

INDEX TO VOLUME 153

This index covers both the *Initial Reports* and *Scientific Results* portions of Volume 153 of the *Proceedings of the Ocean Drilling Program*. References to page numbers in the *Initial Reports* are preceded by "A" with a colon (A:) and to those in the *Scientific Results* (this book) by "B" with a colon (B:).

The index was prepared by Earth Systems, under subcontract to the Ocean Drilling Program. The index contains two hierarchies of entries: (1) a main entry, defined as a keyword or concept followed by a reference to the page on which that word or concept appears, and (2) a subentry, defined as an elaboration on the main entry followed by a page reference.

The index covers text, figures, and tables but not core-description forms ("barrel sheets"), core photographs, or thin-section descriptions. Also excluded from the index are bibliographic references, names of individuals, and routine front and back matter.

The Subject Index follows a standard format. Geographic, geologic, and other terms are referenced only if they are subjects of discussion. A site chapter in the *Initial Reports* is considered the principal reference for that site and is indicated on the first line of the site's listing in the index. Such a reference to Site 920, for example, is given as "Site 920, A:45–119."

For further information, including available electronic formats, contact the Chief Production Editor, Ocean Drilling Program, 1000 Discovery Drive, College Station, Texas 77845-9547, U.S.A., e-mail: pub_production@ODP.TAMU.EDU.

VOLUME 153 SUBJECT INDEX

- accretion, oceanic lithosphere, A:5
- actinolite
- hydrothermal veins, A:162–163, 202, 207, 242, 250–251, 267, 269–270; B:162, 524–525
 - metamorphic minerals, B:536
 - metamorphism, B:391–393
 - mineral chemistry, B:167–170
 - photograph, A:70, 83, 87–88, 135, 138–139, 146, 155, 158, 163, 183, 189, 196–199, 203, 205, 243–245, 249–250, 268, 270; B:43, 138, 166–167, 169–170, 402–403
 - vs. chlorite, B:395
- See also* veins, actinolite; veins, actinolite–chlorite; veins, hornblende–actinolite–chlorite
- actinolite, recrystallized, composition, B:81–82, 90–93
- adcumulus, gabbros, B:361
- albite
- gabbroic rocks, B:105–106
 - photograph, B:120
- albitization
- photograph, B:149
 - veins, B:171
- alteration, hydrothermal
- assemblages, B:68–69
 - bulk-rock and mineral chemistry, B:199–205
 - clinopyroxenite, A:80–81
 - crystalline rocks, A:255
 - diabase, A:85–86; B:370–373
 - downhole and cross-hole variations, A:88–91, 158, 202–203, 242–244, 267
 - gabbroic rocks, A:81–85, 152, 195–201, 235–238, 265–267; B:159–161
 - geochemistry, A:65–66
 - greenschist facies, B:389–398
 - hydrothermal veins, B:155–178
 - isotopes, B:313–315
 - mass balance, B:394–395
 - olivine-bearing ultramafic rocks, A:57
 - oxides and sulfides, B:523–529
 - peridotites, B:35–59, 265–275, 518
 - petrology, A:72–91, 151–158, 193–204, 235–244, 265–267
 - photograph, A:54, 85, 89–90, 154–158, 196–199, 243–245, 264–265; B:119
 - temperature, B:167–170
 - ultramafic rocks, A:56–57
 - vs. depth, A:80, 117, 153, 174–175, 195–196, 213, 242, 256, 267
 - vs. remanent magnetization, B:432
 - websterite, B:325–328
- alteration, patchy, photograph, A:81
- alteration halos
- assemblages, B:161–162
 - hydrothermal veins, B:162
 - photograph, A:268; B:166, 169, 392–393
- aluminum
- amphiboles, B:394–395
 - hydrothermal alteration, B:395
 - mineral chemistry, B:272
 - peridotites, B:518
 - vs. aluminum + iron + titanium, B:544
 - vs. magnesium/(magnesium + iron + manganese) ratio, B:394
 - vs. sodium, B:271
 - vs. sodium + potassium, B:390 395
- vs. titanium, B:390, 395, 544–545
- See also* chromium/(chromium + aluminum) ratio; gabbro, magnesium–aluminum; titanium/(aluminum + iron + titanium) ratio; titanium/aluminum ratio
- aluminum (IV), vs. aluminum (VI), B:546
- aluminum (VI), vs. aluminum (IV), B:546
- aluminum + iron + titanium system, vs. aluminum, B:544–545
- aluminum number, vs. magnesium number, B:270
- aluminum oxide
- bulk-rock and mineral chemistry, B:202–205
 - diabase, B:364–365
 - harzburgite, A:74
 - mafic and ultramafic rocks, B:184–185, 189
 - peridotites, A:67, 278–280
 - vs. calcium oxide, A:75
 - vs. chromium number, B:299
 - vs. chromium oxide, B:288, 324, 514
 - vs. chromium/nickel ratio, A:78
 - vs. depth, A:75, 78
 - vs. lanthanum/ytterbium ratio, B:232
 - vs. magnesium number, B:279, 299
 - vs. magnesium number in clinopyroxene, B:95
 - vs. magnesium oxide, A:75; B:366
 - vs. titanium oxide, B:283
 - websterite, B:323, 329
- See also* calcium oxide/aluminum oxide ratio
- aluminum oxide/FMM ratio
- vs. calcium oxide/FMM ratio, B:216
 - vs. magnesium oxide/FMM ratio, B:215
 - vs. titanium oxide/FMM ratio, B:216
 - vs. vanadium/FMM ratio, B:216
 - vs. zirconium/FMM ratio, B:216
- aluminum oxide/silica ratio
- bulk-rock and mineral chemistry, B:205–208
 - vs. depth, B:212
 - vs. magnesium oxide/silica ratio, A:75; B:213
 - aluminum/(silicon + aluminum) ratio, vs. sodium/(calcium + sodium) ratio, B:544–545
 - aluminum/(silicon + aluminum) ratio, vs. titanium/(aluminum + iron + titanium) ratio, B:544–545
- aluminum/silicon ratio, vs. magnesium/silicon ratio, B:300
- amphibole
- binary intercationic correlations, B:544–545
 - classification, B:541
 - composition, B:97, 524
 - gabbros, B:390–391, 544–545
 - hydrothermal veins, A:79; B:525
 - magnesium number, B:251, 254
 - metamorphism, B:391–393
 - mineral chemistry, B:167–170, 173, 175–176, 501–502, 539, 541–545
 - photograph, A:85, 155, 201; B:119, 125, 137–141, 158, 174, 403
- See also* hornblende
- amphibole, brown, dikelets, B:247
- amphibole, fibrous, photograph, A:199
- amphibole, recrystallized, composition, B:81–82, 90–93
- amphibolite
- alteration, A:82–83
 - lithology and bulk chemistry, B:186–198
 - melting spider diagrams, B:214
 - petrology, A:63–64
 - photograph, A:53, 89–90, 244; B:165
 - static and dynamic metamorphism, A:241
- amphibolite facies, photograph, A:90
- amphibolitization photograph, A:190; B:392–393
- See also* microgabbro, amphibolitized
- andradite, veins, B:524
- anorthite
- average in igneous and recrystallized plagioclase, B:96
 - gabbroic rocks, B:105–106, 108–109
 - melt–rock interactions, B:82–83, 93
 - plagioclase in gabbroic rocks, B:480
 - plagioclase neoblasts, B:112
 - variations in deformed plagioclase samples, B:98
 - vs. depth, B:112, 225
 - vs. forsterite, B:338
 - vs. magnesium number, B:251, 335
 - vs. magnesium number in clinopyroxene, B:94
 - vs. potassium oxide, B:96
 - vs. strontium, B:347
- antigorite
- photograph, B:46
 - serpentinitization, B:39–42, 47–49
- apatite
- dikelets, B:247
 - fluid inclusions, B:404–405
 - gabbros, B:339, 341
 - photograph, A:89, 91, 184, 198, 201; B:45, 402, 406
 - serpentinitization, B:39
- aragonite
- photograph, A:70
 - serpentinitization, B:42
 - vein X-ray diffraction patterns, A:86
- augen tails, fabrics, B:148–149
- augite
- metamorphic minerals, B:536
 - photograph, B:158, 160
 - recrystallization, B:158–159
- axial valley, tectonics, A:10–12
- backscattered electron images, shear zones, B:138–141
- baddeleyite, gabbros, B:338–341
- banding
- gabbroic rocks, B:159–161
 - photograph, A:134–136, 189, 201, 244
- barium, vs. cesium, B:302
- basalt
- geochemistry, B:181–241
 - isotopes, B:310
 - lanthanum/ytterbium ratio, B:232
 - melting regime, B:184–185
 - tectonics, A:11
- See also* metabasalt
- basalt, lanthanum, vs. lanthanum/ytterbium ratio, B:230
- basalt, mid-ocean ridge, depletion, B:361
- basaltic magma, mineral/melt partition coefficients, B:228
- bastite
- photograph, A:81, 88, 97; B:41, 48
 - serpentinitization, B:38–39, 382
- bathymetry
- Kane Fracture Zone, A:8
 - Site 920, B:8
 - tectonic windows, B:63–64
- Bay of Islands Complex Ophiolite, aluminum oxide/silica ratio, vs. magnesium oxide/silica ratio, B:213

mafic and ultramafic rocks, B:187–189, 198
biotite, recrystallized, composition, B:81–82, 90–93
blastesis, gabbros, B:536
bravoite, hydrothermal veins, B:524
breccia, photograph, A:100
breccia, quartz, fluid inclusions, B:410
brines
 magmatic volatiles, B:407–409
 serpentinitization, B:412–413
brucite
 photograph, B:40
 serpentinitization, B:47–49
bulk moduli, crystalline rocks, B:445–448

calcium
 peridotites, A:66–67
 pyroxene in gabbroic rocks, B:484–487
 See also pyroxene, calcium; sodium/(calcium + sodium) ratio
calcium number
 gabbroic rocks, B:108–109
 vs. depth, B:112, 220, 223, 225
calcium oxide
 bulk-rock and mineral chemistry, B:204–205
 diabase, B:223, 364–365
 harzburgite, A:74
 peridotites, A:67
 vs. aluminum oxide, A:75
 vs. carbon dioxide, A:77
 vs. chromium oxide, B:288
 vs. chromium/nickel ratio, A:78
 vs. clinopyroxene/orthopyroxene ratio, A:77
 vs. depth, A:75–76; B:212
 vs. magnesium number, A:194, 239; B:349
 vs. magnesium oxide, B:348–349, 366, 371
 vs. pyroxene, A:77
calcium oxide/aluminum oxide ratio
 crystallization, B:208–213
 vs. plagioclase, A:147
 vs. strontium, A:147
calcium oxide/calcium oxide + sodium oxide)
 ratio, vs. magnesium number, B:218
calcium oxide/FMM ratio, vs. aluminum oxide/FMM ratio, B:216
calcium/sodium ratio, plagioclase, B:158–160
carbon dioxide
 crystalline rocks, A:65
 fluid inclusions, B:405
 harzburgite, A:73
 magmatic volatiles, B:407–409
 vs. calcium oxide, A:77
 vs. depth, A:76
 See also water + carbon dioxide system
carbonate
 hydrothermal veins, A:79–80; B:524
 peridotites, A:67
 photograph, A:88, 100; B:56
cataclasite
 photograph, A:167, 249
 See also metagabbro, cataclastic
cataclasite
 gabbros, B:70–71
 hydrothermal veins, A:162–163
 photograph, A:157; B:70
cataclastic zones
 downhole variations, A:248–249
 fabrics, B:148–149
 gabbroic rocks, A:160–162, 269
 hydrothermal veins, B:171–172
 photograph, B:149
 See also ultracataclastic zones
cerium, chondrite-normalized, vs.
 chondrite-normalized lanthanum, B:234

cerium/ytterbium ratio
 mafic and ultramafic rocks, B:184–185, 188
 vs. chromium, B:283
cesium, vs. barium, B:302
chadacrysts, photograph, A:230
chalcopyrite, hydrothermal veins, B:524
chilled margin, photograph, A:126
chlorite
 hydrothermal veins, A:79, 162–163, 202, 207, 242, 250–251, 267, 269–270; B:524
metamorphism, B:391–393
mineral chemistry, B:168–170, 173, 175–176
photograph, A:70, 83–84, 87–88, 130, 135, 138–139, 144, 146, 155–156, 158, 163, 183, 189, 196–197, 201, 203, 205, 243–245, 249–250, 265, 270; B:43, 45, 138, 167–171, 403, 528
serpentinitization, B:39, 47
vs. actinolite, B:395
See also veins, actinolite–chlorite; veins, amphibole–chlorite; veins, chlorite; veins, chlorite–iron oxides; veins, chlorite–plagioclase–quartz; veins, chlorite–prehnite; veins, chlorite–quartz; veins, hornblende–actinolite–chlorite
chromite
 hydrothermal veins, B:524
 mineral chemistry, B:527
See also ferrichromite
chromium
 diabase, B:223, 372
 vs. cerium/ytterbium ratio, B:283
 vs. magnesium number, A:147, 239; B:538
 vs. magnesium oxide, A:78
 vs. titanium, B:496
 websterite, B:323–324
chromium/(chromium + aluminum) ratio
 mafic and ultramafic rocks, B:184–185, 189
 vs. iron/(iron + magnesium) ratio, B:516
chromium/nickel ratio
 gabbroic rocks, A:193
 vs. aluminum oxide, A:78
 vs. calcium oxide, A:78
 vs. nickel, A:148, 195, 240
chromium number
 spinel, B:256, 260
 vs. across-channel variations, Site 920, B:273
 vs. aluminum oxide, B:299
 vs. magnesium number, B:269, 281, 299
 vs. sodium oxide, B:260
 vs. titanium oxide, B:260
 websterite, B:323–324
chromium oxide
 amphiboles, B:97
 clinopyroxene in gabbroic rocks, B:488–489
 vs. aluminum oxide, B:288, 324, 514
 vs. calcium oxide, B:288
 vs. magnesium number, B:254, 279, 299, 325, 339
 vs. magnesium number in clinopyroxene, B:95
 websterite, B:323
chrysotile
 hydrothermal vein X-ray diffraction patterns, A:86
 photograph, B:40, 47–48, 53, 55–56
 serpentinitization, B:38–39, 47
clasts
 hydrothermal veins, B:171–172
 photograph, A:128, 157
clathrate, melting temperature, B:408
clay minerals
 hydrothermal veins, A:79–80, 270–271
 photograph, A:89, 249; B:56, 167

serpentinitization, B:42
See also smectite; veins, clay minerals; veins, epidote–clay minerals
clinochlore, hydrothermal vein X-ray diffraction patterns, A:86
clinopyroxene
 backscattered electron images, B:139–141
 chemical modifications in peridotite near gabbroic dikelets, B:260
 chromium oxide, B:488–489
 crystal-plastic fabric, A:95
 dikelets, B:249–251
 gabbroic rocks, A:126–141, 181, 193, 218–231; B:335–336, 339, 348, 473, 477–478
 hydrothermal alteration, A:151, 153, 196–197, 236, 267
 lanthanum/ytterbium ratio, B:231–232
 mafic and ultramafic rocks, B:184–185, 189
 magmatic differentiation, B:261
 magnesium number, B:217, 251, 254
 magnesium number average in igneous and recrystallized material, B:96
 magnesium number variations in deformed samples, B:98
 metamorphism, B:401–404
 mineral chemistry, B:158–160, 177, 462–464, 499–500, 535, 537–538
 mineral/melt partition, B:219
 modal proportions, A:150, 241
 peridotites, A:52–58, 60; B:269–270, 278, 291–293, 509–511, 514–515
 phase equilibria, B:536
 photograph, A:55, 64, 70, 89–90, 129, 131–132, 137–138, 155, 158, 183, 186, 188, 200–201, 221–224, 227, 229–230, 237, 243–244, 262, 264, 268; B:84, 117, 125, 137–141, 146–147, 149, 158, 160, 166–167, 170, 174, 245, 248, 403, 520–521
 plutonic rocks and ultramafics, B:256–260
 rare earths, B:344
 recrystallization, B:101–105, 144–145
 serpentinitization, B:382
 sodium oxide, B:231–234
 vs. depth, A:76, 239, 267; B:255
 websterite, B:324
See also gabbro, brown-clinopyroxene; neodymium isotopes (clinopyroxene); orthopyroxene; oxygen isotopes (clinopyroxene); plagioclase–clinopyroxene ratio; pyroxene; strontium isotopes (clinopyroxene)
clinopyroxene, aluminum, vs. sodium, B:271
clinopyroxene, aluminum oxide, vs. titanium oxide, B:283
clinopyroxene, chromium, vs. cerium/ytterbium ratio, B:283
clinopyroxene, coarse-grained, photograph, A:128
clinopyroxene, degree of recrystallization, vs. degree of recrystallization of plagioclase, B:145
clinopyroxene, igneous, composition, B:80–81, 83, 85–86
clinopyroxene, iron oxide, vs. samarium, B:347
clinopyroxene, lanthanum/ytterbium ratio, vs. ytterbium, B:359
clinopyroxene, magnesium number
 vs. chromium oxide, B:339
 vs. sodium oxide, B:339
 vs. strontium, B:281
 vs. titanium oxide, B:340
 vs. zirconium, B:281
clinopyroxene, oxides, vs. depth, B:212

clinopyroxene, pegmatitic, photograph, B:402
 clinopyroxene, poikilitic, photograph, A:127; B:34
 clinopyroxene, recrystallized, composition, B:81–82, 85–86
 clinopyroxene, sodium, vs. titanium, B:270
 clinopyroxene, ytterbium/scandium ratio, vs. lanthanum/scandium ratio, B:359
 clinopyroxene/orthopyroxene ratio, vs. calcium oxide, A:77
 clinopyroxenite
 alteration, A:80–81
 lithology and bulk chemistry, B:186–198
 petrology, A:48–51, 62–63
 photograph, A:54
 See also pyroxenite
 compressional wave velocity
 crystalline rocks, A:112–113, 115, 172, 255, 273
 gabbros, A:172
 peridotites, B:441–442
 vs. bulk density, A:214
 vs. density, A:176, 273; B:447, 453
 vs. porosity, A:176, 214
 vs. pressure, B:443
 vs. shear wave velocity, B:454
 compressional wave velocity/shear wave velocity ratio, vs. density, B:453
 core complexes, oceanic, evolution, B:72–74
 coronitic textures
 amphiboles, B:397
 photograph, A:183, 189, 196–197, 201, 264
 correlation
 cross-hole geochemistry, A:149
 geochemistry and petrology, A:150
 crack-seal. *See* veins, crack-seal
 cracks
 hydrothermal veins, B:174
 See also deformation; foliation; fractures;
 microcracks; structures
 cracks, extensional, hydrothermal veins, B:162
 cracks, tension, serpentinization, B:386–387
 creep, diffusion, recrystallization, B:150
 creep, dislocation, magnetite and ilmenite, B:132–133
 crenulation cleavage, photograph, A:99
 crescumulate texture
 gabbroic rocks, A:191–193
 photograph, A:186–187, 229, 237
 crust, lower, seismic velocity, B:437–454
 crust, magnetization, B:429–436
 crust, oceanic
 crystalline rocks, A:114–115
 crystallization, B:333–350
 density, A:175–176
 gabbroic rocks, B:71–74
 hydrothermal veins, B:155–178
 model of melting, B:236
 serpentinite, B:17–18
 tectonic windows, B:61–76
 See also lithosphere, oceanic
 crustal Layer 3, serpentinization, B:412–413
 crystal-plastic. *See* deformation, crystal-plastic;
 fabric, crystal-plastic; fabric, plastic;
 foliation, crystal-plastic; shear zones,
 crystal-plastic; structures, crystal-plastic
 crystallization
 gabbroic rocks, B:98
 melts, B:208–213
 oceanic crust, B:333–350
 cummingtonite, photograph, A:63
 cumulate, gabbroic rocks, B:93–94, 361
 cumulus, crystallization, B:333–350
 deep-tow photographs

geomorphology, B:7–13
 intersection massif, B:64–69
 deformation
 gabbroic rocks, A:158–167, 204–209, 244–251, 267–271; B:70–71, 106–108
 iron–titanium oxides, B:123–141
 mafic rocks, A:98–100
 magnetic anisotropy, B:419–427
 magnetite and ilmenite, B:132
 photograph, A:159, 243; B:117
 serpentinite, B:14–18
 stereographic projection, B:557
 vs. depth, A:101, 163–167, 247–251
 See also foliation; joints
 deformation, brittle
 gabbroic rocks, A:160–163, 206–208, 269–271; B:159–161
 metamorphic minerals, B:534
 peridotites, A:95–98
 serpentinization, B:49, 51–52
 vs. depth, A:163, 166, 251
 deformation, crystal-plastic
 hydrothermal veins, B:170–175
 photograph, A:244
 deformation, ductile
 gabbroic rocks, B:77–98
 metamorphic minerals, B:533–534
 peridotites, B:23–34
 deformation textures, gabbroic rocks, B:105
 deformation twins
 photograph, B:118, 120
 See also twinning
 demagnetization
 crystalline rocks, A:172–173, 272
 gabbroic rocks, A:211–212, 253–254; B:431–433
 demagnetization, alternating-field, vector diagrams, A:110, 171; B:433–435
 density
 gabbroic rocks, A:171–172; B:442–444
 peridotites, B:442–444
 seismic velocity, B:440–444
 vs. compressional wave velocity, A:176, 273; B:447, 453
 vs. compressional wave velocity/shear wave velocity ratio, B:453
 vs. depth, A:118, 257
 vs. porosity, A:257, 273; B:446
 vs. serpentinized fraction, B:447
 density, bulk
 vs. compressional wave velocity, A:214
 vs. velocity, A:118
 density, GRAPE
 crystalline rocks, A:114–115
 gabbroic rocks, A:256
 density, subgrain boundary, vs. finite strain, B:25
 detachment faults
 evolution, B:74
 serpentinite, B:17
 diabase
 alteration, A:85–86
 dikes, B:363–377
 geochemistry, A:148–149; B:491–495
 intrusions, B:72–74
 isotopes, B:310–311
 lithology and bulk chemistry, B:186–198
 major oxides, A:148
 melting spider diagrams, B:214
 petrography, B:363–364
 petrology, A:134–135, 152
 photograph, A:52, 56, 72, 90, 126, 161
 rare earths, B:227
 trace elements, B:222–227
 trace-element spider diagrams, B:221
 zirconium/yttrium ratio, B:374
See also metadiabase
 diabase, aluminum oxide, vs. magnesium oxide, B:366
 diabase, europium/samarium ratio, vs. samarium, B:359
 diabase, hydrothermal, alteration, A:158
 diabase, lanthanum/scandium ratio, vs. ytterbium/scandium ratio, B:359
 diabase, lanthanum/ytterbium ratio, vs. ytterbium, B:359
 diabase, magnesium oxide
 vs. calcium oxide, B:366, 371
 vs. iron oxide, B:366
 vs. nickel, B:366
 vs. sodium oxide, B:366
 vs. titanium oxide, B:366
 diabase, phryic
 alteration, A:157–158
 petrology, A:48–50, 64
 diabase, zirconium
 vs. nickel, B:373
 vs. yttrium, B:375
 diabase, porphyritic, petrology, A:64
 diabasic rocks, fluid inclusions, A:86–88
 diapirism
 serpentinite, B:17
 serpentinization, B:52
 dikelets
 gabbroic rocks, B:243–264
 magnesium number, B:254
 photograph, B:248
 thickness, vs. depth, B:246, 255
 dikelets, abundance, vs. depth, B:246
 dikelets, thickness, vs. depth, B:246, 255
 dikes
 diabase, B:363–377
 isotopes, B:308, 310, 315–316
 photograph, A:161, 246
 dikes, crosscutting, petrography, B:363–364
 diopside
 hydrothermal veins, B:524
 mantle, B:277–284
 photograph, B:521
 diorite
 photograph, A:138–139
 See also quartz diorite; veins, dioritic
 ductile deformation. *See* deformation, ductile; shear zones, ductile
 dunite
 alteration, A:75–76
 lithology and bulk chemistry, B:186–198
 melt channels, B:211
 petrology, A:48–51; B:14–16
 photograph, A:53, 58; B:39
 replacement, B:266
 dunite, serpentinized
 dikelets, B:249
 magmatic differentiation, B:261
 edenite. *See* hornblende, edenitic
 elastic constants, seismic velocity, B:445–450, 452–454
 elongate minerals, photograph, A:159, 186–188, 205, 229, 237
 en echelon arrays, photograph, B:49
 enstatite
 metamorphic minerals, B:536
 mineral chemistry, B:459
 photograph, B:520
 epidote
 hydrothermal veins, A:202, 208, 242, 251; B:524

- metamorphic minerals, B:536
photograph, A:157; B:167, 403
See also veins, epidote; veins, epidote–clay minerals; veins, epidote–prehnite
- europium
anomalies, B:235
gabbros, B:357, 359–361
- europium/samarium ratio, vs. samarium, B:359–361
- exsolution, photograph, A:199; B:520–521
- exsolution lamellae, photograph, B:119
- extension
crust, B:17–18
evolution, B:72–74
hydrothermal veins, B:174
serpentization, B:52
See also tectonics, extensional
- fabric
foliation dip, A:246
gabbroic rocks, A:162; B:143–153
magnetic anisotropy, B:419–427
magnetic susceptibility, B:553
photograph, A:71, 159, 224; B:170
serpentinite, B:13
stereoplots, A:102, 104
vs. depth, A:101, 103, 163, 166, 248
See also magnetic fabric; petrofabrics
- fabric, anastomosing
brittle deformation, A:95–97
serpentine, B:38–39
- fabric, associated with magmatic layering, metamorphic minerals, B:532
- fabric, brittle
gabbroic rocks, A:160, 246–247
recrystallization, B:149
vs. depth, A:247
- fabric, crystal-plastic
gabbroic rocks, A:159–160, 204–206, 245–246, 268–269
mafic rocks, A:100
photograph, A:205, 248; B:150, 165, 167
recrystallization, B:101–105, 145–147
serpentization, B:51–52
serpentinitized peridotites, A:92–95
vs. depth, A:100–103, 247; B:245
- fabric, crystallographic, shear zones, B:129–130
- fabric, deformation, photograph, B:117
- fabric, fibrous, hydrothermal veins, B:164
- fabric, lattice, harzburgite, B:23–28
- fabric, magmatic
gabbroic rocks, A:159, 204, 244–245, 268
recrystallization, B:145
vs. depth, A:247
- fabric, magnetic
contour plots, A:114
serpentinitized peridotites, A:110
vs. foliation, A:171, 212, 254
- fabric, plastic, vs. depth, A:209; B:558
- fabric, random shape (equant textures), metamorphic minerals, B:531–532
- fabric, semibrittle, recrystallization, B:147–149
- fabric dip, vs. depth, A:209; B:57
- fabric intensity
downhole variations, B:172
vs. depth, A:271
- fabric strike, vs. depth, B:57
- fault scarps, morphology, B:12
- fault zones
gabbroic rocks, B:71–74
tectonics, A:10–12
- faults
brittle deformation, A:97–98
gabbroic rocks, A:160, 206, 269
- hydrothermal veins, B:171–172
intersection massif, B:64–69
photograph, A:161
serpentinitization, B:51–52
vs. depth, A:101–102, 104, 163, 249–250
- faults, normal, post-serpentinitization, B:18–19
- fayalite, metamorphic minerals, B:536
- feldspar
fabrics, B:148–149
photograph, B:149
vs. olivine, B:395
See also anorthite; plagioclase
- felsic rocks. *See* veins, felsic
- ferrichromite
photograph, B:527
veins, B:524
See also chromite
- ferromagnesian ratio. *See* aluminum oxide/FMM ratio; calcium oxide/FMM ratio; titanium oxide/FMM ratio; vanadium/FMM ratio; zirconium/FMM ratio
- ferrosilite, mineral chemistry, B:459
- fibers
photograph, B:48, 170
serpentinitization, B:42
- fluid evolution, slow-spreading environment, B:399–415
- fluid inclusions
gabbroic and diabasic rocks, A:86–88
gabbroic rocks, A:202
homogenization temperatures and salinities, B:407–408, 410
photograph, A:91, 203; B:406
slow-spreading environment, B:399–415
temperature, B:68–69
- fluid inclusions, daughter-mineral-bearing, composition, B:405–406
- fluid inclusions, liquid-dominated, composition, B:404–405
- fluid inclusions, methane–water–hydrogen, composition, B:406
- fluid inclusions, pressure, vs. temperature, B:410
- fluid inclusions, vapor-dominated, composition, B:405
- fluid/rock interaction, serpentinitization, B:383, 385
- fluid/rock ratio
bulk-rock and mineral chemistry, B:199–205
hydrothermal veins, B:171
major elements, B:396
oxygen isotopes, B:386, 468–469
- fluids, intercumulus, gabbros, B:361
- foliation
drag, B:158
hydrothermal veins, B:44, 170–175
magnetic fabric, A:254; B:422–424
mineralogy, B:78–93
photograph, A:59, 81–82, 90, 92–94, 97–100, 105, 223, 234, 250; B:79, 117, 164–165
recrystallization, B:101–105
serpentinite, B:16
serpentinitization, B:42
stereographic projection, B:557
vs. depth, A:103
vs. magnetic fabric, A:171, 212
See also cracks; deformation; faults; foliation; fractures; joints; microfractures; microstructures; shear zones
- foliation, anastomosing, serpentinite, vs. depth, A:101, 103
- foliation, crystal-plastic
gabbroic rocks, B:159–161
photograph, A:161; B:245
- foliation, serpentine, vs. depth, A:101
- foliation dip
pyroxene and spinel, B:30
vs. depth, A:249, 271; B:172
- formation factor, vs. porosity, A:176, 214, 257, 274
- forsterite
fractionation, B:225
gabbros, B:335–336
metamorphic minerals, B:536
olivine, B:217, 514
olivine in gabbroic rocks, B:481
vs. anorthite, B:338
vs. depth, B:514
vs. nickel oxide, B:279, 273, 338
See also olivine
- fractional crystallization
gabbronorite, B:93–94
heterogeneity, B:282–283
melts, B:229
- fractional crystallization, magnesium oxide, vs. calcium oxide, B:349
- fractionation
crystallization, B:210–211, 357
magma mixing, B:225
melts, B:229
oxygen isotopes, B:383
- fractures
gabbros, B:70–71
hydrothermal veins, B:171–172
photograph, A:130, 248–249
vs. depth, A:104, 247–248
See also faults; foliation; joints; microfractures; microstructures; shear zones
- gabbro
crystallization, B:333–350
density, B:442–444
dikelets, B:246
fluid inclusions, B:410
geochemistry, A:144–148; B:351–362, 491–495
ion probe data, B:339–346
isotopes, B:315–316
lithology and bulk chemistry, B:186–198
magmatic differentiation, B:261
magnesium number, B:254
metamorphism, B:531–546
mineralogy, B:78–93
modal proportions, A:150
petrography, A:145, 235; B:445
petrology, A:62–64; B:68–71
photograph, A:82, 84, 91, 220–224, 269–270; B:137–141, 170
remanent magnetization, B:429–436
static and dynamic metamorphism, A:199–200, 240
- thin sections and textures, A:247
- trace elements, A:142–143, 233
See also metagabbro; metatrotolite; microgabbro; norite; troctolite
- gabbro, brown-clinopyroxene, petrology, A:219–223
- gabbro, cataclastic
alteration, A:156–157
photograph, A:156–157
- gabbro, coarse-grained, photograph, A:128, 221, 224–226
- gabbro, deformed, photograph, B:165
- gabbro, europium/samarium ratio, vs. samarium, B:359
- gabbro, forsterite
vs. anorthite, B:338
vs. nickel oxide, B:338

- gabbro, gneissic
alteration, A:156
petrology, A:48–50, 63–64
photograph, A:53, 224, 243
- gabbro, iron–titanium, phase equilibria, B:536, 540
- gabbro, lanthanum/scandium ratio, vs. ytterbium/
scandium ratio, B:359
- gabbro, lanthanum/ytterbium ratio, vs. ytterbium/
B:359
- gabbro, lead isotopes, vs. strontium isotopes,
B:314
- gabbro, lineated
alteration, A:156
petrology, A:127–129, 261–265
photograph, A:127, 130, 138, 140, 159, 161
- gabbro, magnesium–aluminum, phase equilibria,
B:536, 540
- gabbro, magnesium number
vs. anorthite, B:338
vs. calcium oxide, B:349
vs. nickel, B:354
vs. titanium, B:538
vs. titanium oxide, B:340
- gabbro, magnesium oxide, vs. calcium oxide,
B:349
- gabbro, mylonitized, photograph, B:117
- gabbro, neodymium isotopes, vs. strontium
isotopes, B:311
- gabbro, oceanic, hydrothermal alteration,
B:389–398
- gabbro, oxide
alteration, A:76–78, 155
deformation textures, B:105
distribution, A:133, 228
lanthanum/scandium ratio, vs.
ytterbium/scandium ratio, B:359–360
- lithology and bulk chemistry, B:186–198
- petrography, B:472
- petrology, A:132–134, 226; B:68–71
- photograph, A:54, 89, 135, 137–138, 201;
B:403
- static and dynamic metamorphism,
A:200–201, 239–240
- textures, A:231
- gabbro, pegmatic
alteration, A:156
petrology, A:63, 129, 131
photograph, A:55, 133, 137, 144, 183
- gabbro, porphyroclastic, photograph, B:164
- gabbro, pyroxene-rich, distribution, A:133
- gabbro, rodginized, photograph, A:53
- gabbro, troctolitic
aluminum, vs. magnesium/(magnesium
+ iron + manganese) ratio, B:394
- aluminum, vs. sodium + potassium system,
B:394
- aluminum, vs. titanium, B:394
- modal mineralogy and reaction paths, B:393
- photograph, A:198
- static and dynamic metamorphism,
A:197–198, 241
- gabbroic rocks
anorthite, B:480
bulk chemistry and cryptic geochemical
downhole variations, B:215–222
- calcium–magnesium–iron plot, B:484–487
- chemical composition mean values, B:495
- chromium oxide, B:488–489
- CIPW norms, B:494
- cores, B:186
- deformation, A:158–167, 204–209, 244–251,
267–271
- fluid inclusions, A:86–88, 202; B:404–406
- forsterite, B:481
- geochemistry, A:141–151, 191–193, 231–235;
B:99–121, 491–504
- hydrothermal alteration, A:81–85, 152,
154–158, 195–201, 235–238, 265–267
- hydrothermal veins, A:85–86, 201–202,
241–242; B:155–178
- index properties, A:272–274
- iron–titanium oxides, B:123–141
- isotopes, B:306, 308, 310
- lithology and bulk chemistry, B:186–198
- magmatic evolution, B:77–98
- magnesium number, B:210–211
- mineralogy, B:471–490
- modal layering and cyclicity, A:229–231
- modal variations, A:191
- nickel oxide, B:482–483
- petrography, A:192
- petrology, A:124–141, 152, 181–187, 218–230
- photograph, A:126, 128–129, 246, 250; B:167,
170
- porosity change in time, B:446
- recrystallization, B:143–153
- sodium oxide, B:232–233
- static and dynamic metamorphism,
A:197–201, 238–241
- tectonic windows, B:61–76
- tectonics, A:11
- thin sections and textures, A:165
- trace elements, A:192
- trace-element spider diagrams, B:221
- upper mantle, B:243–264
- vs. depth, A:226–229, 263–264
- See also* intrusions, gabbroic; shear zones,
gabbroic; veins, gabbroic
- gabbroic rocks, aluminum
vs. sodium + potassium system, B:390
vs. titanium, B:390
- gabbroic rocks, calcium number, vs. depth, B:220
- gabbroic rocks, coarse-grained
chemical interactions with ultramafic host
rocks, B:251–260
- mineralogy and texture, B:244–251
- photograph, B:245
- vs. depth, B:244
- gabbroic rocks, compressional wave velocity
vs. density, B:447–453
- vs. shear wave velocity ratio, B:453–454
- gabbroic rocks, density, vs. porosity, B:446
- gabbroic rocks, magnesium number
vs. chromium oxide, B:339
- vs. depth, B:220
- vs. iron oxide, B:218
- vs. sodium oxide, B:339
- gabbroic rocks, olivine-bearing, petrology,
A:261–265
- gabbroic rocks, phosphorus oxide, vs. zirconium,
B:347
- gabbroic rocks, strontium, vs. zirconium, B:347
- gabbroic rocks, titanium, vs. chromium, B:496
- gabbronorite
dikelets, B:246
- geochemistry, B:491–495
- hydrothermal alteration, A:154–155
- localization, B:93–94
- mineralogy, B:78–93
- petrography, B:472
- petrology, A:187–190
- photograph, A:137, 190, 205, 234; B:245
- rare earths, B:345, 347
- static and dynamic metamorphism, A:200–201
- See also* gabbro; norite; olivine gabbronorite
- gabbronorite, mylonitic, photograph, B:84
- gabbronorite, oxide
- mineralogy, B:78–93
- photograph, A:188; B:79, 248
- rare earths, B:345
- static and dynamic metamorphism, A:200–201
- garnet
mineral chemistry, B:528
- mineral/melt partition, B:219
- See also* grossular; hydrogarnet
- geochemistry
crystallization, B:333–350
- gabbroic rocks, B:99–121, 491–504
- peridotites and mafic rocks, B:181–241
- Site 920, A:64–72
- Site 921, A:141–151
- Site 922, A:191–193
- Site 923, A:231–235
- ultramafic rocks, B:457–470
- geochemistry, whole-rock
gabbroic rocks, B:108–110, 351–362, 491
- hydrothermal alteration, B:393–394
- ultramafic rocks, B:457–459
- geodynamics, serpentinization, B:386–387
- geology
intersection massif, B:64–69
- Site 920, B:9–10
- geomorphology
serpentinite outcrops, B:7–13
- tectonic windows, B:63–64
- geothermometry
oxygen isotopes, B:467–468
- shear zones, B:130–132
- glass
melting regime, B:184–185
- glass, magnesium oxide, vs. calcium oxide, B:348
- gneiss. *See* gabbro, gneissic; metagabbro, gneissic
- gneissic texture, gabbroic rocks, B:159–161
- gold, serpentinized peridotites, B:514
- gouge
fabrics, B:148–149
- gabbroic rocks, B:71
- photograph, A:157, 167
- grain size
magnetite and ilmenite, B:130–131
- olivine-bearing ultramafic rocks, A:57
- peridotites, A:58–62
- vs. depth, A:62; B:25
- grains, ribboned, fabrics, B:148–149
- granulite facies, petrology, A:196
- greenschist facies
gabbroic rocks, B:159–161
- hydrothermal alteration, B:389–398
- hydrothermal veins, B:171–172
- petrology, A:196
- photograph, A:53
- See also* metamorphic facies
- grossular
veins, B:524
- See also* garnet; hydrogarnet
- hafnium
gabbro, B:341–342
- See also* zirconium/hafnium ratio
- halite
dissolution temperature, B:408
- fluid inclusions, B:405–406
- photograph, A:91
- halite–water system, pressure, vs. temperature,
B:412
- harzburgite
AFM diagram, B:210
- lattice fabrics, B:23–28
- lithology and bulk chemistry, B:186–198
- melt channels, B:211
- melting spider diagrams, B:214

- oxygen isotopes, B:464–468
 petrology, B:14–16
 photograph, A:56; B:15, 248, 384, 520–521
 replacement, B:266
 websterite, B:321–331
See also dunite; peridotite
 harzburgite, altered, photograph, A:87
 harzburgite, aluminum oxide/silica ratio, vs.
 magnesium oxide/silica ratio, B:213
 harzburgite, depleted, photograph, A:54
 harzburgite, mylonitic, photograph, A:94; B:248
 harzburgite, oxides, vs. depth, B:212
 harzburgite, porphyroclastic
 alteration, A:73–75
 photograph, A:83
 harzburgite, residual, photograph, A:84
 harzburgite, serpentinized
 density, vs. serpentinized fraction, B:447
 dikelets, B:249
 hydrothermal alteration, A:75–76
 mesoscopic character, B:33–34
 petrology, A:48–62
 photograph, A:51–52, 54–55, 58–60, 64,
 70–72, 81–82, 84, 87, 92–94, 97, 100,
 105; B:39, 245, 248
 harzburgite, spinel
 chromium number, vs. across-channel
 variations, B:273
 magnesium number, vs. aluminum number,
 B:270
 magnesium number, vs. chromium number,
 B:269
 magnesium number, vs. nickel oxide, B:272
 magnesium number, vs. titanium oxide, B:272
 nickel oxide, vs. forsterite, B:269, 273
 Hawaiian Pyrolite, aluminum oxide/silica ratio, vs.
 magnesium oxide/silica ratio, B:213
 hedenbergite, hydrothermal veins, B:525
 hematite
 deformation mechanism maps, B:133
 photograph, B:56
 Hess Deep, isotopes, B:306–307
 high-field strength elements
 heterogeneity, B:282–283
 peridotite, B:289–291
 hornblende
 metamorphic minerals, B:536
 mineral chemistry, B:167–170
 photograph, A:53, 72, 139, 146, 198, 201;
 B:158, 166–167, 248
See also amphibole; veins, hornblende–
 actinolite–chlorite
 hornblende, edenitic, hydrothermal veins,
 B:171–172
 hornblende, pargasitic, hydrothermal veins,
 B:171–172
 hummocky terrains, deep-tow photography,
 B:7–13
 hydration
 gabbroic rocks, B:159–161
 hydrothermal veins, B:172
 serpentization, B:47, 49, 51–52, 412
 upper mantle, B:17–18
 hydrofracturing, photograph, A:100
 hydrogarnet
 photograph, A:85
See also garnet, grossular
 hydrogen, fluid inclusions, B:406
 hydrothermal alteration. *See* alteration,
 hydrothermal
 hydrothermal veins. *See* veins, hydrothermal
 hypabyssal rocks
 petrology, A:62–64
See also intrusives; mafic rocks; ultramafic
- rocks
 hypersolidus, deformation, B:106–108
 igneous layering
 gabbroic rocks, A:126–141
 modal layering and cyclicity, A:229–231
 igneous petrology
 Site 920, A:51–64
 Site 921, A:126–141
 Site 922, A:182–191
 Site 923, A:219–231
 Site 924, A:263–265
 igneous rocks, mineralogy, B:78–93
 igneous units
 definition, A:135–141
 gabbroic rocks, A:190–193
 ilmenite
 backscattered electron images, B:139–141
 dikelets, B:247
 gabbros, B:338, 341
 mineral chemistry, B:539–540
 phase equilibria, B:540
 photograph, A:199; B:528
 shear zones, B:130–132
See also oxide, iron–titanium
 ilvaite
 hydrothermal veins, B:524
 mineral chemistry, B:529
 photograph, B:529
 inclusions, nodular, websterite, B:321–331
 index properties
 crystalline rocks, A:112–113, 172, 255, 273
 gabbroic rocks, A:173–175, 211–214,
 254–257, 272–274
 vs. depth, A:173–175
 instrumental neutron activation analysis data,
 gabbro, B:339–346
 intergrowths, spinel–orthopyroxene–
 clinopyroxene, photograph, A:60
 intersection massif, geology, B:64–69
 intrusions
 bulk-rock and mineral chemistry, B:198–215
 evolution, B:72–74
 gabbro, A:63
 serpentization, B:47
 intrusions, gabbroic, deformation, B:16
 intrusives, oxide-bearing, petrology, A:187–190
 ion probe data, gabbros, B:339–346
 iron
 gabbros, B:82, 93
 pyroxene in gabbroic rocks, B:484–487
 websterite, B:329
See also aluminum + iron + titanium system;
 magnesium/(magnesium + iron +
 manganese) ratio; titanium/
 (aluminum + iron + titanium) ratio
 iron/(iron + magnesium) ratio, vs. chromium/
 (chromium + aluminum) ratio, B:516
 iron oxide
 AFM diagram, B:210
 gabbroic rocks, A:133–134; B:108–109, 495
 harzburgite, A:74
 mafic and ultramafic rocks, B:187–189, 198
 photograph, A:137–138, 154, 190, 196–197,
 199; B:146, 170
 vs. across-channel distance, B:272
 vs. depth, B:111
 vs. magnesium number, B:218
 vs. magnesium oxide, B:366
 vs. samarium, B:347
 vs. sodium oxide, B:184–185, 188
See also veins, chlorite–iron oxides
 iron oxide/magnesium oxide ratio, vs. sodium
 oxide, B:218, 235
- iron/silicon ratio, vs. loss on ignition, A:148
 isothermal remanent magnetization. *See* remanent
 magnetization, isothermal
 isotopes
 diabase, B:365, 367–370, 372, 376
 gabbroic rocks, B:99–121, 351–362, 471–490
 mantle heterogeneity, B:305–319
 websterite, B:325
- joints
 brittle deformation, A:97–98
 downhole variations, A:249–250
 gabbroic rocks, A:160, 206, 269
See also deformation; faults; fractures
- Kane Transform
 diopside, B:277–284
 drilling, A:5
 fluid evolution, B:399–415
 gabbroic rocks, B:77–98, 491–504
 geochemistry, B:181–241
 geology, A:8–13
 seismic velocities, B:437–454
 site description, A:45–119, 121–177
 ultramafic rocks, B:457–470
See also MARK area; median valley;
 Mid-Atlantic Ridge
- kinematics, recrystallization, B:149
 kink bands, photograph, B:119–120
 Koenigsberger ratio, gabbros, A:169; B:430–431
- lanthanum
 diabase, B:223
 gabbroic rocks, B:108–109
 vs. depth, B:111
 vs. lanthanum/ytterbium ratio, B:217, 230
- lanthanum, chondrite-normalized
 vs. chondrite-normalized cerium, B:234
 vs. chondrite-normalized ytterbium, B:234
- lanthanum/samarium ratio
 gabbro, B:341–342
 mafic and ultramafic rocks, B:184–185, 188
- lanthanum/scandium ratio, vs. ytterbium/scandium
 ratio, B:359–360
- lanthanum/ytterbium ratio
 distribution, B:235
 modal clinopyroxene, B:231
 modal olivine, B:231
 modal plagioclase, B:231
 modal plagioclase/modal clinopyroxene ratio,
 B:231
 vs. aluminum oxide, B:232
 vs. lanthanum, B:217, 230
 vs. magnesium oxide/silica ratio, B:232
 vs. nickel, B:232
 vs. phosphorous oxide, B:233
 vs. scandium, B:232
 vs. ytterbium, B:230, 359
 vs. zirconium, B:233
- laths, photograph, A:227–228
 lava
 deep-tow photography, B:7–13
 lava, magnesium number, vs. calcium oxide,
 B:349
- lava, magnesium oxide, vs. calcium oxide, B:349
- lead isotopes
 diabase, B:365, 367, 376
 gabbroic rocks, B:109, 113, 115, 355–358
 minerals in gabbro, B:316
 plutonic rocks, B:308–312
 vs. strontium isotopes, B:314
 websterite, B:325
- lead isotopes (clinopyroxene), vs. lead isotopes
 (plagioclase), B:312

lead isotopes (plagioclase), vs. lead isotopes (clinopyroxene), B:312
 lead-204. *See* lead-206/lead-204 ratio; lead-207/lead-204 ratio; lead-208/lead-204 ratio
 lead-206/lead-204 ratio
 vs. lead-207/lead-204 ratio, B:116, 312, 327, 358, 369
 vs. lead-208/lead-204 ratio, B:116, 312, 327, 358, 369
 lead-207/lead-204 ratio, vs. lead-206/lead-204 ratio, B:116, 312, 327, 358, 369
 lead-208/lead-204 ratio, vs. lead-206/lead-204 ratio, B:116, 312, 327, 358, 369
 leucocratic texture. *See* segregations, leucocratic; veins, leucocratic
 lherzolite
 lithology and bulk chemistry, B:186–198
 melt channels, B:211
 petrology, A:48–51
 replacement, B:266
 See also harzburgite; peridotite; spinel-lherzolite facies
 lherzolite, aluminum oxide/silica ratio, vs. magnesium oxide/silica ratio, B:213
 lherzolite, magnesium number
 vs. aluminum number, B:270
 vs. chromium number, B:269
 lherzolite, nickel oxide, vs. forsterite, B:269
 lineation
 crystal-plastic deformation, B:31
 hydrothermal veins, B:170–175
 magnetic fabric, B:422–424
 photograph, A:130, 224; B:164
 See also deformation; foliation; gabbro, lineated
 lithologic units
 Site 920, A:48–51
 Site 921, A:124–126
 Site 922, A:181–182
 Site 923, A:218–219
 Site 924, A:261–262
 vs. depth, A:107
 lithosphere, oceanic
 accretion, A:5
 See also crust, oceanic
 lizardite
 serpentization, B:38–39, 42, 47
 X-ray diffraction data, B:50
 loss on ignition
 harzburgite, A:73
 vs. iron/silicon ratio, A:148
 vs. strontium isotopes, B:113
 mackinawite, hydrothermal veins, B:524
 mafic rocks
 bulk-rock geochemistry, A:65–69
 geochemistry, A:68; B:181–241
 structures, A:98–100
 See also hypabyssal rocks; intrusives; ultramafic rocks
 magma
 primary or parental sources, B:370–373
 See also textures, magmatic; veins, felsic, magmatic; veins, magmatic; volatiles, magmatic
 magma, parental, geochemistry, B:341–346
 magma chambers
 fractionation, B:225
 isotopes, B:305–319
 magma channeling
 modification of peridotites, B:270–271
 peridotites, B:265–275
 magma mixing, fractionation, B:225
 magma transport, fractionation, B:261–263

magmatic differentiation, magmatic rocks, B:261–263
 magmatic evolution, gabbroic rocks, B:77–98
 magnesium
 gabbros, B:82, 93
 pyroxene in gabbroic rocks, B:484–487
 See also iron/(iron + magnesium) ratio
 magnesium/(magnesium + iron + manganese) ratio, vs. aluminum, B:394
 magnesium number
 augite, B:158–160
 average in igneous and recrystallized clinopyroxene and orthopyroxene, B:96
 bulk-rock and mineral chemistry, B:203–205
 clinopyroxene, B:217, 256, 260
 crystallization, B:210–211
 diabase, B:223
 fractionation, B:261–263
 gabbroic rocks, B:108–109, 335–338, 342, 348, 352–355
 gabbronorite, B:93–94
 harzburgite, A:74
 mafic and ultramafic rocks, B:187–189, 198
 mafic rocks, A:68
 magma channeling, B:271
 metamorphism, B:391–393
 olivine, B:459
 peridotites, B:278–280
 plutonic rocks, B:218
 titanium oxide, B:279
 variations in deformed clinopyroxene, orthopyroxene, and olivine samples, B:98
 vs. across-channel distance, B:272–273
 vs. aluminum number, B:270
 vs. aluminum oxide, B:279, 299
 vs. anorthite, B:251, 338
 vs. calcium oxide, B:349
 vs. calcium oxide/(calcium oxide + sodium oxide) ratio, B:218
 vs. chromium, A:147, 239; B:538
 vs. chromium number, B:269, 281, 299, 325
 vs. chromium oxide, B:254, 279, 339
 vs. depth, A:151; B:111, 211, 220, 223, 225, 255
 vs. distance from dikelet, B:259
 vs. iron oxide, B:218
 vs. magnesium oxide/silica ratio, B:210
 vs. major oxides, A:147, 194, 239
 vs. nickel, A:147, 194, 239; B:354
 vs. nickel oxide, B:259
 vs. remanent magnetization, B:432
 vs. silica, B:175–176
 vs. sodium, B:538
 vs. sodium oxide, A:147; B:218, 254, 279, 339
 vs. strontium, B:282
 vs. titanium, B:538
 vs. titanium oxide, B:254, 260, 340, 515
 vs. yttrium, A:147, 194, 239
 vs. zinc, A:147
 vs. zirconium, A:79, 239; B:282
 See also nickel oxide/magnesium number ratio
 magnesium number, in clinopyroxene
 vs. anorthite content, B:94
 vs. major oxides, B:95
 magnesium oxide
 AFM diagram, B:210
 bulk-rock and mineral chemistry, B:199–205
 diabase, B:223, 364–365, 371
 gabbroic rocks, B:495
 harzburgite, A:73–74
 olivine, B:300
 peridotites, B:289

vs. aluminum oxide, A:75; B:366
 vs. calcium oxide, B:348–349, 366, 371
 vs. chromium, A:78
 vs. iron oxide, B:366
 vs. nickel, A:78; B:366
 vs. sodium oxide, B:366
 vs. titanium oxide, A:79; B:366
See also iron oxide/magnesium oxide ratio
 magnesium oxide/FMM ratio, vs. aluminum oxide/FMM ratio, B:215
 magnesium oxide/silica ratio
 bulk-rock and mineral chemistry, B:205–208
 vs. aluminum oxide/silica ratio, A:75; B:213
 vs. depth, B:212
 vs. lanthanum/ytterbium ratio, B:232
 vs. magnesium number, B:210
 magnesium/silicon ratio, vs. aluminum/silicon ratio, B:300
 magnetic anisotropy
 crystalline rocks, A:107, 109–110
 magnetic susceptibility, B:421–422
 reorientation of structural features, B:553–556
 serpentized peridotites, B:419–427
 vs. remanent inclination, A:114
 See also magnetic susceptibility
 magnetic anisotropy, degree, vs. magnetic fabric, B:422
 magnetic anomalies, crust, B:436
 magnetic declination
 change with orientation, B:556
 vs. depth, A:106–107; B:434, 549
 magnetic fabric
 vs. degree of anisotropy, B:422–424
 See also fabric; petrofabric
 magnetic fabric, foliation, vs. lineation, B:421
 magnetic inclination
 change with orientation, B:556
 gabbroic rocks, A:167–171, 253–254
 histogram, A:110, 171
 vs. depth, A:106–107, 168–169, 210, 251, 271; B:434, 549
 magnetic inclination, paleomagnetic, rotation paths, A:115
 magnetic inclination, remanent, vs. magnetic susceptibility, A:114
 magnetic intensity, vs. depth, A:106–107, 168, 210, 251, 271
 magnetic polarity, gabbroic rocks, A:167–171, 211, 253–254; B:432–433
 magnetic properties
 crystalline rocks, A:272
 discrete sample measurements, A:107, 109–110, 168–169, 210, 252–253, 271–272
 gabbroic rocks, A:170, 211, 252
 summary, A:108–109
 whole-core and half-core measurements, A:271
 whole-core measurements, A:106–107, 167–168, 209–210, 251–252
 magnetic susceptibility
 gabbroic rocks, A:167–171, 253
 vs. depth, A:107, 168, 251, 271
 vs. remanent inclination, A:114
 See also magnetic anisotropy
 magnetite
 alteration, B:433–434
 backscattered electron images, B:139–141
 deformation mechanism maps, B:133
 gabbros, B:338, 341
 hydrothermal veins, A:79; B:524
 magnetic fabric, B:422–423
 mineral chemistry, B:539–540
 oxygen isotopes, B:382–385, 466

photograph, A:87, 89; B:41, 427, 527, 529
 serpentization, B:42
 shear zones, B:130–132
See also ilmenite; oxide; titanomagnetite
magnetite, titanium
 phase equilibria, B:540
 photograph, B:528
See also ilmenite; oxide; titanomagnetite
major elements
 diabase, B:364–365
 diopside, B:277–280
 gabbros, B:352–355, 492
 peridotites, B:289
 peridotites and mafic rocks, B:181–241
 troctolite, B:396
 websterite, B:323–325
major oxides
 diabase, A:148
 gabbroic rocks, A:142–143, 192, 233
 peridotites, A:61, 66–68
manganese. *See* magnesium/(magnesium + iron + manganese) ratio
manganese oxide, AFM diagram, B:210
mantle
 composition, A:10–11
 composition and structure, B:505–521
 diabase, B:375
 diopside, B:277–284
 dynamics, B:317
 heterogeneity, B:282–283, 305–319
 melting spider diagrams, B:214
 mineral/melt partition coefficients, B:228
 serpentization, B:44, 47
 sources, B:315
See also melt–mantle interactions
mantle, altered, crystalline rocks, A:114–115
mantle, aluminum oxide/silica ratio, vs.
 magnesium oxide/silica ratio, B:213
mantle refertilization, bulk-rock and mineral chemistry, B:205–208
mantle, residual, crystallization, B:208–213
mantle, upper
 gabbroic rocks, B:243–264
 mineral chemistry, B:274
 seismic velocity, B:437–454
 uplift and exposure, B:17–18
MARK area
 crystallization, B:333–350
 deformation of iron–titanium oxides, B:123–141
 diabase dikes, B:363–377
 diopside, B:277–284
 drilling, A:5–13
 fluid evolution, B:399–415
 gabbroic rocks, B:351–362, 471–504
 gabbroic shear zones, B:99–121
 geochemistry, B:181–241
 hydrothermal alteration, B:389–398
 hydrothermal veins, B:155–178
 mantle heterogeneity, B:305–319
 metamorphism, B:531–546
 microfabrics and recrystallization, B:143–153
 peridotites, B:265–275
 remanent magnetization, B:429–436, 547–559
 seismic velocities, B:437–454
 serpentization, B:35–59
 tectonic windows, B:61–76
 tectonics, B:5–21
 ultramafic rocks, B:457–470
See also Kane Transform; median valley; Mid-Atlantic Ridge
median valley
 intersection massif, B:64–69
 tectonics, B:5–21

See also Kane Transform; MARK area; Mid-Atlantic Ridge
melt
 crystallization, B:208–213
 gabbroic rocks, B:93–94, 109–110, 113
 perfect fractional crystallization, B:229
 peridotites, B:294
See also mineral/melt partition coefficients
 melt, in equilibrium with clinopyroxene, B:231–234
melt channels, pyroxenite, B:211
melt–mantle interactions, fractionation, B:261–263
melt migration, magnetite, B:133–134
melt–rock interactions, composition, B:82–83, 93
melting
 bulk–rock and mineral chemistry, B:205–208
 bulk–rock composition, B:215
 depth and degree, B:373–376
 diabase, B:227
 geochemistry, B:183–186
 heterogeneity, B:282–283
 spider diagrams, B:214
 tectonics, B:234–235
melting, aluminum oxide/FMM ratio, vs.
 zirconium/FMM ratio, B:216
mesh textures
 photograph, B:40–41
 serpentization, B:48–49
metabasalt
 fluid inclusions, B:410
See also basalt
metadiabase
 geochemistry, B:491–495
See also diabase
metagabbro
 alteration, A:81–82
 photograph, B:70
See also gabbro; metagabbro; mylonite, porphyroclastic, metagabbroic; olivine metagabbro; veins, metagabbroic
metagabbro, altered, photograph, A:96
metagabbro, cataclastic, photograph, A:126
metagabbro, gneissic, photograph, A:90
metagabbro, oxide, alteration, A:81–82
metagabbro, porphyroclastic, alteration, A:83–84
metamorphic facies
 gabbros, B:536
See also granulite facies; greenschist facies
metamorphic petrology
 Site 920, A:72–92
 Site 921, A:151–158
 Site 922, A:193–204
 Site 923, A:235–244
 Site 924, A:265–267
metamorphic rocks, petrology, A:72–91, 151–158, 193–204, 235–244, 265–267
metamorphism
 assemblages, B:68–69
 fluid evolution, B:401–404
 gabbroic rocks, B:159–161, 389–398, 531–546
 peridotites, B:16–17
 recrystallization, A:267
 serpentization, B:44, 47
 shear zones, B:157–159
 metamorphism, dynamic, gabbroic rocks, A:197–201, 238–241
metamorphism, static, gabbroic rocks, A:197–201, 238–241
metasomatism
 hydrothermal alteration, B:397
 peridotites, A:66–67
metatrotolite
 petrology, A:182
See also gabbro, troctolitic; troctolite
methane
 fluid inclusions, B:406
 salinity, B:411–412
microcracks
 compressional wave velocity, B:443
 hydrothermal veins, B:162
 photograph, B:149
 porosity, B:440–442
See also cracks; fractures
microfractures
 gabbroic rocks, A:207
 photograph, A:91, 154, 203; B:406
See also faults; foliation; fractures; joints; microcracks; microstructures; shear zones
microgabbro
 hydrothermal veins, B:158–159
 petrology, A:63–64
 photograph, A:225–226, 234; B:160
See also gabbro; metagabbro; olivine microgabbro; veins, microgabbro
microgabbro, amphibolitized, photograph, A:72
micropeginite, photograph, A:157
microstructures
 gabbroic rocks, A:209; B:101–105, 151–153
 photograph, B:118–121, 149
 shear zones, B:128–129
 vs. depth, A:208–209, 271
See also cataclastic zones; deformation; faults; foliation; fractures; joints; microfractures; shear zones
microstructures, semibrittle, photograph, B:149
Mid-Atlantic Ridge
 drilling, A:5–13
 fluid evolution, B:399–415
 gabbroic rocks, B:77–98, 243–264
 geochemistry, B:181–241
 metamorphism, B:531–546
 seismic velocities, B:437–454
 site description, A:45–119, 121–177, 179–215, 217–274
 spreading centers, A:5
See also Kane Transform; MARK area; median valley
mid-ocean ridges
 composition, A:10–11
 crystalline rocks, A:114–115
 lithosphere, A:5
 serpentization, B:23–34
mineral chemistry
 gabbroic rocks, B:491–495
 hydrothermal veins, B:167–170
 metamorphic minerals, B:534–539
 peridotites, B:266–270
 ultramafic rocks, B:457–470
mineral/melt partition coefficients
 basaltic magma, B:228
 olivine, pyroxene, and garnet, B:219
mineralization, serpentized peridotites, B:52–54
mineralogy
 gabbros, B:334–335, 471–490
 seismic velocity, B:444–445
 serpentization, B:382
monticellite, metamorphic minerals, B:536
mylonite
 gabbroic rocks, B:71–74, 104–105
 petrology, A:63–64
 photograph, A:94, 200, 224; B:34, 79, 120, 245
 tectonics, B:44, 47
 ultramafic composition, B:246
See also gabbro, mylonitic; harzburgite, mylonitic; protomylonitic zones; shear

- zones, mylonitic
- mylonite, porphyroclastic
alteration, A:75–76
photograph, A:82, 90–91
- mylonite, porphyroclastic, metagabbroic,
alteration, A:84–85
- mylonitic zones, gabbroic rocks, B:159–161
- mylonitization. *See* gabbro, mylonitized
- natural remanent magnetization. *See* remanent magnetization, natural
- neoblasts
gabbroic rocks, B:159–161
photograph, A:129, 137, 156, 160, 166–167, 201, 203; B:119, 148–149, 520
recrystallization, B:101–105
size variation, B:146–148
- neoblasts, twinned
photograph, A:128
See also twinning
- neodymium
diabase, B:364–365
peridotites, B:291
- neodymium isotopes
diabase, B:365, 367, 376
gabbroic rocks, B:109, 113, 115, 355–358, 471–490
minerals in gabbro, B:316
plutonic rocks, B:308–312
vs. strontium isotopes, B:311, 326, 358, 368
websterite, B:325
- neodymium isotopes (clinopyroxene), vs.
neodymium isotopes (plagioclase), B:312
- neodymium isotopes (plagioclase), vs.
neodymium isotopes (clinopyroxene), B:312
- nickel
diabase, B:223, 364–365, 372
gabbros, B:352–355
vs. chromium/nickel ratio, A:148, 195, 240
vs. depth, A:78
vs. lanthanum/ytterbium ratio, B:232
vs. loss on ignition, A:72
vs. magnesium number, A:147, 194, 239; B:354
vs. magnesium oxide, A:78; B:366
vs. zirconium, B:373
See also chromium/nickel ratio
- nickel oxide
olivine in gabbroic rocks, B:482–483
vs. across-channel distance, B:272
vs. forsterite, B:269, 273, 338
vs. magnesium number, B:259
- nickel oxide/magnesium number ratio, vs. depth, B:255
- nickel sulfide. *See* sulfide, iron–nickel
- niobium, gabbroic rocks, B:496
- norite
mineralogy, B:78–93
See also gabbro; gabbronorite; olivine norite
- NRM. *See* remanent magnetization, natural
- oikocrysts
photograph, A:132, 221, 227–228, 230, 237; B:118
recrystallization, B:101–105
- olivine
alteration, A:151, 195–196, 235–236, 265, 267
chemical modifications in peridotite near gabbroic dikelets, B:259
crystal-plastic fabric, A:95
forsterite, B:217
gabbroic rocks, A:126–141, 181–193, 218–231; B:335–336, 472–473, 476–477
- harzburgite, B:266–267
- lanthanum/ytterbium ratio, B:231
- magnesium oxide, B:300
- metamorphism, B:401–404
- mineral chemistry, B:459–460, 497, 536, 539
- mineral/melt partition, B:219
- modal proportions, A:150, 241
- nickel oxide, B:482–483
- oxygen isotopes, B:466
- peridotites, A:52–58, 60; B:277–278, 290, 506–507
- phase equilibria, B:536
- photograph, A:58, 64, 81–82, 89–90, 94, 127, 129, 131–132, 134–135, 138–139, 144, 154, 167, 183–188, 196–200, 203, 206, 220–232, 234, 236–237, 244, 262, 264–266; B:33–34, 48, 84, 118–121, 138, 146–147, 158, 160, 248, 384, 392–393, 401, 502
- plutonic rocks and ultramafics, B:251, 254–255, 257–260
- preferred orientation, B:26–29
- recrystallization, B:101–105, 144–145
- serpentinitization, B:382
- textures, B:24–28
- ultramafic rocks, A:57, 60, 72
- variations of magnesium number in deformed samples, B:98
- vs. depth, A:151, 239, 267; B:225
- vs. feldspar, B:395
- websterite, B:321–331
See also forsterite; gabbro, poikilitic, olivine; gabbroic rocks, olivine-bearing; ultramafic rocks, olivine-bearing
- olivine, degree of recrystallization, vs. degree of recrystallization of plagioclase, B:145
- olivine, forsterite, vs. nickel oxide, B:273, 338
- olivine, grain size, vs. depth, A:62
- olivine, magnesium number, vs. nickel oxide, B:272
- olivine, oxides, vs. depth, B:212
- olivine gabbro
alteration, A:154
geochemistry, A:144–148; B:491–495
lithology and bulk chemistry, B:186–198
mineralogy, B:78–93
modal layering, A:231
petrography, B:471
petrology, A:182–186, 261–265; B:68–71
photograph, A:134–135, 138, 183, 185, 188–189, 203, 220, 223, 225, 227, 231–232, 237, 244, 264–266, 270; B:79, 84, 161, 165–167, 401, 403
- rare earths, B:345, 347
- relation to oxide gabbro and norite, B:82
- remanent magnetization, B:431
- static and dynamic metamorphism, A:198–199, 240
- tectonics, A:11
- olivine gabbro, poikilitic
composition, B:336–337
- petrology, A:131–132, 186–187, 223–226, 263
- photograph, A:127, 131–132, 139–140, 144, 221, 225, 228, 262
- olivine gabbronorite
geochemistry, B:491–495
See also gabbro; norite
- olivine metagabbro
photograph, B:402
See also metagabbro
- olivine microgabbro
dikelets, B:246
- photograph, B:248
See also microgabbro
- olivine norite
geochemistry, B:491–495
See also norite
- olivine, recrystallized, composition, B:81–82, 90–93
- olivine, serpentinitized, photograph, A:51
- optical indicatrix axes, gabbroic rocks, B:105–107
- orthopyroxene
alteration, A:153–154, 197, 236
crystal-plastic fabric, A:92–95
gabbroic rocks, B:338, 340, 473–474, 479
mafic and ultramafic rocks, B:184–185, 189
- magnesium number average in igneous and recrystallized material, B:96
- metamorphism, B:401–404
- mineral chemistry, B:459, 461–462, 498, 535–536
- mineral/melt partition, B:219
- peridotites, A:52–58, 60; B:269, 279–280, 291, 296–297, 507–511
- phase equilibria, B:536
- photograph, A:59, 63, 72, 90, 137, 154; B:34, 48, 138, 248, 520–521, 529
- preferred orientation, B:26–29
- serpentinitization, B:382
variations of magnesium number in deformed samples, B:98
See also clinopyroxene; clinopyroxene/orthopyroxene ratio; pyroxene
- orthopyroxene, chromium number
vs. aluminum oxide, B:299
vs. magnesium number, B:299
- orthopyroxene, grain size, vs. depth, A:62
- orthopyroxene, porphyroclasts, photograph, A:51, 64, 81, 88, 92–94, 97
- orthopyroxene, recrystallized, composition, B:81–82, 90–93
- osmium, peridotites, B:518
- overprinting, recrystallization, B:149
- oxide
gabbroic rocks, A:187–191; B:338, 341
hydrothermal alteration, B:523–529
photograph, B:165
See also intrusions, oxide-bearing; metagabbro, oxide
- oxide, iron–titanium
deformation textures, B:105
photograph, A:155, 189; B:125, 137–141, 248
rheology, B:123–141
See also titanomagnetite
- oxide gabbro. *See* gabbro, oxide
- oxide gabbronorite. *See* gabbronorite, oxide
- oxide metagabbro. *See* metagabbro, oxide
- oxygen isotopes
magnetite, B:382–385
plutonic rocks, B:309–310, 312–313
serpentine, B:382–385
serpentinitization, B:381–388
temperature, B:467–468
ultramafic rocks, B:464–468
vs. fluid/rock ratio, B:386
- oxygen isotopes (clinopyroxene), vs. oxygen isotopes (plagioclase), B:313
- oxygen isotopes (plagioclase), vs. oxygen isotopes (clinopyroxene), B:313
- oxygen isotopes, whole-rock values, vs. mineral values, B:467
- paleomagnetism
Site 920, A:106–111
Site 921, A:167–171
Site 922, A:209–211

- Site 923, A:251–254
 Site 924, A:271–272
 paleopiezometry, magnetite and ilmenite, B:132–133
 palladium
 peridotites, B:518
See also platinum group elements
 pargasite. *See* hornblende, pargasitic
 pegmatite. *See* gabbro, pegmatic;
 micropegmatite; pyroxenite, pegmatic
 pentlandite
 hydrothermal veins, B:524
 serpentization, B:38–39
 peridotite
 brittle deformation, A:95–98
 bulk-rock composition, B:299–300
 density, B:442–444
 diopside, B:277–284
 high-temperature ductile deformation, B:23–34
 hydrothermal veining, B:35–59
 isotopes, B:306, 315–316
 magma channeling, B:265–275
 magnesium number, B:210, 254
 magnesium oxide in olivine, B:300
 modal mineralogy, A:52–58, 60
 petrography, B:444
 petrology, A:48–62
 photograph, A:53, 58; B:12
 porosity, B:440–442
 serpentization, B:35–59, 382
 sodium oxide, B:231–234
 subaxial history, B:16–17
 textures and grain size, A:58–62
 trace elements, B:289–291
See also dunite; harzburgite
 peridotite, abyssal
 chromium number, vs. magnesium number, B:281
 chromium, vs. cerium/ytterbium ratio, B:283
 geochemistry, B:181–241
 magnesium number, vs. strontium, B:282
 magnesium number, vs. zirconium, B:282
 rare earths, B:282
 titanium oxide, vs. aluminum oxide, B:283
 peridotite, aluminum/silicon ratio, vs.
 magnesium/silicon ratio, B:300
 peridotite, aluminum oxide/silica ratio, vs.
 magnesium oxide/silica ratio, B:213
 peridotite, cesium, vs. barium, B:302
 peridotite, chromium number
 vs. aluminum oxide, B:299
 vs. magnesium number oxide, B:299
 peridotite, chromium oxide
 vs. aluminum oxide, B:288, 514
 vs. calcium oxide, B:288
 peridotite, iron/(iron + magnesium) ratio, vs.
 chromium/chromium + aluminum ratio, B:516
 peridotite, magnesium number
 vs. aluminum oxide, B:299
 vs. chromium oxide, B:339
 vs. sodium oxide, B:339
 peridotite, residual
 abyssal, sodium oxide, B:232
 melting regime, B:185–186
 peridotite, serpentized
 bulk-rock geochemistry, A:69
 composition and structure, B:505–521
 compressional wave velocity, vs. density, B:447–448, 453
 compressional wave velocity, vs. shear wave velocity ratio, B:453–454
 crystal-plastic fabric, A:92–95
 density, vs. porosity, B:446
 gold, B:514
 hydrothermal alteration, A:73–76
 magmatic differentiation, B:261
 magnesium number, vs. nickel oxide, B:259
 magnesium number, vs. titanium oxide, B:515
 magnetic anisotropy, B:419–427
 photograph, A:55; B:384
 porosity change in time, B:446
 spinel and clinopyroxene, B:256
 tectonics, A:11–12
 velocity, vs. serpentized fraction, B:447
 peridotite, strontium/zirconium ratio, vs.
 zirconium, B:302
 peridotite, suboceanic
 aluminum, vs. sodium, B:271
 heterogeneity, B:285–303
 titanium, vs. sodium, B:270
 peridotite, zirconium/hafnium ratio, vs. zirconium, B:302
 permeability, serpentization, B:386–387
 petrofabric
 gabbroic rocks, B:105–106
 magnetic fabric, B:422–423
See also fabric; magnetic fabric
 petrography
 alteration, B:523
 gabbro, B:445
 gabbroic rocks, A:145, 192, 235; B:334–335, 471–472
 magnetic fabric, B:422–423
 metamorphic minerals, B:531–534
 peridotites, B:265–270, 444
 phase equilibria
 clinopyroxene–olivine–quartz system, B:348
 gabbroic rocks, B:495–496
 hydrothermal alteration, B:523–529
 metamorphic minerals, B:536, 540
 metamorphism, B:391–393
 serpentization, B:47–49
 phenocrysts, photograph, A:72
 phosphorus oxide
 vs. lanthanum/ytterbium ratio, B:233
 vs. titanium oxide, A:195
 vs. zirconium, B:347
 physical properties
 gabbroic rocks, A:212
 Site 920, A:111–115
 Site 921, A:171–176
 Site 922, A:211–215
 Site 923, A:254–257
 Site 924, A:272–274
 physical properties units, gabbroic rocks, A:255–257
 piezometry. *See* paleopiezometry
 pigeonite
 metamorphic minerals, B:536
See also pyroxene
 pillow lava, photograph, B:11
 plagioclase
 anorthite average in igneous and recrystallized material, B:96
 anorthite variations in deformed samples, B:98
 dikes, B:249–251
 fluid inclusions, B:404–406
 gabbroic rocks, A:126–141, 181–193, 218–231; B:335, 337, 472–475
 hydrothermal alteration, A:153–154, 197, 236, 238, 267
 hydrothermal veins, A:163, 267
 lanthanum/ytterbium ratio, B:231
 metamorphism, B:401–404
 mineral chemistry, B:158–160, 167–170, 502–504, 539–540
 modal proportions, A:150, 241
 neoblasts, B:148–149
 phase equilibria, B:540
 photograph, A:70, 72, 85, 89–91, 129, 131–132, 134, 137–139, 141, 144, 146, 154–160, 166–167, 183–186, 189–190, 200–201, 203, 205–206, 220, 222, 224, 227–228, 230, 237, 243–244, 264, 266, 268; B:84, 118–121, 138, 146, 150, 158, 160–161, 166, 170, 174, 245, 248, 403, 406
 rare earths, B:344
 recrystallization, B:101–105, 144–145
 vs. calcium oxide/aluminum oxide ratio, A:147
 vs. depth, A:267
See also neodymium isotopes (plagioclase); oxygen isotopes (plagioclase); strontium isotopes (plagioclase); veins, chlorite–plagioclase–quartz; veins, plagioclase–rich
 plagioclase, altered, photograph, A:85
 plagioclase, anorthite, vs. strontium, B:347
 plagioclase, degree of recrystallization, vs. degree of recrystallization of olivine and clinopyroxene, B:145
 plagioclase, heteradecumulus, photograph, A:236
 plagioclase, igneous, composition, B:80–81, 83, 87–89
 plagioclase, lanthanum/ytterbium ratio, vs. ytterbium, B:359
 plagioclase, recrystallized, composition, B:81–82, 87–89
 plagioclase, zoned, photograph, A:72
 plagioclase/clinopyroxene ratio, vs. lanthanum/ytterbium ratio, B:231
 planar features
 magnetic susceptibility, B:553
See also preferred orientation
 plastic flow, structures, B:28–29
 plates, bathymetry, A:10–11
 platinum group elements
 serpentized peridotites, B:514–517
See also palladium
 plutonic rocks
 geochemistry, B:181–241
 isotopes, B:305–319
 lanthanum/ytterbium ratio, B:232
 magnesium number, B:218
 petrology, A:62–64
 sodium oxide, B:232
See also hypabyssal rocks; igneous rocks; intrusives; mafic rocks; ultramafic rocks
 poikilitic texture
 photograph, A:187–188
See also olivine gabbro, poikilitic
 Poisson's ratio, crystalline rocks, B:445–448
 polymimetic aggregates, photograph, A:81
 polymimetic lens, photograph, A:63
 porosity
 change in time, B:446
 microcracks, B:440–442
 vs. compressional wave velocity, A:176, 214; B:443
 vs. density, A:257, 273; B:446
 vs. depth, A:117, 174–175, 213, 256
 vs. formation factor, A:176, 214, 257, 274
 vs. resistivity, A:119
 vs. seismic velocity, A:118; B:440–442
 porphyroclastic texture
 gabbroic rocks, B:159–161
 peridotites, B:12
See also gabbro, porphyroclastic

- porphyroclasts
backscattered electron images, B:139–141
gabbroic rocks, B:104
harzburgite, B:23–28
orthopyroxene, B:459
photograph, A:59, 166, 190, 200–201, 205, 223–224, 238, 243, 248, 269; B:39, 47–49, 84, 117, 119–121, 125, 137–141, 146–147, 520–521
serpentization, B:42
See also harzburgite, porphyroclastic; metagabbro, porphyroclastic; mylonite, porphyroclastic; orthopyroxene, porphyroclasts
- porphyroclasts, orthopyroxene, photograph, A:51, 64, 81, 92–94, 97
- postcumulus, crystallization, B:333–350
- potassium. *See* sodium + potassium system
- potassium oxide
AFM diagram, B:210
diabase, B:223
gabbroic rocks, B:495
vs. anorthite, B:96
- potassium/titanium ratio, mafic and ultramafic rocks, B:184–185, 187
- preferred orientation
magnetic susceptibility, B:553
olivine and orthopyroxene, B:26–29
photograph, A:92–93, 128, 159, 205, 223–224; B:117
shear zones, B:157–159
See also planar features
- prehnite
hydrothermal veins, A:85–86, 202, 242
metamorphic minerals, B:536
photograph, A:54–55, 84, 89–91, 100, 157, 198, 243
See also veins, chlorite–prehnite; veins, epidote–prehnite
- pressure
crystallization, B:348–349
vs. compressional wave velocity, B:443
- primocrysts, photograph, A:236
- protomylonitic zones
gabbroic rocks, B:159–161
See also mylonite
- pseudomorphism, serpentization, B:38–39
- pseudomorphs, photograph, A:264–265; B:48
- pyrite
hydrothermal veins, A:79–80; B:524
photograph, B:56
serpentization, B:42
- pyrolite. *See* Hawaiian Pyrolite
- pyroxene
calcium–magnesium–iron plot, B:484–487
foliation dip, B:30
isotopes, B:310
oxygen isotopes, B:466
photograph, A:84, 133, 160, 269; B:41
vs. calcium oxide, A:77
websterite, B:324
See also clinopyroxene; clinopyroxene/orthopyroxene ratio; gabbro, pyroxene-rich; orthopyroxene; pigeonite
- pyroxene (calcium), hydrothermal veins, B:524
- pyroxenite
AFM diagram, B:210
hydrothermal alteration, A:76–78
melt channels, B:211
melting spider diagrams, B:214
petrology, A:63
photograph, A:70, 91; B:248
See also clinopyroxenite
- pyroxenite, magnesium number, vs. sodium oxide, B:218
- pyroxenite, pegmatitic, photograph, A:54
- pyrrhotite
hydrothermal veins, B:524
photograph, B:528
- quartz
fluid inclusions, B:404–405
photograph, A:198; B:171, 403, 406
See also veins, chlorite–plagioclase–quartz; veins, chlorite–quartz; veins, quartz
- quartz diorite
petrography, B:472
photograph, A:146
- rare earths
clinopyroxene, B:344
crystallization, B:212
diabase, B:227, 364–365
diopside, B:281–282
gabbros, B:339–347, 354–356, 360–361
mixing with scandium, B:359–361
model liquids in equilibrium with clinopyroxene, B:346
peridotites, B:291, 302–303, 515–517
plagioclase, B:344
websterite, B:329
- rare earths, bulk-rock, comparison of plutonic and basaltic rocks, B:227–231
- recrystallization
augite, B:158–159
gabbroic rocks, B:101–105, 109–110, 113
harzburgite, B:33–34
metamorphism, A:267
mineralogy, B:78–93
photograph, A:128, 159–160, 166, 223, 243; B:46, 118–121, 137–141, 147
plagioclase, B:158–159
serpentization, B:39–42
shear zones, B:130–132
See also olivine, recrystallized; orthopyroxene, recrystallized; plagioclase, degree of recrystallization; plagioclase, recrystallized
- recrystallization, dynamic, gabbroic rocks, B:143–153
- remanent magnetization
reorientation of structural features, B:547–559
temperature, B:435
vs. hydrothermal alteration, B:432
vs. magnesium number, B:432
- remanent magnetization, isothermal, vs. induction, A:111
- remanent magnetization, natural
crystalline rocks, A:107, 109–111
gabbroic rocks, A:167–171, 209–211, 251–254, 271–272; B:429–436
peridotites, B:421
- residue after leaching, vs. strontium isotopes, B:361
- resistivity
crystalline rocks, A:112–113, 115, 172, 255, 273
vs. depth, A:117, 174–175, 256
vs. porosity, A:119
- rheology, deformation of iron–titanium oxides, B:123–141
- ribboned texture. *See* grains, ribboned
- ridge-transform intersection, evolution, B:72–74
- rift valleys
deep-tow photography, B:7–13
drilling, A:5–6
- rocks. *See* melt–rock interactions
- rodingite. *See* gabbro, rodingitized
- rubidium/strontium ratio, distribution, B:235
- salinity
fluid inclusion homogenization, B:407–408, 410
fluids, B:409–411
seawater condensation model, B:411
- salite, hydrothermal veins, B:524
- samarium
gabbros, B:357
peridotites, B:291
vs. europium/samarium ratio, B:359
vs. iron oxide, B:347
See also lanthanum/samarium ratio
- scandium
mixing with rare earths, B:359–361
peridotites, B:518
vs. lanthanum/ytterbium ratio, B:232
See also lanthanum/scandium ratio
- sea-floor spreading
crystalline rocks, A:114–115
episodic and steady-state spreading, B:71
hydrothermal veins, B:155–178
tectonic windows, B:61–62
tectonics, B:5–21
See also spreading cells; spreading centers; spreading ridges
- secondary minerals
dikelets, B:247
photograph, A:154–160, 196–199, 243–245, 249; B:45
vs. depth, A:80, 153, 195–196, 242, 256, 267
- sediments, alteration of websterite, B:325–328
- segregations, leucocratic
deformation, B:80
photograph, B:79, 84
- seismic layer 2, density, A:175–176
- seismic velocities, lower crust and upper mantle, B:437–454
- Semail ophiolite, gabbros, B:175
- Serocki Volcano, drilling, A:5–6
- serpentine
brittle deformation, A:95–97
hydrothermal vein X-ray diffraction patterns, A:86
hydrothermal veins, A:79–80; B:524
mesh texture, B:38–39
oxygen isotopes, B:382–385, 466
photograph, A:58, 63, 70, 81, 83, 87–88, 92–93, 96–100, 105; B:43, 45–49, 51, 53, 55–56, 384
recrystallization, B:39–42
serpentization, B:382
- serpentinite
brittle deformation, A:97–98
evolution, B:72–74
magnetic susceptibility, B:553
photograph, B:11–12, 15, 385, 427
porosity, B:440–442
tectonic setting, B:5–21
See also shear zones, serpentinite
- serpentinite, sheared, photograph, A:99
- serpentization
bulk–rock and mineral chemistry, B:199–205
diabase, B:372
hydration, B:412
lithology and bulk chemistry, B:186–198
magnetic fabric, B:422–423
oxygen isotopes, B:381–388
peridotites, B:23–34, 35–59
photograph, A:51; B:40–41
See also harzburgite, serpentized; olivine, serpentized; peridotite, serpentized
- serpentization, whole–rock, anastomosing

- fabric, B:38–39
 serpentized fraction
 vs. density, B:447
 vs. velocity, B:447
 shear moduli, crystalline rocks, B:445–448
 shear wave velocity
 peridotites, B:441–442
 vs. compressional wave velocity, B:454
 See also compressional wave velocity/shear wave velocity ratio
 shear zones
 backscattered electron images, B:138–141
 brittle deformation, A:97–98
 deformation textures, B:105
 gabbroic rocks, B:71–74
 hydrothermal veins, A:162–163
 intersection massif, B:64–69
 iron–titanium oxides, B:123–141
 metamorphism, B:401–404
 photograph, A:96, 128, 161, 166, 188, 190, 203, 205–206, 223–224, 234, 238, 244, 250; B:12, 15, 70, 79, 149, 158, 165, 167
 porphyroclasts, A:206
 serpentinite, B:16
 serpentization, B:44, 47
 shear zones, crystal-plastic, peridotites, A:95
 shear zones, discrete, strain, B:157–159
 shear zones, ductile, mineralogy, B:78–93
 shear zones, gabbroic, geochemistry, B:99–121
 shear zones, mylonitic, photograph, B:125, 137–141
 shear zones, serpentinite, vs. depth, A:101–102
 side-scan sonar, intersection massif, B:64–69
 silica
 bulk-rock and mineral chemistry, B:199–205
 harzburgite, A:74
 mafic and ultramafic rocks, B:187–189, 198
 vs. magnesium number, A:147, 194, 239; B:175–176
 See also aluminum oxide/silica ratio; magnesium oxide/silica ratio
 silicates, hydrothermal alteration, B:523
 silicates, secondary, hydrothermal veins, B:524–525
 silicon
 amphiboles, B:97
 peridotites, B:518
 See also aluminum/(silicon + aluminum) ratio; aluminum/silicon ratio; iron/silicon ratio; magnesium/silicon ratio
 Site 648, drilling, A:5
 Site 670
 drilling, A:5
 serpentization, B:381–388
 Site 735
 amphibolites, B:94
 deformation fabrics, B:174
 Site 920, A:45–119
 camera survey, A:48
 coring, A:47
 diabase dikes, B:363–377
 diopside, B:277–284
 ductile deformation, B:23–34
 gabbroic rocks, B:243–264
 geochemistry, A:64–72; B:190–197
 hydrothermal alteration, B:523–529
 igneous petrology, A:51–64
 lithologic units, A:48–51
 magnetic anisotropy, B:419–427
 mantle, B:505–521
 metamorphic petrology, A:72–92
 operations, A:47–51
 paleomagnetism, A:106–111
 peridotites, B:265–275, 285–303
 physical properties, A:111–115
 serpentization, B:35–59, 381–388
 site description, A:45–119
 structural geology, A:92–106
 tectonics, B:5–21
 websterite, B:321–331
 Site 921, A:121–177
 camera surveys, A:123–124
 coring, A:123
 crystallization, B:333–350
 diabase dikes, B:363–377
 gabbroic rocks, B:471–490
 gabbroic rocks chemistry, B:216–219
 geochemistry, A:141–151; B:198–202
 igneous petrology, A:126–141
 iron–titanium oxides, B:123–141
 lithologic units, A:124–126
 metamorphic petrology, A:151–158
 operations, A:122–124
 paleomagnetism, A:167–171
 physical properties, A:171–176
 site description, A:121–177
 structural geology, A:158–167
 Site 922, A:179–215
 camera surveys, A:180–181
 coring, A:180
 gabbroic rocks chemistry, B:219
 geochemistry, A:191–193; B:203–204
 igneous petrology, A:182–191
 iron–titanium oxides, B:123–141
 lithologic units, A:181–182
 metamorphic petrology, A:193–204
 operations, A:180–181
 paleomagnetism, A:209–211
 physical properties, A:211–215
 scandium, B:360–361
 site description, A:179–215
 structural geology, A:204–209
 Site 923, A:217–258
 camera surveys, A:218
 coring, A:219
 crystallization, B:333–350
 gabbroic rocks, B:471–490
 gabbroic rocks chemistry, B:220, 222
 geochemistry, A:231–235; B:205–209
 igneous petrology, A:219–231
 lithologic units, A:218–219
 metamorphic petrology, A:235–244
 operations, A:218
 paleomagnetism, A:251–254
 physical properties, A:254–257
 site description, A:217–258
 structural geology, A:244–251
 Site 924, A:259–274
 camera surveys, A:260–261
 coring, A:261
 igneous petrology, A:263–265
 lithologic units, A:261–262
 metamorphic petrology, A:265–267
 operations, A:260–261
 paleomagnetism, A:271–272
 physical properties, A:272–274
 site description, A:259–274
 structural geology, A:267–271
 Sites 920–924
 remanent magnetization, B:547–559
 structural features, B:547–559
 Sites 921–923
 gabbroic rocks, B:99–121, 351–362
 magmatic evolution, B:77–98
 Sites 921–924
 fluid evolution, B:399–415
 hydrothermal veins, B:155–178
 tectonic windows, B:61–76
 skarn, hydrothermal veins, B:524
 slickenfibers, photographs, B:15
 slip fiber. *See* veins, slip-fiber
 smectite
 metamorphic minerals, B:536
 photograph, A:154, 156–157, 243
 See also clay minerals
 Snake Pit Hydrothermal Area, drilling, A:5
 sodium
 mineral chemistry, B:271
 vs. aluminum, B:271
 vs. magnesium number, B:538
 vs. titanium, B:270
 See also calcium/sodium ratio;
 sodium/(calcium + sodium) ratio;
 sodium/(calcium + sodium) ratio, vs.
 aluminum/(silicon + aluminum) ratio
 sodium oxide
 AFM diagram, B:210
 clinopyroxene, B:231–236
 diabase, B:223
 gabbros, B:337–338, 495
 liquid composition, B:235
 mafic and ultramafic rocks, B:184–185, 187
 melts in equilibrium with clinopyroxene, B:231–234
 vs. chromium number, B:260
 vs. iron oxide, B:184–185, 188
 vs. iron oxide/magnesium oxide ratio, B:218, 235
 vs. magnesium number, A:147, 194, 239; B:218, 254, 279, 339
 vs. magnesium number in clinopyroxene, B:95
 vs. magnesium oxide, B:366
 websterite, B:323
 See also calcium oxide/(calcium oxide + sodium oxide) ratio; sodium/(calcium + sodium) ratio
 sodium + potassium system
 amphiboles, B:97
 vs. aluminum, B:390, 394
 sphalerite, hydrothermal veins, B:524
 spheine. *See* titanite
 spinel
 chemical modifications in peridotite near gabbroic dikelets, B:259
 crystal-plastic fabric, A:95
 diabase, B:227
 foliation dip, B:30
 harzburgite, B:267–269
 mafic and ultramafic rocks, B:184–185, 189
 oxygen isotopes, B:466
 peridotites, A:52–58; B:298
 photograph, A:64; B:248, 427, 527
 plutonic rocks and ultramafics, B:256–260
 See also harzburgite, spinel
 spinel, chromian
 mineral chemistry, B:464–465, 511, 515
 peridotites, B:279–280
 spinel, chromium number
 vs. across-channel variations, B:273
 vs. aluminum oxide, B:299
 vs. magnesium number, B:281, 299, 325
 spinel, iron/(iron + magnesium) ratio, vs.
 chromium/(chromium + aluminum) ratio, B:516
 spinel, magnesium number, vs. titanium oxide, B:260, 272
 spinel facies
 diabase, B:375
 melting, B:234–235
 mineral/melt partition coefficients, B:228
 spinel harzburgite. *See* harzburgite, spinel

spinel–lherzolite facies, photograph, A:60
 spreading cells
 bathymetry, A:10–11
 See also sea-floor spreading
 spreading centers
 mid-ocean ridges, A:5
 See also sea-floor spreading
 spreading ridges
 fractionation, B:261–263
 See also sea-floor spreading
 strain, ductile, gabbroic rocks, B:77–98
 strain, finite, vs. subgrain boundary density, B:25
 strain, localization, B:157–159
 stress, magnetite and ilmenite, B:132–133
 strontium
 anomalies, B:235
 gabbroic rocks, B:496
 partitioning, B:372
 vs. anorthite, B:347
 vs. calcium oxide/aluminum oxide ratio, A:147
 vs. magnesium number, B:282
 vs. zirconium, B:347
 See also rubidium/strontium ratio
 strontium isotopes
 diabase, B:365, 367, 370, 376
 gabbroic rocks, B:109–110, 113, 115, 355–358, 471–490
 mafic and ultramafic rocks, B:184–185, 188
 plutonic rocks, B:308–312
 vs. depth, B:116
 vs. lead isotopes, B:314
 vs. loss on ignition, B:113
 vs. neodymium isotopes, B:311, 326, 358, 368
 vs. residue after leaching, B:361
 websterite, B:325
 strontium isotopes (clinopyroxene), vs. strontium isotopes (plagioclase), B:312
 strontium isotopes (plagioclase), vs. strontium isotopes (clinopyroxene), B:312
 strontium/zirconium ratio, vs. zirconium, B:302
 structural domains, serpentinite, B:14–16
 structural features, remanent magnetization, B:547–559
 structural geology
 Site 920, A:92–106
 Site 921, A:158–167
 Site 922, A:204–209
 Site 923, A:244–251
 Site 924, A:267–271
 structural logs, vs. depth, A:102, 105, 163, 166
 structures, crystal-plastic, peridotites, B:28–29
 submersible dives
 geomorphology, B:7–13
 intersection massif, B:64–69
 subsolidus
 deformation, B:106
 veins, B:171
 See also textures, subsolidus
 sulfide
 hydrothermal alteration, B:523–529
 photograph, A:100
 serpentinitization, B:44
 serpentinitized peridotites, B:52, 54
 sulfide, acicular, photograph, B:40
 sulfide, iron–nickel, acicular, serpentinitization, B:38–39
 talc
 hydrothermal veins, A:79; B:524
 metamorphic minerals, B:536
 metamorphism, B:391–393
 photograph, A:154, 189, 196–197, 199, 243; B:43

tectonic rotation, paleomagnetism, A:107, 110–111
 tectonic windows, B:61–76
 tectonics
 fluid evolution, B:400–401
 hydrothermal veins, B:170–175
 MARK area, B:123–124
 melting, B:234–235
 serpentinite, B:5–21
 serpentinitization, B:386–387
 Sites 921–923, B:99–100
 tectonics, extensional, crystalline rocks, A:114–115
 temperature
 fluid inclusion homogenization, B:407–408, 410
 hydrothermal veins, B:167–170
 isotopes, B:313
 oxygen isotopes, B:467–468
 remanent magnetization, B:435
 serpentinitization, B:47–49
 shear zones, B:130–132
 tension gashes, photograph, B:12
 tephroite, metamorphic minerals, B:536
 textures
 gabbroic rocks, B:99–121
 harzburgite, B:23–28, 33–34
 metamorphic minerals, B:531–534
 metamorphism, B:391–393
 peridotites, A:58–62; B:506–511, 514–515
 photograph, B:40–41, 118–121
 serpentinitization, B:382
 textures, magmatic, metamorphic minerals, B:531–532
 textures, subsolidus deformation, metamorphic minerals, B:532–534
 thermal conductivity
 crystalline rocks, A:112, 114, 173, 255
 gabbroic rocks, A:212
 vs. depth, A:117, 174–175, 213, 256
 Tinaquillo Lherzolite, aluminum oxide/silica ratio, vs. magnesium oxide/silica ratio, B:213
 titanite, photograph, A:199
 titanium
 alteration, B:208
 anomalies, B:235
 gabbroic rocks, B:108–109, 339–340, 496
 mineral chemistry, B:271
 peridotites, B:518
 vs. aluminum, B:390, 394, 544–545
 vs. chromium, B:496
 vs. depth, B:111
 vs. magnesium number, B:538
 vs. sodium, B:270
 websterite, B:329
 See also aluminum + iron + titanium system; gabbro, iron–titanium; magnetite, titanium; potassium/titanium ratio; titanium/(aluminum + iron + titanium) ratio
 titanium/(aluminum + iron + titanium) ratio, vs. aluminum/(silicon + aluminum) ratio, B:544–545
 titanium/aluminum ratio, augite, B:158–160
 titanium oxide
 bulk-rock and mineral chemistry, B:202–205
 gabbros, B:338
 peridotites, B:278–280
 vs. across-channel distance, B:272–273
 vs. aluminum oxide, B:283
 vs. chromium number, B:260
 vs. depth, A:151
 vs. magnesium number, A:147, 194, 239; B:254, 260, 279, 340, 515
 vs. magnesium number in clinopyroxene, B:95
 vs. magnesium oxide, A:79; B:366
 vs. phosphorus oxide, A:195
 vs. zirconium, A:240
 websterite, B:323
 titanium oxide/FMM ratio, vs. aluminum oxide/FMM ratio, B:216
 titanomagnetite
 gabbroic rocks, A:133–134
 photograph, A:199
 See also ilmenite; iron–titanium oxides; magnetite; magnetite, titanium
 trace elements
 diabase, A:148; B:364–365
 diabase and gabbroic rock spider diagrams, B:221–222, 224, 226
 diopside, B:277–284
 gabbroic rocks, A:142–143, 149–151, 192, 233; B:215–222, 339–349, 352–355, 493
 peridotites, A:67–68; B:289–291
 peridotites and mafic rocks, B:181–241
 trace elements, bulk-rock, comparison of plutonic and basaltic rocks, B:227–231
 transforms
 tectonics, A:10–11
 See also ridge–transform intersection
 tremolite
 hydrothermal vein X-ray diffraction patterns, A:86
 hydrothermal veins, B:162
 metamorphic minerals, B:536
 mineral chemistry, B:167–170
 photograph, A:70, 83, 189, 196–197, 199, 243
 troctolite
 dikelets, B:249
 geochemistry, B:491–495
 lanthanum/scandium ratio, vs. ytterbium/scandium ratio, B:359–360
 lanthanum/ytterbium ratio, vs. ytterbium, B:359
 lithology and bulk chemistry, B:186–198
 magmatic differentiation, B:261
 magnesium number, B:254
 metamorphism, B:392
 mineralogy, B:78–93
 modal layering, A:231
 petrography, B:471
 petrology, A:181–187, 261–265; B:68–71
 photograph, A:131, 134, 141, 183–186, 190, 198, 201, 205, 220, 227, 231, 236–238, 262, 265–266; B:165, 170, 248
 remanent magnetization, B:431
 See also gabbro, troctolitic; metatrotolite
 troctolite, altered, major elements, B:396
 trondhjemite
 lithology and bulk chemistry, B:186–198
 photograph, A:138–139
 See also veins, trondhjemite
 twinning
 photograph, A:159, 166; B:121
 See also neoblasts, twinned
 ultracataclastic zones
 fabrics, B:148–149
 See also cataclastic zones
 ultramafic rocks
 bulk-rock geochemistry, A:65–69
 bulk-rock and mineral chemistry, B:198–215
 cores, B:185
 geochemistry, A:64–68
 geochemistry and mineral chemistry, B:457–470
 intrusions, B:243–264

- lithology and bulk chemistry, B:186–198
 magnesium number, B:210–211
 oxygen isotopes, B:464–468
 petrology, A:48–62
 serpentinitization, B:381–388
 sodium oxide, B:232
See also hypabyssal rocks; intrusives; mafic rocks; plutonic rocks
 ultramafic rocks, olivine-bearing, grain size and alteration, A:57
- vanadium
 alteration, B:208
 peridotites, B:518
 vanadium/FMM ratio, vs. aluminum oxide/FMM ratio, B:216
 vein density, downhole variations, B:172
 vein dip, vs. depth, A:102, 104, 163–164, 166, 209, 271; B:57, 172, 557–558
 vein strike, vs. depth, B:57, 557–558
 veining, serpentinitized peridotites, A:85
 veinlets, photograph, A:59, 82–83, 87, 89, 138, 196, 203, 205, 245; B:402
 veins
 assemblages, B:161–165
 brittle deformation, A:97
 cataclasites and shear zones, A:162–163
 contour plots, A:114
 crystallization, B:208–213
 density distribution and orientation, B:165–167
 distribution, A:133, 228
 fluid inclusions, B:410
 fluid/rock ratio, B:397
 gabbroic rocks, A:162–163, 201–202, 207–208, 241–242, 269–271
 generations, B:52
 hydrothermal alteration, A:76–78
 mafic rocks, A:98–100
 magnesium number, vs. nickel oxide, B:272
 magnetic fabric, B:422–423
 magnetic susceptibility, B:553
 melt channels, B:211
 metamorphism, B:401–404
 mineral chemistry, B:167–170
 mineral composition, B:523–529
 mylonites, B:30
 olivine gabbros, A:208
 orientations and generations, A:163
 peridotites, B:35–59, 294
 petrology, A:62–64
 photograph, A:70, 83, 87–92, 96–100, 105, 134, 138–139, 144, 155, 157–158, 163, 183–184, 190, 198, 201, 203, 225, 243, 268, 270; B:12, 15, 39, 45, 47–49, 51, 53–56, 160, 403
 stereographic projection, B:557
 stereoplots, A:104
 temperature, B:167–170
 vs. depth, A:101, 103, 250–251
 websterite, B:329
 X-ray diffraction patterns, A:86
See also veins, amphibole; veins, amphibole–chlorite
 veins, actinolite, photograph, B:165, 167
 veins, actinolite–chlorite
 downhole variations, A:250–251
 gabbroic rocks, A:162, 202, 207, 242, 269–270
 photograph, B:167–170
 veins, amphibole
 assemblages, B:162
 photograph, B:164–166, 174
 veins, amphibole–chlorite
 assemblages, B:162–164
- photograph, B:168
 veins, chlorite
 assemblages, B:164
 gabbroic rocks, A:202, 242
 photograph, B:168, 170
 veins, chlorite–iron oxides, assemblages, B:164–165
 veins, chlorite–plagioclase–quartz, assemblages, B:164–165
 veins, chlorite–prehnite, assemblages, B:164–165
 veins, chlorite–quartz, photograph, B:171
 veins, clay minerals, gabbroic rocks, A:270–271
 veins, composite, assemblages, B:164–165
 veins, crack-seal, serpentinitization, B:51–52
 veins, dioritic, alteration, A:157
 veins, en echelon
 assemblages, B:164–165
 photograph, B:168
 veins, epidote
 assemblages, B:164–165
 gabbroic rocks, A:208
 vs. depth, A:251
 veins, epidote–clay minerals, photograph, B:167
 veins, epidote–prehnite, gabbroic rocks, A:202, 242
 veins, felsic
 alteration, A:157
 assemblages, B:161–162
 gabbroic rocks, A:162, 207–208
 photograph, A:157–158, 198, 245; B:161, 401
 vs. depth, A:250
 veins, felsic, magmatic, petrology, A:134
 veins, gabbroic, photograph, A:70, 72, 83–85
 veins, hornblende–actinolite–chlorite, photograph, B:168
 veins, hydrothermal
 bulk-rock and mineral chemistry, B:199–205
 carbonate minerals + pyrite + clay minerals system, A:80
 distribution and orientation, B:44
 gabbroic rocks, A:85–86, 201–202, 242
 magmatic veins, A:85–86
 mineralogy, A:267
 petrology and structure, B:155–178
 serpentinite + amphibole + chlorite + talc system, A:79
 serpentinite + carbonate minerals + pyrite + clay minerals system, A:79–80
 serpentinite + magnetite, A:79
 serpentinitization, B:39–44
 serpentinitized peridotites, A:79–80
 X-ray diffraction data, B:50
- veins, leucocratic
 deformation textures, B:105
 petrology, A:226; B:68–71
 photograph, B:79, 121
- veins, magmatic
 gabbroic rocks, A:201, 241–242
 hydrothermal veins, A:85–86
 petrology, A:187–190
 photograph, A:246
 ultramafic samples, A:72
- veins, metagabbroic, photograph, A:84
 veins, microgabbro, photograph, B:160
 veins, plagioclase-rich, photograph, A:128
 veins, quartz, photograph, B:171
 veins, slip-fiber, photograph, B:43
 veins, trondhjemite
 alteration, A:157
 photograph, B:403
- velocity
 slow-spreading environment, B:437–454
 vs. bulk density, A:118
 vs. porosity, A:118
- vs. serpentinized fraction, B:447
 vesuvianite, veins, B:524
 violarite, veins, B:524
 volatiles, magmatic, evolution, B:407–409
- water + carbon dioxide system, harzburgite, A:73
 water content
 crystalline rocks, A:112–113, 172, 273
 fluid inclusions, B:405–406
 harzburgite, A:73
 magmatic volatiles, B:407–409
 vs. depth, A:76
- websterite
 lithology and bulk chemistry, B:186–198
 petrology, A:48–51
 relationship with magmatic rocks, B:328–329
 websterite, chromium number, vs. across-channel variations, B:273
- websterite, chromium oxide, vs. aluminum oxide, B:324
- websterite, lead-207/lead-204 ratio, vs. lead-206/lead-204 ratio, B:327
- websterite, lead-208/lead-204 ratio, vs. lead-206/lead-204 ratio, B:327
- websterite, magnesia number
 vs. chromium number, B:325
 vs. nickel oxide, B:272
 vs. titanium oxide, B:272
- websterite, strontium isotopes, vs. neodymium isotopes, B:326
- wehrliite
 AFM diagram, B:210
 lithology and bulk chemistry, B:186–198
 magnesium number and forsterite content, B:217
 photograph, A:221, 232, 236
- wehrliite, aluminum oxide/silica ratio, vs. magnesium oxide/silica ratio, B:213
- wehrliite, oxides, vs. depth, B:212
- wollastonite, mineral chemistry, B:459
- xenocrysts, plagioclase, B:82–83, 93
- ytterbium
 gabbroic rocks, B:108–109
 peridotites, B:291
 vs. depth, B:111
 vs. lanthanum/ytterbium ratio, B:230, 359
See also cerium/ytterbium ratio; lanthanum/ytterbium ratio
- ytterbium, chondrite-normalized, vs. chondrite-normalized lanthanum, B:234
- ytterbium/scandium ratio, vs. lanthanum/scandium ratio, B:359–360
- yttrium
 gabbroic rocks, B:341–342, 496
 vs. magnesium number, A:147, 194, 239
 vs. zirconium, A:79, 149, 195; B:375
See also zirconium/yttrium ratio
- zeolites
 hydrothermal veins, A:85–86
 photograph, A:89–91
- zinc, vs. magnesium number, A:147
- zircon
 composition, B:249–251
 dikelets, B:246–247
 gabbros, B:338–341
 photograph, A:89, 157, 184, 198; B:45, 84, 248
 serpentinitization, B:39
- zirconium
 alteration, B:208
 anomalies, B:235

diabase, B:227
gabbroic rocks, B:108–109, 339–344, 346, 496
peridotites, B:291
vs. depth, B:111
vs. lanthanum/ytterbium ratio, B:233
vs. magnesium number, A:79, 239; B:282
vs. nickel, B:373
vs. phosphorus oxide, B:347

vs. strontium, B:347
vs. strontium/zirconium ratio, B:302
vs. titanium oxide, A:240
vs. yttrium, A:79, 149, 195; B:375
vs. zirconium/hafnium ratio, B:302
See also strontium/zirconium ratio
zirconium/FMM ratio, vs. aluminum oxide/FMM ratio, B:216

zirconium/hafnium ratio, vs. zirconium, B:302
zirconium/yttrium ratio
distribution, B:235, 374
vs. depth, A:151
zoisite, photograph, A:249
zoning
See plagioclase, zoned