Contents

Acknowledgements					
Pro	eamb	le	xi		
1		kground to the work, organization of the text and history of arch The scene The victim and materials The suspect The scope of geoforensics	1 4 5 6 8		
2	Physical geography, geomorphology, landform interpretation, archaeology, stratigraphy and hydrodynamics				
	2.1	Physical geography	13		
	2.2	Atmosphere	16		
	2.3	Types of landscapes, landscape change and human influences on the land- scape (short and long term)	18		
	2.4	Soils	33		
	2.5	Hydrodynamics of rivers, lakes, estuaries, seas and oceans	47		
	2.6	Geography, geomorphology, geological and soil maps, and other resources	50		
	2.7	Groundwater	53		
3	Geophysics				
	3.1	Seismic methods: macro to micro	55		
	3.2	Gravity/gravimetrics	64		
	3.3	Electrical	66		
	3.4	Magnetic and electromagnetic	70		
	3.5	Ground-penetrating radar (GPR)	77		
	3.6	Radiometrics	85		
	3.7	Review of why some methods are favoured and others not	88		
4	Remote sensing				
	4.1	Definitions	91		
	4.2	Conventional aerial photography: rural and urban examples	92		
	4.3	Geoscience use of light photography	93		
	4.4	Infrared photography	102		
	4.5	Elevation modelling	104		
	4.6	Photogrammetry	105		

CONTENTS

5

	4.7	Synthetic Aperture Radar (SAR) and interferometry	105
	4.8	Multispectral and thermal imaging	106
	4.9	Hyperspectral imaging	109
	4.10	Satellite mapping	109
		Long-distance LiDAR (satellite, aerial)	114
		Laser scanning of scenes and objects	117
	4 13	X-ray imagery, X-ray tomography and neutron activation	117
	4.14	Field Portable X-ray Fluorescence (FPXRF) spectrometry	122
	4.15	Some conjecture on the future of remote sensing applications	124
5	Spatial location and geographic information science		
,	5.1	Geographic location and crime	125
	5.2	Spatial data and GIS	137
	5.3	Spatial analysis within GIS	140
	5.4	Use of Google Earth in criminal investigations	152
			155
6	Scale	e, sampling and geostatistics	155
	6.1	Scale and spatial resolution	155
	6.2	Sampling for geological materials at urban and non-urban crime scenes	157
	6.3	Timing of the crime	157
	6.4	Sample size	157
	6.5	Lateral variation	159
	6.6	Use and misuse of statistics in forensic studies	160
	6.7	Statistical sampling	161
	6.8	Number of samples required for robust statistical analysis	164
	6.9	Comparing 'like with like'	165
	6.10	Addressing the issue of comparing related material	165
	6.11		166
	6.12	Spatial awareness and use of spatial statistics: application of geostatistics	168
	6.13		172
	6.14	GIS and geostatistics	179
7	Cor	iventional geological analysis	183
	7.1	Elementary analysis of rocks	185
	7.2	Hand-specimen analysis – case studies from Murray and Tedrow (1991)	187
	7.3	Sediment analysis	190
	7.4	Fossils and microfossils	220
	7.5	A paradigm shift in geoforensics?	237
8	Trace evidence		
	8.1	What is geological trace evidence?	241
	8.2	Scanning Electron Microscope (SEM)	249
	8.3	Laser Raman spectroscopy	253
	8.4	Inductively-coupled plasma spectroscopy	253
	8.5	Isotope analysis	254
	8.6	X-ray diffraction and trace evidence	254
	8.7	Manufactured or processed materials that geoscience techniques	
		can analyse	259
	8.8	Some conjecture on the future of trace evidence	266
		,	

CONTENIS	VII

9 The	The search for buried materials			
9.1	Introduction	269		
9.2	 9.2 Possible methodologies for non-urban underground searches 9.3 Underwater searches and scene mapping (remote sensing, geophysics) 			
9.3				
9.4	Gas monitoring, organic remains and the decomposition of bodies	288		
9.5	Weird and wonderful burial locations	290		
10 Circ	0 Circuit complete			
Appendix 1. Search methods				
Appendix 2. Soil sampling				
A.1		305		
Glossary				
References				
Index				