

Index

Note: Page numbers denoted in *italics* indicate figures and those in **bold** indicate tables.

- abiogenic processes 7
- absolute dating methods 266
- active springs 270
- air circulation *see* circulation
- air sampling methods 327–329
- akaganeite 33
- algae
 - calcification 178–186
 - colonization 181
 - desmid 155–157
 - see also* microalgae
- algal tufas 239
- alkaline streams, tufa 65–81
- aphotic zone, microbial processes 18–20
- aragonite 18, 19, 33
 - chemical composition 211
 - crystal orientation 215–218
 - laminae 215
 - morphologies 219
 - nanotextures 211–224
 - striations 221
 - scanning transmission x-ray microscopy (STXM) mapping 220–221
 - textures 218
- Austria
 - Obir cave 295–321
 - study site 298–299
- bacteria
 - active/passive role 39
 - ion concentration 35
 - oxidizing 31
- bacterial mineralization 32–36
 - active/passive 43–44
 - models 31, 35
- barite precipitation 42–43, 42
- barrage tufa 193, 194
- barrages 345
- biofilm 7, 41, 52
 - anchorage 201, 205, 205
 - annual lamination 105–107, 106
 - biodiversity 85
 - calcification pattern 105–107, 106
 - calcite precipitates 197–198
 - colonization 193, 195
 - colonization rates 201, 202
 - development 75
 - erosion 207
 - growth 208
 - humidity 17–18
 - light gradients 17–18
 - nutrient availability 208
 - photic 197–198
 - photosynthesis induced calcification 83
 - species composition 85
 - structure 105–107, 106, 195–197, 196–197, 202–203
 - substrate 205, 205
 - substrate destruction 11
 - temperature gradients 17–18
- biogenic minerals, sequestration of radionuclides 32
- biogenic processes 7
- biogenicity 20–21
- biogeochemical cycles 44
- biological activity 183
 - light intensity 180–181
- biomarker signals, lipid groups 23
- biomineralization 31–50
 - control mechanisms 44
 - myxococcus* induced 37–43
 - organic macromolecules 35–36
 - strain specific 42
- biosorption 38–39
- borings 10–11, 11, 24
- bryophyte tufas 239
- buffering capacity 51, 52, 65, 68, 68, 75
- calcarene 39
- calcification 83–118
- calcite 18, 19, 33, 40–41, 40, 136
 - basal layer 199, 206
 - concentrations 236
 - constructive processes 12–17
 - corrosion 7–30, 289
 - dissolution 11–12, 24
 - mass balance 105, 112
 - nanofibres 225–238
 - nanospherulites 197, 198
 - partition coefficient 305–307
 - seasonal composition 337–339
 - solubility curve 338
 - spatiotemporal variability 283
 - sump grown 206–207
 - see also* rhombic calcite
- calcite crystals 13, 14–15, 19, 201
 - microcrystalline calcite 300, 314–315
 - morphology 15, 303, 315
 - type 12–15
- calcite fabric 339–342
 - seasonal microclimate 323–344
- calcite growth rate 181–182
 - control parameters 283
- calcite nucleation rate, algal growth 182
- calcite precipitation 1, 2, 7–30
 - aphotic extracellular polymeric substances (EPS) 198–200
 - computer simulation 352
 - crystal morphology 17
 - microbial control 7, 17, 23
- calcite saturation 83, 104, 104, 110, 110, 111, 323
- calcite saturation index 15, 92, 143, 151–152, 172–174, 178, 178, 183, 186, 255, 338, 342
 - tufa texture 179
 - water temperature 186
- calcite-water partitioning data **309**
- calcium bicarbonate, Ion Activity Product 76
- calcium carbonate
 - polymorphs 33
 - saturation state 52
 - supersaturation 245
- calcium carbonate growth, crystal effects 323
- calcium carbonate precipitation 51–63
 - abiotic 42
 - by polysaccharides 59–60
 - experiments 54–55, 59, 60
- calcium hardness 196–197
- calcium ion concentration 194–195, 289–291
- carbon 14 dating 245, 258, 324
- carbon dioxide *see* CO₂
- carbonate
 - annual growth laminae 23
 - depositional climate 272–273
 - Henderson Hasselbach behaviour 69
 - mineralogy 51
 - morphology 51
 - nucleation 52, 144
 - production 39–42
 - stable isotope composition 107, 108
 - textures 160–167
- carbonate precipitation 3, 5
 - biologically induced 3, 15
 - chemical processes 3
 - fungus contribution 225–238
 - photosynthesis 60
 - rate 1
- Carpathian Range 143–191
 - study sites 145–149, 145, **146**, 148
 - topography 147
 - water chemistry 151–152, 153
- cascades 345, 346
- cave air 336
 - advection 285
 - calcite growth 287–291
 - carbon isotopic concentrations 336, 338, 339
 - circulation 284–285, 317
 - CO₂ partial pressure 283, 285–287, 288, 289, 293, 323, 334–335, 335–337, 337–339, 338, 342
 - humidity results 329, 330

- cave air (*Continued*)
 sources and sinks 284–285, 286
 stalagmite growth rate 283–294
 temperature 293
 ventilation 293
- cave microbes
 chemotaxonomic characters 9–11
 colonization 11
 diversity 9–11
 migration 11
 substrate 10–11, 12
 twilight zone 17–18
- cave microclimate 339–342
- cave pearls *see* cave pistololiths
- cave pistololiths 19, 22–23
- cave temperature 324, 329, 330
- cave ventilation 285, 287, 338, 342
 regimes 335–337
 seasonal 295, 337–339
- cave water
 hydrochemistry 331–335
 percolation 283
- caves
 aerosols 316–317
 aphotic zone 7
 environmental monitoring
 methods 327
 fungal activity 226
 geomicrobiology 226–227
 manganese deposits 33–34
 microbes 7–30
 microbial diversity 24
 modern speleothems 323–344
 seasonal physiology 295–321
 trace element enrichment
 316–317
 twilight zone 7, 10–11, 12,
 14–15, 17–18
- Cayman Islands, speleothems 7, 8
- chalcocite 34
- chlorides 35
- circulation 296, 317
 CO₂ partial pressure 317–318
 winter 317–318
- climate changes 24
 cyclic 263
 deposition/erosion 273–275, 276
- climate proxies 317–318
- climate reconstruction, speleothem
 fabrics 342
- CO₂ degassing 1, 83, 85, 88–92, 119,
 198, 206, 255, 283, 285, 323,
 337, 350–351, 353
- carbon isotopes 292
- surface tension 351
- temperature gradients 351
- CO₂ degassing rate 338–339, 338, 342
- CO₂ degassing-calcite precipitation
 model 324, 338, 341, 342
- CO₂ partial pressure 283, 295, 296,
 318, 324
- circulation 317–318
- seasonal variation 308
- spatial distribution 289, 290
- spatial measurement 284
- temporal measurement 284
- vertical distribution 285
- colloid filtration 209
- colloidal transport 307, 315, 318
- columnar calcite 314, 339, 340–341,
 342
- compact calcite 339, 340–341
- computational fluid dynamics
 349–350
- conductivity 122, 150, 196–197, 258
- Ion Activity Product 76
- Kohlrausch's Law 76
- photosynthesis 78–79
- precipitation 76–77
- variation 66, 70, 70
- continental carbonates, tectonics 273
- copper substrate 171
- crystal fabrics, chemical control
 314–315
- crystal orientation 205, 207, 219,
 220–221, 221, 300–303,
 302, 314
- crystal splitting 300
- crystals
 columnar 314
 rhombohedral 315
 stepped faces 315
- cyanobacteria 31, 93–99, 184
 diversity 83, 94–95, 97, 111
 extracellular polymeric substance
 (EPS) producers 52
- filaments 155, 162, 163, 167, 171
- light intensity 181
- morphotypes 93, 93, 94, 95–97,
 96–97, 111
- phylogenetic analysis 96–97
- picocyanobacteria 52
- polysaccharides 51–63
- rDNA lineages 95–97
- sequence analysis 113
- desmid algae 155–157
- detritic components 167–168, 184
- diatom frustules 172
- diatom moulds, light intensity 181
- diatoms 93–99, 157–159, 164, 166,
 184, 202
- diversity 83
- phylogentic analysis 98
- sequence analysis 113
- species 98
- tufa biofilms 98, 99
- distribution coefficient 307, 316,
 331, 333
- drip water 295
 calcite partitioning 318
- calcium 338
- characteristics 298–300
- chemical composition 305–308
- chemistry 299, 323, 337
- colloidal content 316
- composition 316, 334–335,
 337–339, 342
- discharge rates analysis 327
- mean discharge 316
- oxygen isotope ratio 291–292, 291
- recharge pathways 329–331, 332
- seasonal composition 316,
 337–339, 342
- stable isotope composition
 307–308
- stalagmites distribution
 coefficient 307–308
- trace element composition 309
- drip water rate 300, 301, 323
- ion supply 305
- variations 329–331, 332, 334–335
- event laminae 304, 309–312, 318
- aerosols 317
- circulation regime 317
- elemental variation 309–312
- strontium pattern 309, 312
- trace element patterns 315–317
- exopolymers 83–118
- extracellular polymeric substances
 (EPS) 35–36, 44, 51, 85,
 101–104, 193, 218
- binding sites 51–52, 56, 57, 58,
 58
- biofilms 83, 219
- calcite precipitation 85, 207
- calcium binding capacity 52
- crystal growth 203–206
- degradation 85, 103, 110, 110,
 112, 206
- extraction protocol 55
- Fourier transform infrared (FTIR)
 spectra 57
- functional groups 55–56
- heterotroph dominated 208
- infrared spectroscopy 54, 55–56
- ion transport 206
- microbes 197
- nucleation sites 85, 206
- polygonal structures 200,
 202–203, 206, 207
- polysaccharide isolation 52–53
- potentiometric titration 53–54,
 56, 57
- secretions 157, 159, 164, 166
- structural domains 83, 101–103,
 102, 111
- total buffering capacity 56–59
- extremophiles 32, 34, 44
- ferrihydrite 33
- filamentous microbes 13, 14–15, 225
- algae 184
- characteristics 227
- phototrophs 199
- trapping & binding 15
- filaments 153–155
- flume systems
 experimental methods 194–195
- pH 67–70, 68
- seasonal data 71–74
- fluvial facies 124, 125, 126, 132
- fluvial tufa deposits 245, 263, 276
- focused ion beam milling 212

- framboidal pyrite 34
 freshwater stromatolites 111, 203
 lamination 207–208
 fungal hyphae 227–228, 231
 breakdown of 225, 236
 crystal nucleation enhancer 236
 scanning electron microscopy
 (SEM) photomicrographs
 233
 size 227
 fungal hyphae cell wall 228, 233
 calcite precipitation template 236
 mineralization 235
 structure and composition
 228–229
 fungi 225, 232
 carbonate precipitation induction
 236
 caves 226
 growth 236
 soil 226
- geomorphological survey methods
 266
- Gibraltar
 St Michaels cave 323–344
 study setting 324–327, 325,
 326, 328
- gours 345
 groundwater 23
 growth inhibitors 314
 gypsum 19
- halite 35
 halogen elements 310
 heterogeneous nucleation 205, 314
 heterotrophic activity 75, 85, 112
 prokaryotes 110
 heterotrophic digestion 206
 heterotrophic exopolymer
 degradation 110
 heterotrophic organisms 1, 193,
 201, 225
- hunite 19
 hydrochemistry 83–118, 111, 252
 experimental methods 112–113
 karst steam water 87–92,
 89–90, 91
 River Piedra 124
 hydrological cycle 183
 stable isotope pattern 324
 trace elements 324
 hydrothermal springs 34, 267, 269
 tectonics 273
- Indonesia, Satonda crater lake
 211–224
- inductively coupled plasma mass
 spectroscopy 297
 infiltration laminae 304, 304, 315
 infrared spectroscopy, extracellular
 polymeric substances (EPS)
 54, 55–56
 inorganic carbon, dissolved
 concentrations 109–111
- inorganic precipitation 83
 copper ions 171, 172–174
 ion microprobe analysis 297–298, 308
 data 310, 312
 iron formations 31
 iron sulphides 34
 irradiance 183
 isotope analysis 85, 143
 see also stable isotope analysis
 isotopic geochemistry 23
 tufa carbonate 65
- Italy, Tuscany 263–281
- karst 1, 2
 calcite precipitation model 351
 dissolution 275
 karst water 83–118
 cycles 88
 experimental methods 66–67
 Germany 84, 86–87, 87
 hydrochemistry 87–92,
 89–90, 91
- kerolite 18
- lacustrine stromatolites 211
 lacustrine tufa deposits 245
 lake water levels, terracing 272–273,
 274
- laminae 168–170, 184, 318
 annual lead concentration 313
 chemical trends 310
 drivers for development 203
 intercrystalline porosity 174
 orientation 205
 paired 339–342, 340–341
 palaeoclimate 107–109
 seasonal 24
 see also event laminae; infiltra-
 tion laminae
 laminated speleothem fabrics 323
 laminated tufa 119
 laminated tufa biofilm 203
 larval housings 160, 169, 184
 lead 295, 313, 314, 318
 light conditions 65, 67
 irradiance 108
 pH 77
 photoperiod length 70–75, 71–74
 seasonal changes 83
 light gradients, biofilm 17–18
 light intensity 78–79
 biological activity 180–181
 limestone substrate 171
- magnesium 315
 calcium compositions 331, 333
 calcium substitution 305
 composition 308
 magnesium calcite 41–42, 41
 magnetite 33–34
 magnetotactic bacteria 33–34
 manganese deposits, caves 33–34
 marine ecosystem 111
 marine stromatolites 111
 biofilms 202–203
- massive tufa 119, 134–135, 140
 metabolic activity 39
 micrite 15, 16, 19, 22–23, 136, 170, 184
 clotted 160–162, 174
 fibrous 165–166
 hemispherically layered 162, 170
 and water energy 179
 micro erosion meter 123
 microalgae 159
 microbes
 calcification 12–15
 caves 7–30
 deep sea floor 44
 deep sub sea 32
 extracellular polymeric
 substances (EPS) 197
 extremophiles 32, 34, 44
 fossilization 33
 preservation 21
 microbial activity 68
 microbial assemblage, changes 79
 microbial biofilms 1
 microbial colonization 186
 microbial composition
 flow rate 201–202
 temperature 201–202
 microbial diversity, tufa biofilms 100
 microbial laminated carbonate 276
 microbial precipitation 193
 active or passive role 23
 microbial processes, aphotic zone
 18–20
 microbialite fabrics 109–111
 microcrystalline calcite 300, 314–315
 microorganisms 83–118
 micropeloids 197, 202, 204
 microspar crystals 197, 201, 203,
 206, 207
 mineral precipitation 1, 15–17
 abiotic processes 32
 biotic processes 32
 genetic control 32
 metabolic activity 32, 36
 Myxococcus induced 31–50
 nucleation sites 101
 types 33
 water saturation index 77
 mineral saturation indices 248
 mineralized microbes
 fabrics 21
 identification 21, 24
 preservation 21–23
 trapping and binding 24
 monetite 242
 monohydrocalcite 19
 moonmilk 19–20, 227, 230
 moss stems 159–160, 172
 myxobacteria 36–37
 Myxococcus Xanthus 43
 myxospores 37
- nanobacteria 44
 nanofibres
 energy dispersive spectrometry
 (EDS) spectra 234

- nanofibres (*Continued*)
 literature on **226**
 mineral 225
 organic origin 225, 233–236
 origin 232, 236
 scanning electron microscopy
 (SEM) photomicrographs
 231, 232, 234
 structures 229
 transmission electron microscopy
 (TEM) photomicrograph
 232
 vadose environments 232
 nanoSIMS 213
 nanospherulite 203, 204
 newberyite 38
 nitrates 34
 non phototrophic prokaryotes 85,
 99–101, 110, 111, 113
 affiliation of isolates **100**
 nucleation 35, 219
 feedback mechanisms 182
 heterogeneous 205, 314
 process 174
 rate 172
 role of organics 44
 substrate 144
 surfaces 176
see also renucleation horizons
- oncoids 2
Oocardium stratum 155–157, 170, 176
 oolites *see* cave pistoliths
 organic colloids 295, 307
 organic compounds 314
 organic nanofibres 225, 233–236
 oxygen
 tufa biofilms 104, 104
see also stable isotopes
- palaeoclimate indicators 107–109
 tufa stromatolites 112
 palaeoclimate proxies, stable isotope
 concentration 291–293
 palaeoclimate reconstruction, lake
 levels 263
 palaeoclimate records, stalagmite
 growth rate 283–294
 palaeoclimate studies 23–24
 palaeoenvironmental indicators
 1–3, 5
 proxy 5
 tufas 65
 paludal depositional systems 245
 paludal tufa systems 193, 276
 palustrine tufa 263
 pathological precipitates 44–45
 perched springline tufa deposits
 245–262
 depositional features 251–252,
259
 isotope composition **254**
 lobe top terrace 251
 lower slope 252
- regional setting 260
 scanning electron microscopy
 (SEM) images 256
 stable isotope data 260, 260
 study site 249, 250
 trace elements **254**
 water chemistry **253**
 waterfall zone 251–252
 petrographic analysis methods
 266, 296–297
 pH 65, 122, 150, 205–206, 255, 296,
 318
 diurnal cycle 67–70, 69
 flume systems 67–70, 68
 light conditions 77
 photosynthesis 75, 78–79
 respiration 75
 seasonal variation 308
 temperature 77
 tufa biofilms 104, 104
 variability 66, 75, 308
- phosphates 34–35
 production 37–39, 39
 phosphorus 313
 acid fraction 241, 243
 alkali fraction 239, 241, 243
 carbonate fraction 242
 co-precipitation 242
 concentration 311
 dithionite fraction 239, 240, 243
 ethylene diamine tetraacetic acid
 (EDTA) fraction 240, 243
 form of 242
 fractionation 239–244, 241, **241**
 fractionation methods 239–240
 sodium carbonate fraction 242
 uptake ratios 239
 water soluble 240, 242
- photosynthesis 85, 105
 carbonate precipitation 60
 CO₂ assimilation 110
 pH 75
 respiration 75, 78–79
 water chemistry 75–76
- phototrophic metabolism 75, 206
 phototrophic microbes 193
 picocyanobacteria 52
 polysaccharides, active sites 51,
 52–53
- pool fingers 18–19, 20
 potentiometric titration, extracellular
 polymeric substances (EPS)
 53–54, 56, 57
- precipitation
 activation energy knick point 2
 conductivity 76–77
 mechanisms 205–206
 microbial influence 77–79
 photosynthesis induced 109, 112
 products 207
see also calcite precipitation;
 mineral precipitation
- prokaryotes 85, 99–101, **100**, 110,
 111, 113
- quartz formation 44
- radiometric data 263
 rainfall 108, 296, 334–335
 data **121**
 tufa deposition 263
 renucleation horizons 304–305, 304
 respiration 205–206
 pH 75
 photosynthesis 75, 78–79
 rhombic calcite 206
 rimstone 345
 river valley, geomorphological
 evolution 263–264
- scanning electron microscopy 248,
 303, 303
 methods 212, 297
 results 229–232
 scanning transmission x-ray
 microscopy 213
- schertelite 38
 seawater, composition 109, 111
 sediment
 isotopic composition 140
 monitoring methods 122–124, 266
 stable isotope analysis 122–124
 thickness **126**
- sedimentation rates 122, **127–128**
 measurements 126–129
 periodic patterns 126
 seasonal pattern 119
 seasonal variations 124–126
- sedimentological data 119–142
 silicates 34
 soil
 air 336
 carbon cycle 225
 CO₂ partial pressure 283, 289
 fungal activity 226
 mineralized nanofibres 225
 samples 229
 temperatures 283, 287, 289–291,
 291, 324
- Spain
 climate 121–122
 geology 121–122
 hydrology 121–122
 tufa study area 120
- sparite 162–163, 174, 176
 sparite bushes 163–165, 176
 sparry calcite 165–167, 172, 178, 183
 speleothems 1–5, 2, 243, 283
 calcite partitioning 318
 Cayman Islands 7, 8
 climate reconstruction 342
 cyclical calcite deposition 324
 environmental change record 295
 fabrics 1, 7, 323, 342
 formation processes 7, 20
 geochemistry 24, 323
 growth rate 7, 318
 microbes 20–23
 microclimate proxy record 323

- water supply 1
- zinc 318
- sphalerite 34
- spring water, chemical composition 258
- stable isotopes
 - analysis 245, 297
 - annual variations 296
 - composition 107–109, 108, **136**, 137, 138–139, 295, 307–308
 - concentrations 83, 248, 251
 - data 119–142
 - flow conditions 138–139
 - hydrological cycle 324
 - ratios 143, 323
 - seasonal microclimate 323–344
 - seasonal pattern 138–139
 - tufa growth rates 143
 - variations 339–342, 340–341
 - ventilation 324
- stalactites 1, 15, 16, 18
 - abiogenically precipitated 24
- stalagmite growth rate 287–289, 291, 309
 - cave atmosphere 283–294
 - palaeoclimate records 283–294
- stalagmites 18
 - annual lamination 295–321, 303–305
 - composition 305–308, 306, 307, **307**, 308–313, **308**, 312, 316
 - depth trends 306
 - drip water 289–291, 291, 307
 - fabrics 300–303
 - geochemistry 295–321
 - growth inhibitors 292–293
 - height data 292
 - ion microprobe 302
 - lamina thickness 306
 - lead concentration 313
 - magnesium concentrations 309–310
 - petrology 295–321, 300–305, 302, 303, 304
 - phosphorus variation 311
 - seasonality 291, 308–313, 317–318
 - stable isotopes 306, 307–308, 308–309
 - sulphur variation 311
 - water film thickness 289
- stromatolites 31, 41
 - biogenicity 211
 - compositional analysis 214
 - coral texture 219
 - cyanobacteria 96–97
 - data 213–218
 - formation 111, 211
 - freshwater and marine 111, 193
 - Indonesia 211–224
 - laminated 15, 16, 83, 96–97
 - mineralogical textures 211
 - neomorphism 112
 - samples 212
 - scanning electron microscopy (SEM) images 215, 217
 - transmission electron microscopy (TEM) images 216, 218
 - see also* freshwater stromatolites; lacustrine stromatolites; marine stromatolites; tufa stromatolites
- stromatolitic tufa 119, 132–134, 140
- strontium 309, 312, 323
 - abundance 339, 336, 341
 - composition **308**
- struvite 37, 38
- substrate 171, 206
- sulphate 34, 295
 - annual variations 296, 309
 - calcite partitioning 305
 - pH variation 309
 - production 42–43
- sulphate reducing bacteria 52, 111
- sulphur concentration 311
- surface tension 347, 347, 353–354
- CO₂ degassing 351
- surveying and dye tracing methods 327
- taylorite 43
- temperature 65, 67, 70–75, 140, 183, 296, 300, 301
 - calcite precipitation 207
 - calculations 139–140
 - data **121**
 - pH 77
 - seasonal changes 83
 - stable isotope data 119
 - tufa microfabric 193–210
 - ventilation 323
 - water chemistry 183, 185
- temperature changes 70–75, 71–74, 126
- temperature gradients
 - biofilm 17–18
 - CO₂ degassing 351
- terraced carbonate deposits 267–271, 346–352
- terraces 345
- terrestrial carbonates 263–264
- thermal springs *see* hydrothermal springs
- topography, travertine terraces 348, 349, 351–352
- total buffering capacity, extracellular polymeric substances (EPS) 56–59
- trace elements 314
 - concentrations 24, 296
 - cycles 323, 339–342, 340–341
 - seasonal microclimate 323–344
- transmission electron microscopy 213
- travertine 143
- travertine terraces 345–355, 346
 - bacterial origin 347
 - characteristic spacing 353, 353
 - dry 348
 - dynamics 348
 - flow velocity 351–352, 352, 353
 - formation 348–350, 352–353
 - growth rate 348, 353
 - hydrodynamics 345–348
 - morphology 345–348, 351–352
 - precipitation localization 350–351
 - rim growth rate 353
 - rim orientation 348
 - rim self repair 348
 - rims 347, 347, 350–351
 - topography 348, 351–352
 - water chemistry 351–352
- travertines 2, 181, 245, 273
 - cross section 350
 - deposition and tectonics 273
 - growth 172
- tritium 255
- tufa 1–5, 2, 119, 143
 - active deposition 145
 - alkaline streams 65–81
 - annual laminations 144
 - biogenic components 153–170
 - biological composition 255
 - biomediated precipitates 78
 - cascade model 245
 - cave deposits 140
 - characteristics 122
 - chemical conditions 65–81
 - chemistry 255
 - climatic indicators 263–281
 - cold climate 275, 276
 - composition **240**
 - cool humid models 193, 194
 - cross sections 129–132, 129, 130, 131, 132
 - crystalline texture 143
 - crystals 173
 - cyclic deposition 272
 - dense laminated 132–134
 - depositional properties 245–262
 - fabrics 1, 52
 - facies 132–136
 - Fe:P ratios 243
 - fibrous texture 181
 - fluvial 119–142
 - formation processes 65, 85
 - geochemistry 245–262
 - geomorphological evolution 272
 - Germany 85
 - high energy settings 177
 - internal structure 151–170, 267
 - isotopic geochemistry 65, 79
 - laminae 65, 79, 132–134, 144
 - lobe age relations 252, 258
 - mass exchange 78
 - micritic texture 143
 - microbial components SEM images 257
 - microbial influence 65–81, 144
 - microfabric 193–210
 - mineralogy 122, 136, 255
 - organically bound phosphorus 243

- tufa (*Continued*)
 origin 144
 palaeoclimatic indicators 65, 245
 palaeoenvironmental archive 144–145
 palaeohydrological indicators 245
 phosphorus content **240**
 phosphorus fractionation 241, **241**
 porous spongy 134–135, 135, 140
 precipitation processes 65, 85
 profile 208
 radiocarbon 255–258
 seasonal record 119–142
 sediment photomicrographs 133, 134, 135
 semi arid models 193, 194, 275
 Spain 119–142
 stable isotope composition **136**, 137, 138, 255–258
 steep banded deposits 135–136, 140
 structure 270
 temperature 139, 193–210
 thickness 144, **158–160**
 water hydrochemistry 258
 water supply 1, 193–210
 Yorkshire 239–244
see also barrage tufa; lacustrine tufa deposits; massive tufa; paludal tufa systems; palustrine tufa; perched springline tufa deposits
- tufa biofilms 83–118, 85
 affiliation of isolates 100
 calcification 83, 112
 cyanobacteria 96–97
 diatoms 98, 99
 microbial diversity 100
 microgradients 104–105, 104
 oxygen 104, 104
 pH 104, 104
 seasonal irradiance 109
- tufa growth rate 143–191, 152–153, 154, 155, 156
 annual 185
 climate conditions 184–186, 275–276
 copper ions 171, 172–174
 data **158–160**
 environmental conditions 119
 facies 143
 isotope ratios 143
 measurement methods 150–151
 microenvironment 174–178
 microorganisms 170–174
 photosynthesis 119
 rainfall 263
 seasonal 176, 182–184, 186
 substrates 171
 temperature 184–186, 185
 texture 181
 variation 182–183
 water chemistry 185, 186
 water energy 179–180
- water flow 143
 water origin 184–186
- tufa samples
 laboratory methods 247–248, 248–251
 thin sections 162
 Yorkshire 239
- tufa stromatolites 105–107, 106
 annual laminae 112
 biofilms **86, 98**
 formation 83
 geobiology 84–85
 neomorphism 109
 palaeoclimatic indicators 112
 stable isotopes 112
- tufa texture 143–191, 178, 208
 algae density 181
 algae diversity 181
 calcite saturation index 179
 data **158–160**
 environmental factors 179–184
 growth rate 181
 microenvironment 174–178
 seasonality 174–178, 182–184
 study methods 151
 water flow 186
- Turkey
 active waterfall 248, 251
 field photos 249
 geological setting 245–246, 246, 247
 Guney waterfall 245–262
 perched springline tufa deposits 245–262
- uranium phosphate 38–39
 uranium series dating 267, 283
- vadose water 295
 Valdelsa succession 263, 276
 carbon 14 data **272**
 chronological dating 271
 episodes of tufa development 272
 facies associations 267–271, 267, 268, 269, 270
 geological setting 264–266, 265
 palaeoclimate 272, 275
 stratigraphic units 266
 tectonic regime 272
 U/Th data **271**
- vaterite 17, 19, 33, 40–41, 40, 207
 Vaucheria 184
 filaments 153–154, 161, 172
 light intensity 180–181
- ventilation 318, 323
 cycles 342
 seasonal variation 308
 stable isotope pattern 324
 temperature 323
see also cave air
- water
 calcite partitioning data **309**
 calcite saturation index 180
- depth 122
 monitoring methods 122–124
 physicochemistry 252–255
 saturation index and mineral precipitation 77
 temperature 108, 122, 180, 252, 258, 300, 301
see also drip water; groundwater; hydrothermal springs; rainfall; seawater; spring water
- water chemistry 65, 248
 Carpathians 151–152, 153
 data 155, **158**
 measurement methods 150–151
 oxygen isotopes 136
 perched springline tufa deposits **253**
 photosynthesis 75–76
 temperature 184
 travertine terraces 351–352
 tufa growth rate 178–186, 178, 185
 variations 5
- water energy
 micrite 180
 porous tufa 179
 sparry crystals 179
 tufa growth 179–180
- water flow 183, 314
 caves 131–132
 fast 129–130
 precipitation rates 1, 200–201, 207
 rate 194–195, 196–197, 201, 351
 rate thresholds 202
 sedimentary record 129–130, 131–132
 solute concentration gradients 351, 353
 spray areas 131–132
 stable isotope composition 138–139
 standing to slow 131
 stepped waterfalls 131
 travertine terraces 351–352, 352, 353
 tufa growth rate 174, 349–350
 tufa microfabric 193–210
 tufa texture 186
 velocity 1, 122, 174, 193–210, 345–347, 349–350, 349, 351–352, 352, 353
- weddellite 43, 43
- x-ray diffraction 248
 data 305
 methods 297
 results 230
- x-ray fluorescence data 313, 314
- Yorkshire, tufas 239–244
- zinc 295, 305, 313, 314, 315