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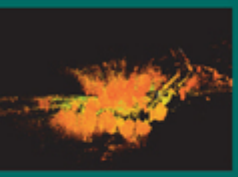

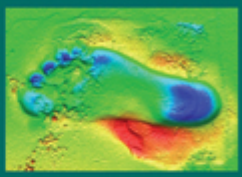

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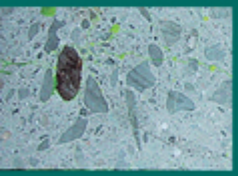
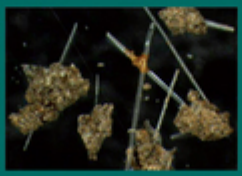
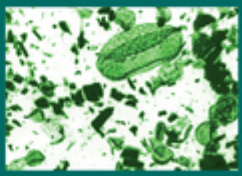

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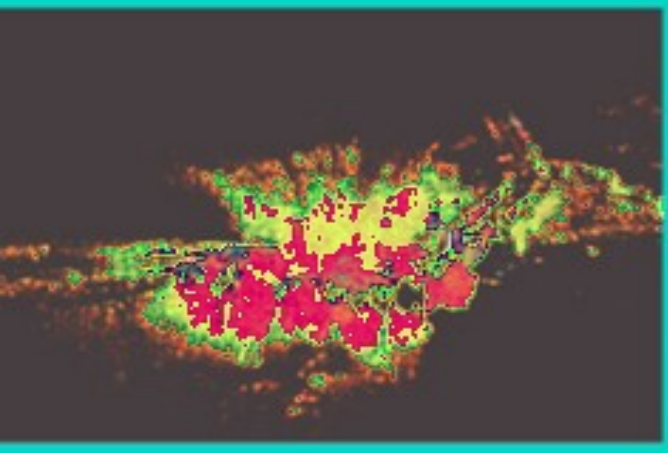

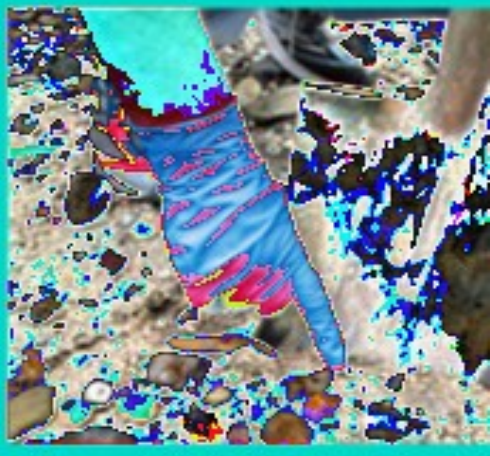

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Criminal and Environmental Soil Forensics

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Cover images (top left to bottom right): Lidar image of a search area; sampling soil from shoe impression at crime scene; optical laser scan of footprint impression in sand; polished section of concrete; trace evidence from urban soil including glass fibres embedded in aggregates; trace evidence from soil including pollen grain. Images all derived from material in this volume.

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Foreword

Having crossed Hadrian's Wall at Carlisle for the short journey from England into Scotland needed to present as guest speaker before the 2007 Soil Forensics Conference in Edinburgh, so capably organised by the Macaulay Institute, it was kind of Professor Karl Ritz from Cranfield University to invite me to follow up observations made there with a foreword to the resulting book; this fabulous compendium of ground-breaking, international science emerging from your important, biennial conference.

As the articles following show, it is a fast-moving science but one taking many different forms and routes, in many different places around the world; places where climate, topography, ecosystems and even cultures vary hugely. However, amongst all that diversity of physical context or intellectual effort, the influence of the soil is the one common scientific denominator, whilst its application to criminal cases of homicide and unlawful killing, a recurrent reminder of man's inhumanity to man, is naturally pre-eminent.

The first, encouraging counterpoint to those grim atrocities against which forensic science is so often deployed is found in magnificent human ingenuity, as it builds remorselessly upon one scientific progression or invention after another to construct reliable mosaic pictures of the past out of whatever fragmentary remains are left us in the present, fit to persuade a court. The second is that universal thirst for justice which drives everyone engaged in the investigative and court process (police officers, forensic scientists, lawyers and ordinary citizens alike) to excavate answers out of those who would bury wickedness.

What my own offering to the conference was about ('March of the Gladiators – Scientists entering the Arena of Lawyers') were gentle words of caution from a former criminal litigator, linked to the dangers from false positives. Those fields of forensics applied in police work are of course far wider than just soil-based (my Police Authority providing a typical example, as recent signatory to a novel 14-force/authority consortium across England & Wales, buying-in a whole range of forensic science 'packages' to support criminal investigation). There are valuable cautionary tales to be had here from the unfortunate experiences of others, presenting forensic evidence before the stern scrutiny of courts, whether from the fallibility of fingerprints or what dangers lie in DNA.

The bottom line was simple – do not expect the courts to receive your findings with uncritical gratitude or the mild controversy of academia. (After all, the life, liberty and reputations of real people hang on your words). But, if your scientific and personal integrity take utter objectivity and self-critical rigour as their companion guardian angels, then you may yet be able to withstand the formalised assault which surely will – and perfectly properly – be launched in the courtroom against your findings and opinions. (Don't forget, a challenge potentially to be maintained – on and off – for several years thereafter).

Your vital role as experts for the administration of justice is invaluable, much appreciated and growing, but do not expect the honour of this arduous responsibility to be afforded you more easily than any other participant, or indeed (citing the tragic, historical example of Sir Bernard Spilsbury) to be provided you as convenient vehicle for winning personal and professional glory.

Neither are our scientific colleagues the sole audience for the deep science found within this book. If the Oxford dictionary defines '*symbiotic*' as the adjective applying to "*a close association of two interdependent animal or plant species, persons or groups*", then those distinguished crime writers also present at the conference were evidence of just such an arrangement; keen as they obviously are to keep up with every last development and weave it into their latest plot no sooner than scientists have announced it.

Not only was it great pleasure to share a table at Conference with such charming and learned scientific folk as Professor Karl Ritz, Professor David Miller or Dr Lorna Dawson, it was also a privilege to be able to debate there in person with celebrated writers like Ian Rankin, whose '*Inspector Rebus*' books are so firmly Scottish but win an international following. Why, having spent most of the conference apologising widely for being a lawyer (one who has – in his time and as an advocate – commissioned, championed, challenged, tested or actually found the forensic evidence relied upon in criminal cases), it gives genuine relief now to claim my attendance there was really made as some sort of writer instead.

Happily, since the publication of *Mosaic (The Pavement that Walked) – the novel by Clive Ashman*[1] – I can. This fictionalised reconstruction of the biggest unsolved crime-cum-art-theft in British archaeology (the overnight theft from post-war Yorkshire, in 1948, of a Roman mosaic floor first found in 1941 then left carefully wrapped in alluvial soil 'till archaeologists could return and prepare it for lifting seven years later) makes it no longer impertinent to claim membership of that happy band. Its plot also offers me points in common to debate with all those field archaeologists which so many forensic soil scientists turn out to be when you scratch them, all those plant biologists who had confined themselves to reconstructing the landscape of ancient Britain from a drilled-out earth core, until that fateful day when they were called out by the police to a scene of crime for the very first time.

To every reader, however you got here and whatever your motivation for taking up and opening "Criminal & Environmental Soil Forensics", let me commend to

[1] Voreda Books, 2008. ISBN 9780955639807. voredabooks@hotmail.co.uk

you a book that captures the very latest research from all over the world. A learning to be applied diligently and built upon carefully, to bring to justice the most intolerable forms of human wrong-doing imaginable. To be applied in the honest belief that – wherever in the world they are – the greater the deterrence that exists for the potential wrong-doer; the greater the grinding certainty for those that really do go on to offend of facing successful detection, prosecution, conviction and detention; then the greater the likelihood for the rest of us of delivering a time of reckoning which can respect the deceased, salve the bereaved and reassure all our communities of their future safety.

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Preface

Soils are present on the outermost layer of the Earth's terrestrial landmass and as such cover a large (but declining) proportion of the planetary surface, playing a pivotal role in the functioning of the contemporary Earth system. Human civilisations are irrevocably bound to them, as they serve as a platform for habitation, and are literally fundamental to food, fibre and fuel production, provide a source of raw materials and act as an archaeological repository. Soils also provide a wider range of ecosystem goods and services, supporting all terrestrial habitats, cycling carbon and nutrient elements, storing and purifying water, acting as a biodiversity reservoir, and regulating atmospheric gases.

Soils are amongst the most complex of known systems. Surface soils comprise a diverse mixture of inorganic and organic materials which are physically structured in a heterogeneous but characteristic manner across some twelve orders of magnitude, from micrometres to megametres. The biomass that they support belowground, which is predominantly microbial, significantly exceeds that aboveground. Subsoils, and the interface with the bedrock (the regolith), are less complex but also have characteristic properties and geographic distribution, as does the fundamental geology.

Soil science has advanced a great deal in the past two decades, and we know increasingly more about the distribution and properties of soils, how they function, and the significance of their fundamental importance. Ironically, the increasing urbanisation of current civilisation, and reduced connections with farming and food production, is resulting in a progressive decline in the appreciation of the importance of soil by the majority of the populace. Yet, humans interact with soils wittingly for sound reasons, and sometimes unwittingly when operating nefariously.

The variety in the constitution, distribution and function of soils provides an intriguing basis, and great potential, for research and application in a forensic context. Their analysis and interpretation can provide intelligence, insight and evidence in the forensic arena at a wide range of scales. This volume, based upon contributions to the Second International Conference on Environmental and Criminal Soil Forensics, held in Edinburgh in 2007, explores the conceptual and practical interplay of soils across scientific disciplines, and investigative and legal spectra. The 32 chapters that follow show that the increasing convergence of a wide range of knowledge and application is leading to a thriving collaboration across disciplines

of criminal and environmental soil forensics, with common perspectives but complementary approaches. The chapters have been grouped broadly into five themes: concepts, evidence, geoforensics, taphonomy and technology. However, the interdisciplinary nature of much of the material means that such apparently discrete structuring should only be used as a guideline. This challenge when aiming to organise the material in a simple manner implies to us as editors that soil forensics is indeed a discipline that is starting to mature.

July 2008 Karl Ritz, Lorna Dawson, and David Miller

All material in the chapters is the responsibility of the respective authors, and any views expressed therein do not necessarily represent those of the editors, their organisations or the publisher.

Acknowledgements

A volume that contains such diverse material as this one requires input, effort and support from many people over and above the 97 authors. We sincerely thank the cadre of independent experts who graciously gave their time and provided insightful and thoroughly professional reviews of the chapters. We gratefully acknowledge the superb professional support from Maryse Walsh and Melanie van Overbeek at Springer. We particularly thank Jane Morrice for her excellent assistance in editing and proof-reading the book contents.

Thanks are also given to the Macaulay Institute and Cranfield University for their institutional support in the running of the Second International Conference on Environmental and Criminal Soil Forensics in 2007, and in the preparation of this book.

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