher the resolution, the greater the resolution but the lower the depth of penetration. It is a technique used to search the subsurface, effective within a few metres from the ground surface.

Apart from its use in forensics, GPR is commonly used by utility companies to map underground pipes and cables, and other infrastructure. ERT, or electrical resistivity tomography, is an electrical method deployed where GPR cannot function well, for instance in areas of high moisture or salt content. It is,

however, much more time-consuming to set up and the results are not available to teams in real time. Comparing the geophysical toolbox, magnetometers are used to collect small variations in the Earth's magnetic field. They can also be used in forensic search applications to locate ferrous metallic objects such as a cache of weapons or a buried knife.

shortly after her disappearance. Professor Lorna Dawson, an eminent geoforensic scientist at the James Hutton Institute in Aberdeen, was called in by County Durham police as part of a specialist team from Aberdeen. Services to assist in the search phase. "We identified target sampling sites across the search area supported by case-specific intelligence and recovered mud from a pair of gloves from the boot of Muir's car," Dawson explains. "We also integrated models of body deposition behaviour such as convenient parking, soil diggability and

conclusion from passers by into our search strategy." They were able to exclude four out of the five possible search areas from their geology shows using an XRD mineralogical analysis of the soil. "That resulted in a hierarchical area of approximately 100m², still large for a search area," Dawson says. The team turned to examining the organic composition of the soil from Muir's gloves to narrow the search area further. Gas chromatography analysis of the alcohol and silicate fractions of the soil organic material revealed specific information about the

vegetation types at the site. Plant species can be identified from the waxy matter molecules on their surfaces. These results allowed Dawson to direct the police to an area of moorland grass, distinct from the rougher and greener that covers much of the moor. Within that area, a police dog handler, Ian Jeffrey, was able to use excellent field craft to identify the exact burial site, confirmed by his Labrador Sita. The results of the analysis of the mud on Muir's gloves had taken police to where Pamela Jackson was found, but the team returned to Muir's car to link him further to

the actual burial site. Despite Muir's best efforts to visit his car they were able to retrieve a sample of soil aggregates deep in the pile of dog-well carpets. It matched the characteristics of the soil from the actual site below the surface of the grave site, proving that he had been in contact with it. Combined with other compelling evidence – such as Muir's fingerprint on the collarbone of a bunch of flowers that he buried with his former partner, phone and CCTV records – a strong case brought together all the strands of evidence and led

to Muir being sentenced to 18 years for the manslaughter of Pamela Jackson. To this day, Muir declares his innocence.

All of the cases were complex and multi-faceted. "The end result has to be justice for the victims and their families, bringing together all the different strands of evidence to make a strong and compelling case to the court," Dawson says.

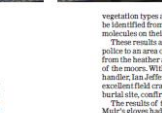
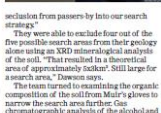
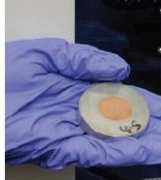
From one of the search's boots, conclusively disproving their alibis. The four brothers were convicted of manslaughter after the jury accepted their version of events that there had been no intent to kill and were ultimately jailed for up to 11 years each.

Pamela Jackson's disappearance
Another case where geoforensic evidence played a key role was the search for a missing person in northern England during 2013. On 7 March, Pamela Jackson's son reported their mother missing after not hearing from her five days. Police quickly focused their attention on her partner, Alton Muir. Muir was quickly established as the chief suspect after Muir's house (his address appeared in his story of events to family members and by the police). During the night and days after Jackson's disappearance, mobile-phone tracking placed Muir in his car travelling between her home in County Durham and his home in Halifax. This tracking encompassed a huge area of the well and isolated moorlands of West Yorkshire, and a distance of 100 miles by road. Muir was a tall runner and gamekeeper who knew the area well. Given that there were no witnesses, a shallow grave could be dug in under five minutes in the soil peaty soil. Muir denied all involvement in the death of his partner, despite recording a suicide note on his phone

Key diffusion of soil samples: the method involves digging the materials with the soil. Results are matched to a reference soil type and used to assist in forensic investigation.

The ground-penetrating radar device, which looks like a lawnmower on large wheels, is used to search the subsurface. The greater the frequency and resolution, the higher the resolution, the greater the resolution but the lower the depth of penetration. It is a technique used to search the subsurface, effective within a few metres from the ground surface.

Gas chromatography analysis determines the makeup of the organic fractions of soil samples.



"The end result has to be justice for the victims and their families, bringing together all the different strands of evidence to make a strong and compelling case to the court." Lorna Dawson, James Hutton Institute

How do you go about finding the best method to locate buried bodies? A good place to start is a body farm. The world's first body farm was opened in 1971 at the University of Tennessee by Dr William Bass to study the process of decomposition of human bodies. Bodies are buried (or placed in man-made or natural graves) in different soil types, and at different times of year – all of which have a major effect on the speed of decomposition. There are now 16 other body farms in the US, and new facilities have opened recently in Australia and the Netherlands. Facilities in the UK use pigs as human corpse proxies. However, some scientists believe that pigs decompose quite differently from humans and so may be of limited use to science. There is also huge variability in the speed of decomposition according to the geology. A body buried 50 or even 100 years ago will still be visible in the soil. While a corpse buried in dry sand will rapidly decay. Body farms have multiple purposes beyond the direct study of the mechanisms of human decomposition. Corpses or cadaver sniffer dogs can be trained at these sites, geophysicists can refine their choice of instrument, and the often difficult interpretation of the tags and other data used by their instruments record. Police and forensic scientists can study and train in the best practice in evidence collection. The problem with body farms is that even the oldest is not very old. So, researchers have looked at parts of old cemeteries that were being developed to assist in replicating the circumstances of many other missing persons' remains. The approach also has limitations as criminals generally do not use coffins to disguise their bodies, but it is providing insight into how long bodies can be identified by geophysical methods, leading into case scenarios.

The facilities, varied as they are, depend on climate and by all accounts there is a shortage of them. It is thought that 120 people a year donate their bodies to the original Tennessee body farm.

Combined with other compelling evidence – such as Muir's fingerprint on the collarbone of a bunch of flowers that he buried with his former partner, phone and CCTV records – a strong case brought together all the strands of evidence and led to Muir being sentenced to 18 years for the manslaughter of Pamela Jackson. To this day, Muir declares his innocence. All of the cases were complex and multi-faceted. "The end result has to be justice for the victims and their families, bringing together all the different strands of evidence to make a strong and compelling case to the court," Dawson says.

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Article on forensic geology, published in Engineering and Technology Magazine (Source: Lorna Dawson and Louise Murray).



The International Union of Geological Sciences, Initiative on Forensic Geology

Dr Laurance Donnelly BSc (Hons), PhD, CGeol, CSci, EurGeol, FGS, FGSA
Founder and Chair, International Union of Geological Sciences (IUGS), Initiative on Forensic Geology (IFG)
Listed as an Expert Adviser (Forensic Geologist) with the UK National Crime Agency (NCA)

IUGS Initiative on Forensic Geology

Forensic geology is an emerging discipline in geoscience. It is the application of geological principles and techniques to the investigation of crimes and the identification of geological hazards. The IUGS Initiative on Forensic Geology (IFG) was established in 2010, following the successful completion of the IUGS Working Group on Forensic Geology (WG-FG) in 2009. The IFG is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science. The IFG is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science. The IFG is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science.

1. Provide international meetings, seminars, conferences and training.
2. Develop a 'Directory' to act as a principal address, information and active participants.
3. Develop an international network whereby each 'member' acts as a principal contact in their respective country for the collection and dissemination of information on forensic geology.
4. Collect, make available and where appropriate review any existing documentation and publications in forensic geology.
5. Produce a document endorsed by the IUGS Committee to be used as a guide to forensic geology.

The IUGS Initiative on Forensic Geology (IFG) was established at the IUGS Executive Committee meeting of the IUGS, 2010, in Beijing, China. The IFG is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science. The IFG is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science. The IFG is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science.

Crime Scene Examination

The examination of geological evidence at crime scenes has traditionally been restricted to soil analysis. A forensic geologist may be required to assist the law enforcement investigator, crime scene manager or forensic scientist at a crime scene to collect geological samples and provide interpretations of the soil, sediment, rocks, and man-made materials.

The following is a list of activities that have been assigned to forensic geologists as part of an investigation to provide evidence. The methodologies for the recovery of geological evidence from crime scenes and analysis are described in detail in articles handling the recovery of geological evidence from clothing, footwear, motor vehicles and other exhibits. All of these have the potential to contribute a case that provides corroborative to forensic evidence.

Geological trace evidence may be required to determine if there has been a comparison between two or more locations to determine if they originated from the same source or not. Geological trace evidence may be transferred onto the body, gear or the clothing of a victim or offender as an associated fingerprint. This is the most common method of forensic geology. It is a forensic geologist's role to identify, collect, analyze, and interpret such evidence. This may be required to determine if there has been a comparison between two or more locations to determine if they originated from the same source or not. Geological trace evidence may be transferred onto the body, gear or the clothing of a victim or offender as an associated fingerprint. This is the most common method of forensic geology. It is a forensic geologist's role to identify, collect, analyze, and interpret such evidence.

When geological trace evidence is interpreted by an experienced forensic geologist it can help with crime reconstruction and may be admissible in a court of law to assist a prosecution or defence case. The aim may be to help determine if there could be an association between the samples collected. The range of fundamental and advanced laboratory techniques commonly used by a forensic geologist are outlined.

Geological Trace Evidence

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

Geological trace evidence includes: minerals, soils and sediments (surface/soil), microstructural soils, and mineral concentrations, whorls and other markings (finger prints, scratches, lines, marks, smudges and staining), anthropogenic particles (shells, etc.), man-made ground, flood ground and disturbed ground, man-made materials derived from geological raw materials (such as bricks, concrete, glass or plastic, metal, man-made granulates, foams or so on) and other man-made materials.

The analysis of geological trace evidence is typically conducted to determine if there may be a comparison between two or more samples. It is important that the same sample is collected. Geological trace evidence may be transferred onto the body, gear or the clothing of a victim or offender as an associated fingerprint. This is the most common method of forensic geology. It is a forensic geologist's role to identify, collect, analyze, and interpret such evidence. This may be required to determine if there has been a comparison between two or more locations to determine if they originated from the same source or not. Geological trace evidence may be transferred onto the body, gear or the clothing of a victim or offender as an associated fingerprint. This is the most common method of forensic geology. It is a forensic geologist's role to identify, collect, analyze, and interpret such evidence.

Search

The need to conduct complex, open area searches for buried brought together the very different and complementary expertise of a geologist and a law enforcement officer. Such a search is the ground, but from the surface, a search and recovery team may be required to conduct a search. A forensic geologist may be required to assist the law enforcement investigator, crime scene manager or forensic scientist at a crime scene to collect geological samples and provide interpretations of the soil, sediment, rocks, and man-made materials.

The search is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science. The search is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science. The search is a global network of forensic geologists and geologists who are interested in the application of geology to forensic science.

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Poster on forensic geology and IUGS-IFG, submitted for the IUGS stand at the 36th International Geological Congress, Delhi, India, March 2020 (Source: Laurance Donnelly).



International Union of Geological Sciences (IUGS) Initiative on Forensic Geology (IFG)

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Carlos Martin Molina Gallego

For the organisation and participation in

The 4th Iberoamerican Seminar on Forensic Geosciences

in association with Reunion Anual de la Unión Geofísica Mexicana (RAUGM)

28th and 29th November 2019, Puerto Vallarta, Mexico,

Laurance Donnelly

Dr Laurance Donnelly
Chair, IUGS-IFG

Robert Fitzpatrick

Prof Robert Fitzpatrick
Vice Chair, IUGS-IFG

Example of IUGS-IFG Certificate issued to delegates that attended the 4th Iberoamerican Congress on Forensic Geology, Puerto Vallarta, Mexico (Source: Laurance Donnelly).

For further information

<http://www.forensicgeologyinternational.org> or <http://www.forensicgeologyinternational.org>



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