

Index

Note: Page numbers in **bold** type refer to tables, those in *italic* type refer to illustrations.

- 1.05–1.01 Ga, Sveconorwegian metamorphism 319–335
42–30 Ma, Rhodope Mountains 171–175
83 Ma, Cretaceous palaeogeography 85
120–123 Ma, granitic plutons 307
150–134 Ma, Verkhoyansk–Chersky orogen 305
270 Ma, copper mineralization, Morocco 269
310 Ma, W–Sn–rare metals 221
325 Ma, W–Sn–rare metals 220
- ABCD *see* Alpine–Balkan–Carpathian–Dinaride orogen
Abitibi, Canada 25–27, 26
accretionary wedge 304
adakitic magmas 59
Adycha–Nera metallogenic zone 3–6, 311–313
Aegean system 75, 76–77
age *see* geochronology; timing
age spectra, Madjarovo ore district 143
Aguablanca Stock, Iberia 185
Allakh–Yun metallogenic zone 306, 307–309
Alpidic fluid system 233, 239–243, 240–243
Alpine–Balkan–Carpathian–Dinaride orogen (ABCD) 81–102, 83
 see also Eastern Alps
 magmatism 82, 87–88, 89, 95–97
 mineralization 81–82, **84**, 87–90, 92–94, 92
 structural evolution 86–90
Altaid orogenic collage 274, 282–283, 284, 286, 289–291, 293
Amerdoul copper mine, Morocco 264, 265
amphiboles, geochemistry **340**
amphibolites, Rhodope Mountains 160–162, 162
anatexis 7
anthophyllite 342, 343, 348–350
⁴⁰Ar/³⁹Ar dating 141–144, **142**, 218, 221
arc–backarc systems 276–277, 276, 279, 280–281, 285–288
arsenopyrite–pyrite mineralization 103–118
Asia *see* North Asia; SE Asia–SW Pacific
asthenosphere upwelling 7, 57, 75
Atlas Mountains, Morocco 247–271
Australia 21, 348–349
Austria, arsenopyrite–pyrite 103–118, 113
- back–arc location 70, 72
see also arc–backarc systems
Baikalide orogenic collage 279, 282–289
Balkans *see* Alpine–Balkan–Carpathian–Dinaride orogen
banatite belt, ABCD 82, 85, 87–88, **89**
Banda Arc 4, 50, 51
barite deposits 232–233, 235–237, 236, 242
base–precious metal ore district 137–150
Bathurst, Canada 21–22, 22
Bergslagen, central Sweden 24
bornite 324
breccia pipe deposit 215–216
Bulgaria 119–136, 137–150, 139
- calcic skarns 185–187, 186
- Carpathian Arc 6–7, 70, 72–74, 93–94
 see also Alpine–Balkan–Carpathian–Dinaride orogen
cataclasites 158–159, 159
Cenozoic magmatic arcs 2–7, 39–47, 40
chalcopyrite 260
collapse, orogenic 73–74, 87, 88
collision zones 3–4, 5, 81–102, 214, 276–277, 299–302
compressional structures, ABCD 86–87
contraction events 254
convergence zones 50–53, 50, 69
 see also subduction zones
copper mineralization
 Cu–Mo mineralization 323–331, 325, 329
 Morocco 258–264, 265, 267–269
 orogenic collages 281
 porphyry deposits 3, 6, 41, 119–136
 Saesvatn, South Norway 323–331, 329
 structural control 247–271
 Zn–Cu–Pb deposits 337–353
cordierite 338, 342–344
coseismic strain model 9–10
Cretaceous
 ABCD belt **84**, 85–90
 ore provinces 81–102
 porphyry copper deposits 120–121
 Verkhoyansk–Chersky orogen 299–317
crustal extension 13, 15
 see also extensional structures
Cu–Mo mineralization 323–331, 329
- décollement type tectonics 255–258, 268
decompression, strain 161–163, 164–166
deformation, Eastern Alps 112–114
detachment systems 153, 155–167, 171–175
Devonian, Uralides 4, 5
Dinarides 229–245
 see also Alpine–Balkan–Carpathian–Dinaride orogen
 discrimination criteria 233–243
 geological formations 231–233
ductile tectonics 112, 252
dykes, U–Pb zircon geochronology 119–135
- earthquakes *see* seismic pumping mechanism
Eastern Alps 92, 103–118, 104
Elatite porphyry copper deposit 119–136
 dating 132–133
 geological setting 120–123
 mineralization 124–125
Eocene 138, 167–168
epithermal mineralization 3, 6, 51
 gold 40–41
 Madjarovo district 146
 mercury 188–189
epizonal mineralization 183–187
Europe 69–79, 81–102
 see also Rhodope Mountains; Sardinia

- exhalites 31
- exhumation, metamorphic rocks 151–178
- extensional structures 179
 detachments 153, 155–156, 171–175
 faults 249–251, 255
- faults 8–10, 103, 249–251, 255, 324
- Finland 342–347
- fluid flows 1, 8–10, 11, 337
see also hydrothermal mineralization
 Alpidic system 239–243, 240–243
 Limousin, France 224
 Permo–Mesozoic 199–212
 Sardinian ore deposits 201–202, 206–207
 Variscan system 237–240, 239–243
- fluorine 337–353
- fluorite 241, 342
- fold-and-thrust belt 302–303
- folds 252–254, 307
- France, W–Sn–rare metals deposit 213–228
- geochemistry
 amphiboles 340
 discrimination criteria 235–243
 Elatsite dykes 121–123, 124
 fluorine 338, 343–347, 348–350
 porphyry copper deposit 119–136
 Sardinian ore deposits 202–205
 sheet silicates 341
 tectonic processes 53–60
- geochronology
 batanite belt 89
 Ifri copper deposit 261–263
 Madjarovo ore district 141–144, 142
 Rhodope Mountains 154–155, 169–170
 Saesvatn supracrustal sequence 323, 324
- geodynamics 1–12, 72–74, 180–182, 299–317
- geotectonics 233–235
- gneisses 160, 161, 161, 332
- gold mineralization 3, 5–6, 70, 183
 Baikalide–Altaid orogenic collage 286
 early collisional fields 306, 307–311
 Eastern Alps 103–118
 late collisional fields 311–315
 North Pacific orogen 278, 281–282
 tectonic controls 39–47
 timing 42, 43, 44
 Yana–Indigirka belt 300, 301, 305–307
 Yana–Kolyma metallogenic belt 277
 Yursky–Brindakit goldfield 307–309, 308
- gold–quartz deposits 307, 309, 312–315
- granitic magmatism 214–218, 214, 221–223
- granitoids, Rhodope Mountains 168
- Greece 69–79, 83, 151–178
- Green Tuff Belt, Japan 16–18, 17
- greenschist facies metamorphism 112
- Guginock mining area 110–111
- Hercynian, copper deposit 247–271
- Hf isotope geochemistry 126–129
- High Seksaoua district, Morocco 247–271, 252
 copper mineralization 258–264, 265, 267–269
 structural evolution 249–258, 264, 266, 267, 268
- high–pressure metamorphic rocks 151–178
- hydrothermal mineralization 81–82
see also epithermal...; magmatic–hydrothermal...;
 mesothermal...
 copper 258–264
 eastern Alps 103–118
 fluorine 337–338
 Madjarovo ore district 145–146
 post–Variscan 201–202, 204, 205–207
 SE Asia 49–67, 50
 tectonic controls 53
- Iberian Massif *see* SW Iberian Variscan Belt
- Iberian Pyrite Belt 24–25, 25, 181, 189–192
- Ifri mine, Morocco 250, 252, 256–257, 258–263
- Indonesia, radiometric ages 62
- isotope analysis
 Dinaride deposits 235–237
 Elatsite porphyry copper deposit 126–132
 Sardinian ores 202–204
 W–Sn–rare metals deposit 218–225
- Jurassic, Verkhoyansk–Chersky orogen 299–317
- knee–folds 252, 254
- Kreuzeck–Goldeck Complex, Austria 103–118
 mineralization 106–112
 structural evolution 112–114, 113
- Kular metallogenic zone 310–311
- Lachlan Fold Belt, SE Australia 21
- lamprophyres 104–105
- Langvatn and Kobbernuten Cu–Mo ores 323–328, 325–326, 329
- laser analyses, micas 262
- late–stage orogenic ore provinces 82–85
- Lau Basin, Pacific Ocean 27
- Limousin, France, W–Sn–rare metals 213–228
- lineation 252
- lithosphere, thickness 61–63
- lithosphere slab
see also roll back
 detachment (tear) 6–7, 8, 73–74, 95, 96
 heat sources 74–76
 melting 57–60
- low–grade metamorphism 319–320, 331
- Madjarovo ore district 137–150, 139
- Madjarovo volcanic complex 138, 145–147, 147
- mafic metamorphic rocks 323, 326, 330–331
- magmatic arcs
 Cenozoic 2–7, 39–47, 40
 Mesozoic 279–281
 Palaeozoic 275–280, 282–289
- magmatic–hydrothermal mineralization
 epizonal Ni–Cu 183–185
 gold, SE Asia 39–47
 SE Europe 69–79
- magmatism
 banatite belt (ABCD) 82, 87–88, 89, 95–97
 granitic 214–218, 214
 Madjarovo ore district 145–146
 subduction zones 53–60
 tectonic controls 60–61

- mantle 4, 56–57
 Manus Basin, Pacific Ocean 27
 marble 163
 mesh structures 8–9
 mesothermal mineralization 9, 105
 Mesozoic magmatic arcs 279–281
 mesozonal mineralization 183
 metal zonation, VMS deposits 31–32
 metallogenic affiliation, Dinarides 229–245
 metallogenic belts
 Eurasia 273–277, 278
 Yana–Indigirka orogen 300, **301**, 305–315
 metallogenic zones 34, 306, 307–315, 342
 metamorphism
 Dinarides 231
 Eocene–Oligocene 167–168
 Finland 338, 342, 344–345
 greenschist facies 112
 high pressure 151–178, 159, 162, 163, 165
 Kreuzeck–Goldeck Complex 105–106
 Sveconorwegian 319–335
 metasomatic mineralization 328–331, 329
 micas **161**, **167**, **262**
 mid–ocean ridge basalts (MORB) 54, 56
 mineralization
 see also copper...; gold...; hydrothermal mineralization
 ABCD 81–82, **84**, 87–90, 92–99, 92
 Alpidic and Variscan cycles 232, 238–243
 Eastern Alps 92
 Kreuzeck–Goldeck Complex 106–112, **111**
 Madjarovo ore district 140–141
 magmatism 95–97
 orogenic collages 277, 280, 281–289
 Ossa Morena Zone, Iberia 183–189, 184
 post–Variscan 201–202, 205–206
 Sardinia 199–212
 subduction zones 60–63
 transpressional structures **191**, **193**
 mining
 ABCD belt **84**
 Elatite porphyry copper deposit 120–121
 Finland 342, 344–345
 Guginock area 110–111
 High Seksaoua district, Morocco 247–271
 Madjarovo ore district 137–150
 Miocene 41, **84**, 90, 93–94
 Mo *see* Cu–Mo deposits
 molybdenite 320, 323, 325, 326–328, 330
 Mongolia 274, 277–281, 285–287
 MORB *see* mid–ocean ridge basalts
 Morocco, High Seksaoua district 247–271
 Mount Read Volcanics, Tasmania 22–24, 23
 mylonites 160, 162–166, 165

 Namurian, W–Sn–rare metals deposit 211, **219**, 220, 222–223, 226
 nappes 86–87, 105, 214
 Neogene 7, 10, 81–102, 90–94
 North Asia
 craton 299–317
 metallogenic zones 300, **301**, 307–315
 orogenic collages 293–297
 North Pacific orogenic collage 274–277, 274
 mineralization 278, 281–289
 tectonic evolution 276, 290, 291–292, 293
 Norway, Sveconorwegian metamorphism 319–335

 oblique tectonics 179–198
 Okhotsk–Alaska arc–backarc system 280
 Oligocene 90–93, 167–168
 ophiolites 283, 284, 304
 ore deposits *see* mineralization
 ore genesis 2, 60
 oroclinal 275, 277, 280, 282
 orogenic collages 273–297, 274, 275
 Baikalide–Altaid 279, 282–289
 mineralization 277, 280, 281–289
 North Asia 293–297
 North Pacific 274–277, 274
 tectonic evolution 289–292
 Transbaikal–Mongolian 277–281
 orogens
 Alpine–Balkan–Carpathian–Dinaride 81–102
 collapse 73–74, 87, 88
 late–stage ore provinces 82–85
 Palaeozoic 274, 303–304
 SE Asia–SW Pacific 2–7
 Sveconorwegian 320, 321
 Verkhoyansk–Chersky 299–315, 300
 orthoamphibole–cordierite rocks 338, 342, 344
 osmium 60
 Ossa Morena Zone, Iberia 180, 182–189

 Pacific *see* North Pacific; SE Asia–SW Pacific
 Palaeogene, Tauern Window 113
 Palaeozoic
 host rocks, Dinarides 229–233, 230, 235
 magmatic arcs 275–280, 282–289
 orogenic belts 274, 303–304
 Sardinian successions 200
 VMS deposits 18–21
 parageneses 229, 234–235, 234, 237, **261**
 Pb–Pb isotope data 132
 Pb–Zn–(Ba) veins, SW Iberian Variscan Belt 187–188
 Permian 199–212, 233
 Permo–Triassic *see* post–Variscan
 Philippine Sea 41–42, 51–52
 plate motions 2–5, 7
 see also collision zones; subduction zones
 Pliocene 3, 41
 polyphase deformation 252–258, 264, 266
 porphyry copper deposits 3, 6, 41, 119–136
 porphyry dykes 121–123, 127, 129
 post–Variscan
 Dinaride formations 232–233
 Sardinian ore deposits 199, 200, 201–202
 pyrite mineralization 103–118, 181, 189–192, 259, 260

 quartz 238–240, 239–242
 see also gold–quartz deposit

 radiometric ages, Indonesia 62
 Rare Metal Granite 214, 215
 rare metals deposit, France 213–228
 Re–Os dating, molybdenite 320, 326–328
 Rhodope Domain 152–154, 153, 172–175
 Rhodope Mountains 151–178, 153

- base-precious metal ore district 137–150
 detachment systems 153, 155–167, 171–175
 exhumation 154–155, 157, 168–169
 granitoids 168
 metamorphism and deformation 166–167
 tectonic evolution 169–175, 170–171
- roll-back 2, 72–76, 73, 91, 92
- Saesvatn, South Norway, metamorphism 319–335
- Saint Sylvestre leucogranitic complex 221–222, 223
- Sardinian Permo-Mesozoic deposits 199–212
 geochemical data 202–205
 mineralization 200, 201–202, 205–206
- scheelite 217
- schists 255, 257
- SE Asia–SW Pacific region 2–6, 3
 evolution 41–44, 43
 magmatic arcs 39–47
 tectonic controls 49–67
- SE Europe 69–79
see also Alpine–Balkan–Carpathian–Dinaride orogen
- seismic pumping mechanism 9, 10
- shear zones, Iberia 183
- Siberian craton 275, 276–277, 300
- siderite + ankerite deposits 232, 235, 238
- skarns, Variscan Belt 185–187, 186
- Skellefte district, northern Sweden 18, 19
- Sn *see* W–Sn–rare metals deposit
- stibnite mineralization 103–118, 111
- stockwork deposit 248, 260, 266
- strain, decompression 161–163, 164–166
- strike-slip faults 9–10, 103, 183–185
- strontium, in barite 237
- structural control 247–271
- subduction zones 2–3, 72
 dynamic and static modes 54
 hinge movements 2–3, 58
 magmatism 53–60
 mineralization 60–63, 72
 recycled components 55–56
- sulphides 183–184, 184, 186, 188, 260
see also volcanic-associated massive sulphide deposits
- sulphur 236
- supracrustal rocks 320–323, 322, 328–331
- Sveconorwegian metamorphism 319–335
 Cu–Mo mineralization 323–331, 325, 329
 metamorphic evolution 328–331
- SW Iberian Variscan Belt 179–198
 Iberian Pyrite Belt 181, 189–192
 Ossa Morena Zone 180, 182–189
 VMS deposits 187, 189–192
- synclinorium, Saesvatn 321–323, 322
- Tauern Window 92, 94, 95, 105, 113
- tectonics
 controls 53, 60–61, 247–271
- North Asia craton 299–317
 reconstructions 41–45, 43, 85–86, 90–92
- terrane accretion, oblique 103–118
- Tertiary 93–94, 103–118
- thrusting, Rhodope Mountains 171–175
- timing
 gold deposits 42, 43, 44
 information 70–71
 mineralization 71–72
 VMS deposits 14–15, 15
 volcanic episodes 6
- Transbaikal–Mongolian orogenic collage 277–291
- transpressional structures 182, 191, 193
- Triassic host rocks, Dinarides 233–235
- Urals 4, 5, 18–21, 20, 287–288
- U–Pb zircon geochronology 126–129, 127
- Variscan belt
 Dinarides 231–232
 fluid systems 238–240, 239–243
 Limousin, France 213–228, 215
 SW Iberia 179–198, 181
- Verkhoyansk metallogenic zones 306, 309–310, 313–315
- Verkhoyansk–Chersky orogen 299–315, 300
 geological features 299–302, 302
 metallogenic belt 300, 301, 305–315
- Verkhoyansk–Chukotka arc–backarc system 276–277, 281
- VHMS/VMS *see* volcanic-associated massive sulphide deposits
- volatiles 337
- volcanic-associated massive sulphide (VHMS/VMS) deposits
 13–37, 14, 33
 characteristics 30–31
 fluorine 3, 4, 6, 337–338, 344–346
 Iberian Pyrite Belt 187, 190–191, 191
 major districts 16–27
 tectonic setting 13–14, 15, 27–28, 27
 volcanic facies 28–30
- wedges 73, 74, 304
- Westphalian, W–Sn–rare metals deposit 219, 221, 223, 226
- whole-rock analyses, fluorine 338, 339
- wolframite 216
- W–Sn–rare metals deposit 213–228
 depositional conditions 223–225
 isotope analysis 218–225
 origin 222, 225
- Xanthi detachment system 158–163, 158, 159, 172
- Yana–Indigirka metallogenic belt 300, 301, 305–307
- Yursky–Brindakit goldfield 307–309, 308
- zircon geochronology 119–136, 127
- Zn–Cu–Pb deposits, fluorine 337–353