

## INDEX TO VOLUME 111

This index provides coverage for both the *Initial Reports* and *Scientific Results* portions of Volume 111 of the *Proceedings of the Ocean Drilling Program*. Index entries with the suffix *a* refer to pages in the *Initial Reports*, and those with *b*, to pages in the *Scientific Results* (this book).

The index is presented in three parts: (1) a Subject Index, (2) a Site Index, and (3) a Paleontological Index. In addition to this printed version, the index is also available in the form of a machine-readable, ASCII-encoded, 9-track magnetic tape, 1600 bpi.

The index was prepared by Wm. J. Richardson Associates, Inc., under subcontract to the Ocean Drilling Program. It follows the concept developed by the Deep Sea Drilling Project at Scripps Institution of Oceanography for a comprehensive, cumulative index of DSDP volumes. Both of these indexes are based on a hierarchy of entries: (1) a main entry, defined as a key word or concept followed by a reference to the page on which that word or concept appears; (2) a subentry, defined as a further elaboration on the main entry followed by a page reference; and (3) a sub-subentry, defined as an even further elaboration on the main entry or subentry followed by a page reference.

The Subject Index follows a standard format. Geographic and individual names are referenced in the index only if they are subjects of discussion. This index also includes broad fossil groups, such as foraminifers and radiolarians, which also appear in the Paleontological Index.

The Site Index is structured to contain entries for the sites discussed in the volume. Site entries are modified by subject subentries.

The Paleontological Index is an index relating to significant findings and/or substantive discussions, not of species names *per se*. This index covers three varieties of information: (1) broad fossil groups, including individual genera and species that have been erected or emended formally; (2) biostratigraphic zones; and (3) fossils depicted in illustrations.

The indexes cover text figures and tables but not core description forms ("barrel sheets") or core photographs. Also excluded are bibliographic references, names of individuals, and routine front and back matter.

For further information, contact the Chief Production Editor, Ocean Drilling Program, 1000 Discovery Drive, College Station, Texas 77840.

## SUBJECT INDEX

- Accretion, Costa Rica Rift, 144b-145b
- Actinolite  
Costa Rica Rift: Site 504, 32b, 124a  
alteration, 63a-66a, 67a  
oxygen isotopes, 35b  
variation with depth, 66a
- Albite  
Costa Rica Rift: Site 504  
alteration, 67a  
variation with depth, 66a
- Alteration  
actinolite, Costa Rica Rift: Site 504, 63a-66a, 67a  
albite, Costa Rica Rift: Site 504, 67a  
chalcopyrite, Costa Rica Rift: Site 504, 63a  
clinopyroxene, Costa Rica Rift: Site 504, 28b, 49b, 61a, 62b, 63a, 64b, 67a  
Costa Rica Rift: Site 504, permeability and, 67a  
crust, oceanic, Costa Rica Rift: Site 504, 59a, 68a, 70a, 118a-119a, 125a, 140b  
magnetite, Costa Rica Rift: Site 504, 67a  
plagioclase, Costa Rica Rift: Site 504, 61a, 62b, 64b, 67a  
quartz, Costa Rica Rift: Site 504, 63a-65a  
sphalerite, Costa Rica Rift: Site 504, 63a  
spheine, Costa Rica Rift: Site 504, 63a-66a, 67a  
*See also* Hydrothermal alteration
- Amphibole, Costa Rica Rift: Site 504, 64b, 65b-67b, 71b-73b
- Anhydrite  
Costa Rica Rift: Site 504, 31b, 33b, 67b  
saturation test, 87a  
sulfur concentrations, 38b, 41b-45b, 56b-57b
- Apatite, Costa Rica Rift: Site 504, 58a
- Atlantic Ocean N, crustal age, 189b
- Augite, sodic, Costa Rica Rift: Site 504, 67b
- Basalt  
Costa Rica Rift: Site 504  
aging changes, 105b-106b  
alteration, 55b, 58b, 62b, 64b, 73b, 75b, 99b, 105b-106b, 124b-125b  
apparent formation factor, 102b-103b  
Archie's law calculations, 101b, 135b-137b, 139b-140b  
cation exchange capacity, 99b-101b  
cerium isotopic ratios, 78b, 81b, 83b  
chemical analyses, 34b-37b  
chemical fluxes, 124b-131b  
classification, 50a-51a  
electrical resistivity, 101b-103b, 133b-145b  
electron microprobe analyses, 23b  
elemental analyses, 129b  
formation factor, 104b-105b  
fractures, 104b-106b  
fusion experiments, 21b  
geochemical log measurements, 121b-122b  
geochemistry, 181a, 183a  
groundmass, 48b, 55a-58a, 61b  
growth experiments, 21b  
hydrogen isotopes, 51b-52b, 54b-55b  
lithology, 99b, 142b-143b  
major-element data, 4b-10b, 50b-51b, 53b, 71a, 74a, 122b, 127b  
mean deviations, 126b  
microprobe analyses, 58a
- mineral paragenesis, 68b-69b, 72b  
modal compositions, 49b  
neodymium isotopes, 57b-58b, 78b-83b  
oxide concentrations, 123b, 126b  
oxygen isotopes, 34b-35b, 38b, 51b-52b, 54b-55b  
petrology, 38a-39a, 40a, 52a, 181a, 183a  
phase relations, 22b  
pillows, 116b-117b, 178b  
porosity, 101b-102b, 104b-105b  
rare earth elements, 77b-83b  
resistivity, 99b  
standard deviations, 126b  
strontium isotopes, 57b-58b, 83b  
ratios, 78b, 81b  
sulfur concentrations, 35b, 38b-39b, 55b-57b  
sulfur isotopes, 35b, 38b-39b, 41b-45b, 54b, 56b  
temperature gradient and, 92b  
textures, 64b  
thermal conductivity, 104a  
trace-element data, 4b-10b, 50b-51b, 53b, 69a, 70a, 72a, 75a  
water content, 54b-55b, 56b  
water/rock ratios, 130b-131b
- Costa Rica Rift: Site 678, alteration, 259a
- East Pacific Rise  
neodymium isotopes, 57b-58b  
strontium isotopes, 57b-58b
- Galapagos Islands  
neodymium isotopes, 57b-58b  
strontium isotopes, 57b-58b
- Tanzawa Mountains, alteration, 72b, 75b  
*See also specific types*
- Basement  
Costa Rica Rift: Sites 501/504, 25a-26a  
basaltic, 28a  
cooling, 255a-256a  
igneous rock, 23a, 30a  
pore-water chemistry, 30a
- Costa Rica Rift: Site 504  
alteration, 59a-60a  
bottom-water circulation, 88b-89b  
calcium concentrations, 180a  
chemical analyses, 36b-37b  
chemical fluxes, 129b-130b  
depth, 27b  
gas samples, 72a, 78a  
hydrology, 108a  
hydrothermal alteration, 162b-164b  
hydrothermal circulation, 37a, 94b-95b, 130b  
iron bacteria, 181a  
lithology, 29b  
lithostratigraphy, 48a, 116b-117b  
magnesium concentrations, 180a  
magnetic properties, 149b  
natural remanent magnetization, 149a-152a  
*See also* Magnetic properties, Costa Rica Rift: Site 504
- permeability, 38a  
porosity, 38a, 92a-93a, 98a-99a, 166a-167a, 169a  
secondary minerals, 29b, 62b-68b  
underpressured region, 255a  
water content, 92a-93a, 98a-99a  
water samples, 73a, 76a, 77a, 79a
- Costa Rica Rift: Site 677, depth, 265a
- Costa Rica Rift: Site 678, depth, 265a
- Costa Rica Rift, hydrothermal circulation, 207b-208b
- Breccia  
Costa Rica Rift: Site 504  
abundance, 125a  
alteration, 65a-66a, 67a
- Calcium concentrations  
Costa Rica Rift: Site 501, 206b-213b  
Costa Rica Rift: Sites 501/504, 27a-28a  
variation with depth, 31a  
Costa Rica Rift: Site 504, 77a-92a, 111a, 115a, 116a-117a, 123a, 206b-212b  
aluminum/iron concentrations vs., 120a  
geochemical log measurements, 121b-122b
- Costa Rica Rift: Site 677, 197b-200b, 206b, 208b-212b, 266a, 268a-269a, 270a
- Costa Rica Rift: Site 678, 197b, 199b-200b, 208b-212b, 266a, 269a, 270a
- Carbonate, Costa Rica Rift: Site 677, weight percent vs. depth, 257a
- Carnegie Ridge, magnetic properties, 156b
- Chalcopyrite  
Costa Rica Rift: Site 504, 30b, 31b-32b, 67b  
alteration, 63a  
sulfur concentrations, 42b-45b, 55b-57b
- Chalk  
Costa Rica Rift: Sites 501/504, 26a  
Costa Rica Rift: Site 504, 180b  
Costa Rica Rift: Site 677  
Unit II, 258a  
Unit III, 258a  
Costa Rica Rift: Site 678, Unit II, 259a
- Chalk, nannofossil, Costa Rica Rift: Site 504, temperature gradient and, 92b
- Chlorite  
Costa Rica Rift: Site 504, 62b, 64b, 68b-69b, 124a  
abundance, 125a  
alteration, 60a-61a, 63a-66a, 67a  
molar compositions, 30b  
oxygen isotopes, 35b  
variation with depth, 66a
- Chromian spinel, Costa Rica Rift: Site 504, 57a-58a
- Clay  
Costa Rica Rift: Site 504, 108a, 114a  
cation exchange capacity, 139b  
electrical resistivity, 103b-104b, 139b  
permeability, 140b  
porosity, 139b-140b  
temperature gradient and, 92b
- Costa Rica Rift, 11a
- Clinopyroxene  
Costa Rica Rift: Site 504, 18b, 32b, 52a-57a, 122b-124b, 124a  
abundance, 125a  
alteration, 28b, 49b, 61a, 62b, 63a, 64b, 67a  
 $\text{Cr}_2\text{O}_3$  vs.  $\text{TiO}_2$ , 58a  
crystallization, 59a  
electron microprobe analyses, 23b  
fractionation, 13b  
microprobe analyses, 50b, 58a  
size, 48b
- Cocos Ridge, magnetic properties, 156b
- Cocos-Nazca spreading system, 116b
- Costa Rica Rift: Site 501  
alkalinity, 203b, 208b, 210b

## SUBJECT INDEX

- ammonium concentrations, 203b  
barium concentrations, 201b  
calcium concentrations, 206b-213b  
chlorinity, 204b-205b, 206b, 210b  
diffusion coefficients, 205b-207b  
lithium concentrations, 204b  
magnesium concentrations, 208b-210b  
manganese concentrations, 202b  
porosity, electrical formation factor vs., 242b  
potassium concentrations, 204b, 210b  
silicon concentrations, 205b, 210b  
sodium concentrations, 204b-205b, 206b, 210b  
strontium concentrations, 201b  
sulfate concentrations, 202b, 210b
- Costa Rica Rift: Sites 501/504**  
bathymetry 24a-25a  
bottom water  
circulation, 28a  
temperatures, 23a  
calcium concentrations, 27a-28a  
variation with depth, 31a  
heat flow, 26a-27a, 255a  
average, 28a  
piston core locations and, 29a  
vertical pore-water flux vs., 31a  
location, 25a, 196b, 255a  
magnesium concentrations, 27a-28a  
variation with depth, 31a  
pore-water flux rate, 28a, 31a, 32a  
sediment thickness, 25a-26a, 195b, 255a-256a  
thermal conductivity, 26a-27a, 30a
- Costa Rica Rift: Site 504**  
alkalinity, 80a-81a, 85a-86a, 89a, 91a-92a, 203b, 208b  
depth vs., 84a  
aluminum concentrations, 111a, 113a, 116a-117a, 122a-123a  
magnesium/calcium concentrations vs., 120a  
ammonium concentrations, 203b  
aphytic rocks, 57a, 58a-59a  
*See also specific types*  
barium concentrations, 201b  
bathymetry, 36a  
borehole convection calculations, 93b-94b  
bottom-water circulation, 79a  
bulk modulus, 172b  
calcium carbonate content, 268b  
calcium concentrations, 77a-92a, 111a, 115a, 116a-117a, 123a, 206b-212b  
aluminum/iron concentrations vs., 120a  
geochemical log measurements, 121b-122b  
chemical trends, 110a, 113a, 115a  
chilled margins, 49a, 53a, 58a  
chlorine concentrations, geochemical log measurements, 121b-122b  
chlorinity, 80a-81a, 83a, 88a-92a, 204b-205b, 206b, 210b  
compressional wave velocity, 93a, 100a-101a, 123a, 129a, 171b-176b  
density, 92a-93a, 98a-99a, 175b  
diffusion coefficients, 205b-207b  
Fe-Ti oxides, 57a, 59a  
crystallization, 59a  
fracture, controlled alteration, 64a-65a  
gadolinium concentrations, geochemical log measurements, 121b-122b  
GRAPE bulk density, 93a, 103a  
heat-flow measurements, 37a  
lithology correlated with, 89b-95b
- hydrogen concentrations, geochemical log measurements, 121b-122b  
iron concentrations, 111a, 113a, 116a-118a, 122a-123a, 125a  
geochemical log measurements, 121b-122b  
magnesium/calcium concentrations vs., 120a  
lithium concentrations, 204b  
lithodensity tool, 100a, 102a-103a  
lithologic units, 47a-50a, 170a-171a  
lithostratigraphy, 317b  
location, 28b, 36a, 110b, 134b, 148b, 179b  
magnesium concentrations, 77a-92a, 116a-117a, 125a, 208b-210b  
aluminum/iron concentrations vs., 120a  
geochemical log measurements, 121b-122b  
magnetic properties, natural remanent magnetization, 149a-152a  
major-element data, 14b, 122b, 127b  
manganese concentrations, 202b  
multichannel seismic logging, 120a-121a, 127a-129a, 132a, 134a  
*See also Site Index*  
multichannel sonic logging, 119a-121a  
neutron activation logging, 99a-100a, 110a  
sediment through casing, 107a-108a, 113a, 114a  
nuclear logging, 98a-99a, 110a  
oxide concentrations, 162b, 164b  
chemical fluxes, integrated, 128b  
permeability, 93b, 152a-156a, 159a-161a, 174a-175a, 317b-319b, 321b-325b  
fluid properties, 320b-321b  
lithology correlated with, 90b-91b  
packer seal, 320b  
*in-situ* vs. calculated bulk, 320b  
slug tests, 319b-320b  
pH, 84a  
Poisson's ratio, 172b, 174b  
porosity, 92a-93a, 93b, 98a-99a, 111a, 152a-156a, 166a-167a, 169a, 171a-175a, 175b, 178b, 237b  
chemical exchange and, 125b, 127b  
electrical formation factor vs., 242b  
false, 128b  
fracture, 163a-164a  
lithology correlated with, 90b-91b  
thermal conductivity, 104a  
total, 162a  
potassium concentrations, 111a, 204b  
resistivity data, 164a-166a, 172a  
salinity, 80a, 83a  
shear modulus, 172b  
silicon concentrations, 116a-117a, 205b, 210b  
geochemical log measurements, 121b-122b  
sodium concentrations, 204b-205b, 206b, 210b  
geochemical log measurements, 121b-122b  
stratigraphy, 233b  
strontium concentrations, 201b  
sulfate concentrations, 82a, 202b, 210b  
sulfide-oxide phase equilibria, 33b  
sulfur concentrations, geochemical log measurements, 121b-122b  
temperature alteration reactions, 67a  
temperature measurements, 37a-38a, 39a, 142b, 167a-170a
- downhole flow, 97a, 107a  
geothermal gradient and, 87b-95b, 97a, 106a  
logging equipment, 95a-97a  
resistances, 105a  
variations, 97a-98a, 107a-109a  
thermal conductivity, 93a, 104a  
geothermal gradient and, 89b-95b  
thorium concentrations, 111a  
titanium concentrations, 110a, 113a, 115a, 118a, 121a  
geochemical log measurements, 121b-122b  
trace-element data, 14b, 67a-68a, 69a  
geochemical log measurements, 121b-122b  
*See also specific elements*  
uranium concentrations, 111a  
water content, 92a-93a, 98a-99a
- Costa Rica Rift: Site 505**  
porosity, 237b  
electrical formation factor vs., 242b
- Costa Rica Rift: Site 677**  
alkalinity, 198b-199b, 203b, 208b, 266a, 268a-269a  
depth vs., 270a  
ammonium concentrations, 203b, 266a, 268a-269a  
depth vs., 270a  
barium concentrations, 198b-199b, 201b  
bulk density, 235b, 277a-280a, 283a  
calcium carbonate content, 264b-267b, 273b-275b  
inversion correlation technique, 269b-270b  
mapping function, 270b, 273b-274b, 276b  
visual matching technique, 270b-272b  
calcium concentrations, 197b-200b, 206b, 208b-212b, 266a, 268a-269a  
depth vs., 270a  
carbon isotope data, 299b-310b  
carbonate content, 276a-279a, 281a, 285a  
thermal conductivity vs., 238b  
chlorinity, 198b-199b, 204b-205b, 206b, 210b, 266a-267a, 268a-269a  
depth vs., 271a  
compressional wave velocity, 281a-282a  
diffusion coefficients, 205b-207b  
electrical resistivity, 234b-235b  
geochemistry, Rock-Eval procedure, 215b-217b  
geolipids, 227b-229b  
GRAPE density, 276a, 282a  
heat-flow data, 255a  
heat-flow measurements, 265a, 292a  
interstitial-water chemistry, 215b-217b, 220b-225b  
amino acids, 215b, 217b-219b, 224b-225b  
iron concentrations, 198b-199b  
lithium concentrations, 198b-199b, 204b  
lithologic units, 257a, 260a  
*See also Costa Rica Rift: Site 677, specific units*  
location, 196b, 254a, 255a  
magnesium concentrations, 187b-200b, 208b-210b, 266a, 268a-269a  
depth vs., 270a  
manganese concentrations, 198b-199b, 202b  
nitrate concentrations, 267a, 268a-269a  
depth vs., 271a  
organic carbon, 292a-293a

- oxygen isotope data, 299b-310b  
 phosphate concentrations, 267a,  
   268a-269a  
 depth vs., 271a  
 porosity, 235b, 237b, 277a-279a, 283a,  
   289a  
   electrical formation factor vs.,  
   241b-242b  
   thermal conductivity variation with,  
   287a  
 potassium concentrations, 198b-199b,  
   204b, 210b  
 shear strength, 235b, 276a-281a, 289a  
 silicon concentrations, 198b-199b, 205b,  
   210b, 266a-267a, 268a-269a  
   depth vs., 271a  
 silicon-opal content, 264b-267b, 272b  
 sodium concentrations, 198b-199b,  
   204b-205b, 206b, 210b  
 strontium concentrations, 198b-199b,  
   201b  
 sulfate concentrations, 198b-199b, 202b,  
   210b  
 temperature measurements, 286a-288a,  
   290a-292a  
 thermal conductivity, 234b, 235b,  
   274a-281a, 284a  
   porosity vs., 240b, 287a  
 water content, 235b, 277a-279a  
   depth and, 283a  
 Costa Rica Rift: Site 678  
   alkalinity, 199b, 203b, 208b, 266a, 269a  
   depth vs., 270a  
   ammonium concentrations, 203b, 266a,  
   269a  
   depth vs., 270a  
   barium concentrations, 199b, 201b  
   bulk density, 236b, 284a, 286a  
   calcium concentrations, 197b, 199b-200b,  
   208b-212b, 266a, 269a  
   depth vs., 270a  
   carbonate content, 234b, 236b, 285a,  
   286a  
   chlorinity, 199b, 204b-205b, 206b, 210b,  
   266a-267a, 269a  
   depth vs., 271a  
   compressional wave velocity, 285a, 286a  
   diffusion coefficients, 205b-207b  
   electrical resistivity, 234b-235b  
   geochemistry, Rock-Eval procedure,  
   215b-217b  
   geolipids, 227b-229b  
   GRAPE bulk density, 287a  
   heat-flow measurements, 265a, 292a  
   interstitial-water chemistry, 215b-217b,  
   220b-225b  
   amino acids, 215b, 217b-219b,  
   224b-225b  
   iron concentrations, 199b  
   lithium concentrations, 199b, 204b  
   lithologic units, 258a-259a  
   *See also* Costa Rica Rift: Site 678,  
   specific units  
 location, 197b, 254a  
 magnesium concentrations, 197b,  
   199b-200b, 208b-210b, 266a, 269a  
   depth vs., 270a  
 manganese concentrations, 199b, 202b  
 nitrate concentrations, 267a, 269a  
   depth vs., 271a  
 organic carbon, 292a-293a  
 phosphate concentrations, 267a, 269a  
   depth vs., 271a  
 porosity, 236b-237b, 284a, 286a  
   electrical formation factor vs., 241b
- potassium concentrations, 199b, 204b,  
   210b  
 shear strength, 236b, 285a, 286a  
 silicon concentrations, 199b, 205b, 210b,  
   266a-267a, 269a  
   depth vs., 271a  
 sodium concentrations, 199b, 204b-205b,  
   206b, 210b  
 strontium concentrations, 199b, 201b  
 sulfate concentrations, 199b, 202b, 210b  
 temperature measurements, 286a-288a,  
   290a-292a  
 thermal conductivity, 234b, 236b, 285a,  
   286a  
   carbonate content vs., 239b  
   water content, 236b, 284a, 286a  
 Costa Rica Rift  
   basement, alteration effects, 7a, 9a  
   igneous rocks, classification, 7a  
   interstitial waters, 20a  
   sulfate concentrations, 84a  
   trace elements, computation of, 10a  
 Costa Rica Rift Zone, CRRZ fractionation  
   path, 12b-13b  
 Crust, oceanic  
   Costa Rica Rift: Sites 501/504, 23a  
   hydrothermal circulation, 28a, 30a,  
   254a-255a  
 Costa Rica Rift: Site 504, 61b  
   accretion, 144b-145b  
   alteration, 59a, 68a, 70a, 118a-119a,  
   125a, 140b  
   cation exchange capacity, 100b  
   chemical fluxes, 119b-120b, 124b-131b  
   drilling history, 126a  
   earthquakes, 115b-116b  
   electrical resistivity, 133b-145b  
   formation, 165b  
   fractures, 104b-106b  
   geochemistry, 108a, 110a, 112a  
   heat transport, 68a, 70a  
   hydrothermal alteration, 43b-45b,  
   97b-98b, 130b, 140b-141b,  
   164b-165b  
   lithology, 100b  
   lithostratigraphy, 116b-117b, 126a,  
   135b  
   mineralogy, 115a  
   permeability, 97b-98b, 153a-156a  
   porosity, 97b-98b, 100b, 153a-156a  
   resistivity, 100b  
   sealing, 97b-98b  
   seismic impedance, 181b-183b  
   seismic reflectivity, 177b-190b  
   slug testing, 113b-114b  
   stress measurements, 109b-115b  
   structure, 120b-121b  
   temperature gradient and, 140b-142b  
   temperature measurements, 175a  
   thickness, 177b, 189b  
   water/rock ratios, 130b-131b  
 Juan de Fuca Ridge, accretion, 144b
- Density  
   Costa Rica Rift: Site 504, 92a-93a,  
   98a-99a, 175b  
   Costa Rica Rift: Site 677, 235b,  
   277a-280a, 283a  
   Costa Rica Rift: Site 678, 236b, 284a,  
   286a
- East Pacific Rise  
   basalts  
     neodymium isotopes, 57b-58b  
     strontium isotopes, 57b-58b
- cation exchange capacity, 101b  
 crustal thickness, 189b  
 electrical resistivity, 135b  
 Ecuador Fracture Zone, location, 179b  
 Ecuador Rift, stress directions, 116b  
 Epidote, Costa Rica Rift: Site 504, 64b, 69b
- Gadolinium, Costa Rica Rift: Site 504,  
   121b-122b
- Galapagos Islands  
   basalt  
     neodymium isotopes, 57b-58b  
     strontium isotopes, 57b-58b
- Galapagos Rift, stress directions, 116b
- Heat flow  
   Costa Rica Rift: Sites 501/504, 26a-27a,  
   28a, 31a  
   Costa Rica Rift: Site 504, 37a, 89b-95b  
   Costa Rica Rift: Sites 677-678, 265a,  
   292a
- Hematite, Costa Rica Rift: Site 504,  
   stability fields, 33b
- Hydrothermal alteration  
   Costa Rica Rift: Site 504, 162b-164b  
   crust, oceanic, Costa Rica Rift, 43b-45b,  
   97b-98b, 130b, 140b-141b,  
   164b-165b
- Hydrothermal circulation  
   Costa Rica Rift: Site 504, 37a, 94b-95b,  
   130b  
   Costa Rica Rift, basement, 207b-208b  
   crust, oceanic, Costa Rica Rift Zone,  
   28a, 30a, 254a-255a
- Ilmenite, Costa Rica Rift: Site 504,  
   hydrothermal  
   alteration, 162b-164b, 167b
- Iron concentrations  
   Costa Rica Rift: Site 504, 113a,  
   116a-118a, 122a-123a, 125a  
   magnesium/calcium concentrations vs.,  
   120a  
   muds, 81a
- Juan de Fuca Ridge, crustal accretion, 144b
- Kane Fracture Zone  
   basalt  
     major-element data, 53b  
     trace-element data, 53b
- Limestone  
   Costa Rica Rift: Sites 501/504, 26a  
   Costa Rica Rift: Site 504, 114a  
   temperature gradient and, 92b  
   Costa Rica Rift: Site 677, Unit III, 258a
- Magnesium concentrations  
   Costa Rica Rift: Site 501, 208b-210b  
   Costa Rica Rift: Sites 501/504, 27a-28a  
   variation with depth, 31a  
   Costa Rica Rift: Site 504, 77a-92a,  
   116a-117a, 125a, 208b-210b  
   aluminum/iron concentrations vs., 120a  
   geochemical log measurements,  
   121b-122b  
   Costa Rica Rift: Site 677, 197b-200b,  
   208b-210b, 266a, 268a-269a, 270a  
   Costa Rica Rift: Site 678, 197b,  
   199b-200b, 208b-210b, 266a, 269a  
   depth vs., 270a
- Magnetic properties  
   Carnegie Ridge, 156b  
   Cocos Ridge, 156b  
   Costa Rica Ridge: Site 504, 148b-155b

## SUBJECT INDEX

- magnetic susceptibility, 149b-155b  
natural remanent magnetization,  
149b-156b
- Costa Rica Rift: Site 504, 148b,  
160b-162b  
Koenigsberger ratio, 89a, 97a,  
151b-152b, 159b-161b  
magnetic anomalies, 165b  
magnetic groups, 148b-152b  
magnetic susceptibility, 88a, 96a,  
159b-161b  
mean destructive field, 89a-90a, 97a,  
151b-152b  
methods, 87a  
natural remanent magnetization,  
159b-161b  
opaque mineralogy, 91a-92a  
reduction, 150b  
remanent magnetization intensity,  
87a-88a, 96a  
stable inclination, 90a-91a, 97a, 98a
- Costa Rica Rift: Site 677, 270a-274a  
magnetic susceptibility, 267a, 270a,  
273a-274a  
methods, 267a  
remanent magnetization intensity, 267a,  
273a
- Nazca Basin, 156b  
Pacific Basin, 156b
- Magnetite  
Costa Rica Rift: Site 504  
alteration, 67a  
hydrothermal alteration, 162b-164b  
stability fields, 33b  
variation with depth, 66a
- Manganese, Costa Rica Rift, 198b-199b,  
202b
- Mid-Atlantic Ridge, MORB fractionation  
path, 12b-13b
- Millerite, Costa Rica Rift: Site 504, 30b
- Mud  
Costa Rica Rift: Site 504  
iron bacteria, 81a-84a, 94a-95a  
iron concentrations, 81a
- Nazca Basin, magnetic properties, 156b
- Olivine  
Costa Rica Rift: Site 504, 52a-56a, 120a,  
124a  
alteration, 17b-18b, 28b, 61a, 62a,  
62b, 64b, 66a, 67a  
crystallization, 59a  
electron microprobe analyses, 23b  
fractionation, 13b  
smectites replacing, 59a
- Ooze, biogenic, Costa Rica Rift: Site 504,  
87b
- Ooze, clayey calcareous  
Costa Rica Rift: Site 677, Unit I, 257a  
Costa Rica Rift: Site 678, Unit I, 259a
- Ooze, clayey diatom, Costa Rica Rift: Site  
677, Unit I, 258a
- Ooze, clayey nannofossil, Costa Rica Rift:  
Site 677, Unit I, 258a
- Ooze, clayey siliceous, Costa Rica Rift: Site  
677, Unit I, 257a
- Ooze, diatom, Costa Rica Rift, 11a-15a
- Ooze, foraminiferal-nannofossil, Costa Rica  
Rift: Site 677, Unit I, 257a
- Ooze, nanofossil  
Costa Rica Rift: Site 504, 114a, 178b,  
180b  
temperature gradient and, 92b
- Ooze, nannofossil-radiolarian, Costa Rica  
Rift, 254a
- Ooze, pelagic, Costa Rica Rift: Sites 501/  
504, 27a
- Ooze, radiolarians  
Costa Rica Rift: Site 504, 114a  
temperature gradient and, 92b
- Ooze, siliceous  
Costa Rica Rift: Site 504, 114a  
temperature gradient and, 92b
- Ooze, siliceous nannofossil  
Costa Rica Rift: Site 677, 254a  
Unit II, 258a  
Costa Rica Rift: Site 678, 254a
- Ophiolite  
Costa Rica Rift: Site 504, 119b  
compressional wave velocity, 173b,  
175b-176b  
geological boundaries, 178b
- Pacific Basin, magnetic properties, 156b
- Panama Fracture Zone, location, 179b
- Peru-Chile Trench, stress directions, 116b
- Plagioclase  
Costa Rica Rift: Site 504, 49b-50b,  
52a-56a, 52b, 64b, 70b, 120a,  
122b-124b, 124a  
abundance, 125a  
alteration, 61a, 62b, 64b, 67a  
calcium concentrations, 11b  
compositional profiles, 24b  
crystallization, 59a  
electron microprobe analyses, 23b  
exchange partition coefficients, 20b,  
26b  
fractionation, 13b  
iron concentrations, 17b-26b  
kinetic disequilibrium, 19b-20b  
liquid, 19b-20b, 25b  
magnesium concentrations, 17b-26b  
microprobe analyses, 51b  
size, 48b
- Porosity  
clay, Costa Rica Rift: Site 504, 139b-140b  
Costa Rica Rift: Site 501, 242b  
electrical formation factor vs., 242b  
Costa Rica Rift: Site 504, 92a-93a, 93b,  
98a-99a, 111a, 152a-156a,  
166a-167a, 169a, 171a-175a, 175b,  
178b, 237b  
basalt, 101b-102b, 104b-105b  
basement, 38a, 92a-93a, 98a-99a,  
166a-167a, 169a  
chemical exchange and, 125b, 127b  
electrical formation factor vs., 242b  
false, 128b  
fracture, 163a-164a  
lithology correlated with, 90b-91b  
thermal conductivity vs., 104a  
total, 162a
- Costa Rica Rift: Site 505, 237b, 242b  
Costa Rica Rift: Site 677, 235b, 237b,  
241b-242b, 277a-279a, 283a, 287a,  
289a
- Costa Rica Rift: Site 678, 236b-237b,  
241b, 284a, 286a
- Prehnite, Costa Rica Rift: Site 504, 62b,  
67b
- Pyrite  
Costa Rica Rift: Site 504, 30b, 31b-32b,  
67b, 124b  
alteration, 61a-63a, 67a  
stability fields, 33b  
sulfur concentrations, 35b, 42b-45b,  
55b-57b
- Pyroxene  
Costa Rica Rift: Site 504, 49b  
phenocryst compositions, 50b
- Pyrrohotite  
Costa Rica Rift: Site 504  
alteration, 63a  
stability fields, 33b
- Quartz  
Costa Rica Rift: Site 504, 30b, 31b-32b  
alteration, 63a-65a  
oxygen isotopes, 35b  
saturation test, 87a
- Reflectors  
Costa Rica Rift: Sites 501/504, 24a-25a  
low-frequency, 26a
- Shear strength  
Costa Rica Rift: Site 677, 235b,  
276a-281a, 289a  
Costa Rica Rift: Site 678, 236b, 285a,  
286a
- Silicate  
Costa Rica Rift: Site 504, alteration,  
28b-30b  
*See also specific types*
- Smectite  
Costa Rica Rift: Site 504, 124a  
abundance, 125a  
cation exchange capacity, 141b
- Sphalerite, Costa Rica Rift: Site 504,  
alteration, 63a
- Sphene  
Costa Rica Rift: Site 504, 67b  
alteration, 63a-66a, 67a
- Spinel, Costa Rica Rift: Site 504,  
crystallization, 59a
- Sulfate concentrations, Costa Rica Rift: Site  
504, 82a, 84a
- Talc, Costa Rica Rift: Site 504, 67b
- Tanzawa Mountains, basalt, 72b, 75b
- Thermal conductivity  
Costa Rica Rift: Sites 501/504, 26a-27a,  
30a
- Costa Rica Rift: Site 504, 93a, 104a
- Costa Rica Rift: Site 677, 234b, 235b,  
240b, 274a-281a, 284a  
carbonate content vs., 238b  
porosity vs., 240b, 287a
- Costa Rica Rift: Site 678, 234b, 236b,  
239b, 285a, 286a
- Titanomagnetite  
Costa Rica Rift: Site 504  
alteration, 61a  
hydrothermal alteration, 162b-164b,  
167b
- Velocity  
Costa Rica Rift: Site 504, 93a,  
100a-101a, 111a, 123a, 129a,  
171b-176b, 180b-181b  
depth profiles, 186b  
Hashin-Shtrikman bounds, 181b, 185b  
porosity relationship, 186b
- Costa Rica Rift: Site 677, 281a-282a
- Costa Rica Rift: Site 678, 285a, 286a
- ophiolite, Costa Rica Rift: Site 504, 173b,  
175b-176b
- Zeolite  
Costa Rica Rift: Site 504, 62b, 66b  
electrical resistivity, 103b-104b
- Zircon, Costa Rica Rift: Site 504, 58a

## SITE INDEX

- Site 501  
 basement, topography, 25a-26a  
 bathymetry, 24a-25a  
 biostratigraphy. *See Paleontological Index*  
 drilling, results, 206b-207b  
 heat-flow anomalies, 29a  
 interstitial-water chemistry, 20a  
 location, 25a, 234b  
 pore-water chemistry, 27a-28a, 210b-213b
- Site 504  
 amphibole analyses, 71b-72b  
 basement  
   alteration. *See Subject Index*  
   borehole waters, 74a, 76a-81a  
   Kuster sampler, 73a, 79a  
   lithostratigraphy, 29b  
   RFT sampler, 71a-73a, 78a-79a  
   secondary minerals, 29b, 62b-68b, 74b  
   topography, 25a-26a  
 bathymetry, 24a-25a, 132a, 134b, 179b  
 biostratigraphy. *See also Paleontological Index*  
 borehole-water chemistry, 80a-87a  
 carbonate content, 114a  
 cation exchange capacity, 99b-101b, 141b  
 chemical fluxes, 124b-125b  
   calculations, 125b, 129b  
   total, 129b-130b  
 coring  
   adjustments, 274b  
   measurements, 98b-100b  
   summary, 43a, 120b-121b, 263b-264b  
 CRRZ fractionation path, 12b-13b  
 drilling  
   history, 37a, 135b  
   objectives, 36a-37a  
   procedures, 17b-18b, 28b, 35a-36a, 42b, 47b-48b, 77b-78b, 88b, 318b-320b  
   results, 4b-10b, 37a-39a, 42b-43b, 59a-67a, 73a-74a, 78b, 88b, 100b-101b, 206b-207b, 321b  
 electrical experiments, 134b-140b  
 electrical resistivity measurements, 98b, 101b-103b, 138b, 143b  
 electron microprobe analyses, 23b  
 geochemistry, 33b-34b, 67a-68a  
 heat-flow anomalies, 29a  
 hydrogen isotopes, 51b-52b, 54b-55b  
 interstitial-water chemistry, 20a  
 ion microprobe results, 42b-43b  
 lithology, 143b  
 lithostratigraphy, 47a-50a, 116b-117b, 135b  
 location, 25a, 132a, 134b, 234b  
 logging  
   analysis, 121b-122b  
   borehole viewer, 109b-117b, 172a, 175a, 176a-180a  
   changes during operations, 42a  
   dual laterolog resistivity, 161a-172a  
   experiments, 39a, 41a-42a  
   intervals, 41a  
   magnetometer, 136a-137a, 139a-141a, 143a, 145a-152a  
   measurements, 39a-41a, 183a  
   neutron activation, 98a-103a, 106a-108a, 110a, 113a, 115a, 118a-119a  
   results, 175a, 180a-181a, 183a

- tools, 41a, 43a-47a, 100a, 102a-103a, 121b  
*See also Site 504, logging, neutron activation; specific types*  
 magnetic properties, 87a  
   inclination, 90a-91a, 151b-154b, 154a-157a  
   initial susceptibility, 88a  
   Koenigsberger ratio, 89a, 151b-152b  
   magnetic anomalies, 165b  
   magnetic groups, 148b, 150b  
   magnetic susceptibility, 151b-152b  
   mean destructive field, 89a-90a, 151b-152b  
   natural remanent magnetization, 149b-152b, 154b-156b  
   opaque mineralogy, 91a-92a  
   remanent magnetization, 87a-88a  
*See also Subject Index*  
 major-element data. *See Subject Index*  
 MORB fractionation path, 12b-14b  
 multichannel sonic logging, 119a-121a, 134a  
   data, 121a, 123a  
   neodymium isotopes, 57b-58b  
   oxide mineralogy, 162b, 164b  
   oxygen isotopes, 34b-35b, 38b, 51b-52b, 54b-55b  
   oxygen-sulfur fugacity diagram, 33b  
   partition coefficients, 19b-20b, 26b  
   permeability measurements, 152a-156a, 158a-161a, 317b-325b  
 petrography, 48b-50b, 50a, 62b  
   aphyric rocks, 58a-59a  
   basalt classification, 18b, 50a, 52a  
   chilled margins, 58a  
   crystallization sequence, 59a  
   groundmass, 55a-58a  
   phenocryst phases, 53a-55a  
   porphyritic rocks, 52a-53a  
   precursor basalts, 61b  
 physical property measurements, 92a-93a  
 pore-space geometry, 105b-106b  
 pore-water chemistry, 27a-28a, 210b-213b  
 seismic properties, 171b-176b  
   impedance, 181b-183b  
   slug testing, 113b-114b  
   stress measurements, 109b-110b, 112b-113b  
   tectonic forces correlated with, 115b-116b  
 strontium isotopes, 57b-58b  
 sulfur isotopes, 35b, 55b-57b  
 synthetic CMP gathers, 185b, 188b  
   wide-aperture, 185b, 189b  
 temperature measurements, 87b-88b, 94a-98a  
   heat-flow distribution, 91b, 93b  
   hydrothermal circulation, 94b-95b  
   lithology correlated with, 89b-91b  
   logging equipment, 95a-97a  
 trace element data. *See Subject Index*  
 vertical seismic profiles, 124a-127a  
   air gun, 128a, 135a-142a, 150a  
   downgoing direct waves, 132a-133a  
   seismolithologic boundaries correlated with, 153a  
   seismolithologic units correlated with, 152a  
   upgoing reflected waves, 133a, 135a, 151a  
   water gun, 132a, 135a, 137a, 143a-145a, 148a

- water/rock ratios, 130b-131b  
 whole-rock chemistry, 50b-51b  
 XRD analyses, 64a  
 XRF analyses, 69a, 115a
- Site 677  
 biostratigraphy. *See Paleontological Index*  
 carbon isotopes, 314b-316b  
 coring  
   disturbance, 235b-236b  
   summary, 256a, 264b  
 drilling  
   data, 253a  
   objectives, 254a-256a  
   procedures, 196b-197b, 227b, 256a-257a  
   results, 197b, 200b, 206b, 292a-294a  
   geolipid analyses, 227b-228b  
   interstitial-water chemistry, 20a, 215b-225b  
   inverse correlation technique, 269b-270b, 272b  
   lithostratigraphy, 257a-258a  
   location, 196b, 215b, 234b, 255a  
   magnetic properties  
   magnetic susceptibility, 267a, 270a-271a  
   natural remanent magnetization, 267a, 272a-273a  
   organic matter diagenesis, 228b-229b  
   oxygen isotopes, 311b, 313b  
   physical-property measurements, 233b-242b, 274a-279a, 280a, 282a-284a, 287a-289a  
   water movement affecting, 236b-237b  
   pore-water chemistry, 265a-267a, 268a-271a  
   sedimentology, 257a-258a  
   stable isotope data, 296b-310b  
   stratigraphy, 233b  
   temperature measurements, 286a-288a, 290a-292a  
   heat-flow distribution, 195b-196b
- Site 678  
 biostratigraphy. *See Paleontological Index*  
 coring  
   disturbance, 235b-236b  
   summary, 256a  
 drilling  
   data, 253a-254a  
   objectives, 254a-256a  
   procedures, 196b-197b, 227b, 256a-257a  
   results, 197b  
   geolipid analyses, 227b-228b  
   interstitial-water chemistry, 20a, 215b-220b, 224b-225b  
   lithostratigraphy, 258a-259a  
   location, 196b, 215b, 234b, 255a  
   organic matter diagenesis, 228b-229b  
   physical property measurements, 233b-242b, 279a, 281a-282a, 284a-288a  
   water movement affecting, 236b-237b  
   pore-water chemistry, 265a-267a, 269a-271a  
   sedimentology, 258a-259a  
   stratigraphy, 233b  
   temperature measurements, 286a-288a  
   heat-flow distribution, 195b-196b

## PALEONTOLOGICAL INDEX

*Amaurolithus amplificus*, Costa Rica Rift:  
Site 678, 264a  
*Amphirhopalum ypsilon*, Costa Rica Rift:  
Site 677, 261b  
*Androsyrpis fenestrata*, Costa Rica Rift:  
Site 677, 258b  
*Androsyrpis huxleyi*, Costa Rica Rift: Site  
677, 259b  
 Benthic foraminifers, Costa Rica Rift: Site  
677, 262a  
*Botryostrobus aquilonaris*, Costa Rica Rift:  
Site 677, 260b  
*Botryostrobus euporus*, Costa Rica Rift:  
Site 677, 260b  
 Calcareous nannofossil  
Costa Rica Rift: Site 501, 15a-16a  
zonation, 18a  
Costa Rica Rift: Site 504, 15a-16a  
zonation, 18a  
Costa Rica Rift: Site 677, 15a-16a, 259a  
Miocene, 261a-262a  
Neogene, 277b-285b  
Pleistocene, 259a, 261a  
Pliocene, 261a  
species list, 284b-285b  
zonation, 18a, 260a  
Costa Rica Rift: Site 678, 15a-16a  
zonation, 18a  
*Calcidisus leptopus*, Costa Rica Rift: Site  
677, 277b  
*Calcidiscus macintyrei*, Costa Rica Rift: Site  
677, 261a  
*Ceratolithus acutus*, Costa Rica Rift: Site  
677, 261a  
*Coccolithus macintyrei*, Costa Rica Rift:  
Site 677, 278b  
*Coccolithus pelagicus*, Costa Rica Rift: Site  
677, 259a, 261a, 277b-278b, 280b,  
281b-283b  
*Collospheara huxleyi*, Costa Rica Rift: Site  
677, 246b, 258b  
*Collospheara tuberosa*, Costa Rica Rift: Site  
677, 258b  
*Dictyocoryne ontongensis*, Costa Rica Rift:  
Site 677, 262b  
*Didymocystis avita*, Costa Rica Rift: Site  
677, 252b  
*Didymocystis penultima*, Costa Rica Rift:  
Site 677, 261b  
*Didymocystis tetrathalamus*, Costa Rica  
Rift: Site 677, 261b  
*Discoaster*, Costa Rica Rift: Site 677,  
277b-278b  
*Discoaster asymmetricus* Zone, Costa Rica  
Rift: Site 677, 280b  
*Discoaster brouweri*  
Costa Rica Rift: Site 677, 261a, 282b  
Costa Rica Rift: Site 678, 264a  
*Discoaster pentaradiatus*, Costa Rica Rift:  
Site 677, 280b

*Discoaster quinqueramus*, Costa Rica Rift:  
Site 677, 281b-282b  
*Discoaster quinqueramus* Zone, Costa Rica  
Rift: Site 677, 261a, 281b  
*Discoaster surculus* Zone, Costa Rica Rift:  
Site 677, 280b, 282b  
*Discoaster triradiatus*, Costa Rica Rift: Site  
677, 280b  
*Emiliania huxleyi*  
Costa Rica Rift: Site 677, 259a, 261a,  
277b-278b  
Costa Rica Rift: Site 678, 264a  
*Eucyrtidium diaphanes*, Costa Rica Rift:  
Site 677, 263a  
*Gephyrocapsa oceanica* Zone, Costa Rica  
Rift: Site 677, 261a, 280b, 283b  
*Globigerinoides fistulosus* Zone, Costa Rica  
Rift: Site 677, 262a  
*Globigerinoides ruber*, Costa Rica Rift: Site  
677, isotope  
analyses, 295b-316b  
*Globorotalia plesiotumida* Zone, Costa Rica  
Rift: Site 677, 262a  
*Globorotalia tumida*, Costa Rica Rift: Site  
677, 289b  
*Globorotalia tumida* Zone, Costa Rica Rift:  
Site 677, 262a  
*Helicosphaera sellii*, Costa Rica Rift: Site  
677, 280b  
*Lamprocystis nigriniae*, Costa Rica Rift:  
Site 677, 262a-263a  
*Lithopera bacca*, Costa Rica Rift: Site 677,  
260b  
*Neogloboquadrina pachyderma*, Costa Rica  
Rift: Site 677, 281b  
*Phormostichoartus corbula*, Costa Rica  
Rift: Site 677, 260b  
*Phormostichoartus doliolum*, Costa Rica  
Rift: Site 677, 260b  
 Planktonic foraminifers  
Costa Rica Rift: Site 501, 16a-17a  
Costa Rica Rift: Site 504, 16a-17a  
Costa Rica Rift: Site 677, 16a-17a, 262a  
Miocene-Pliocene, 262a, 289b-293b  
Pleistocene, 262a  
zonation, 260a  
Costa Rica Rift: Site 678, 16a-17a  
*Pseudodemania lacunosa*, Costa Rica Rift:  
Site 677, 280b  
*Pterocanium prismatum*, Costa Rica Rift:  
Site 677, 251b-252b  
*Pterocanium prismatum* Zone, Costa Rica  
Rift: Site 677, 263a  
*Pterocorys minythorox*, Costa Rica Rift:  
Site 677, 259b  
*Pulleniatina*  
Costa Rica Rift: Site 677, 289b  
datum planes, 293b  
*Pulleniatina obliquiloculata* Zone, Costa  
Rica Rift: Site 677, 262a  
 Radiolarians  
Costa Rica Rift: Site 501, 16a-17a  
Costa Rica Rift: Site 504, 16a-17a  
Site 677 correlated with, 269b  
Costa Rica Rift: Site 677, 16a-17a,  
246b-253b, 262a  
biotum, 247b-252b  
Miocene, 263a  
Pliocene, 263a  
Quaternary, 263a  
sampling procedures, 246b-247b  
Site 504 correlated with, 269b  
species list, 255b-257b  
zonation, 260a, 262a-263a  
Costa Rica Rift: Site 678, 16a-17a  
*Reticulofenestra pseudoumbilica*, Costa Rica  
Rift: Site 677, 261a, 262a, 277b  
*Reticulofenestra pseudoumbilica* Zone, Costa  
Rica Rift:  
Site 677, 280b  
*Reticulofenestra tanga*, Costa Rica Rift: Site  
677, 283b  
*Siphonosphaera tenera*, Costa Rica Rift:  
Site 677, 258b  
*Sphaeroidinella dehiscens*, Costa Rica Rift:  
Site 677, 289b  
*Sphaeroidinella dehiscens* Zone, Costa Rica  
Rift: Site 677, 262a  
*Sphenolithus abies* Zone, Costa Rica Rift:  
Site 677, 280b  
*Spongaster berminghami*, Costa Rica Rift:  
Site 677, 262b  
*Spongaster pentas*, Costa Rica Rift: Site  
677, 262b  
*Spongaster pentas* Zone, Costa Rica Rift:  
Site 677, 251b  
*Spongaster tetras*, Costa Rica Rift: Site 677,  
261b  
*Spongodiscus ambus*, Costa Rica Rift: Site  
677, 262b  
*Stichocorys delmontensis*, Costa Rica Rift:  
Site 677, 252b  
*Stichocorys peregrina*, Costa Rica Rift: Site  
677, 252b, 260b  
*Stichocorys peregrina* Zone, Costa Rica Rift:  
Site 677, 251b  
*Styletactrus universus*, Costa Rica Rift: Site  
677, 247b-251b  
*Thalassionema*, Costa Rica Rift: Site 677,  
283b  
*Thalassionema nitzschiooides*, Costa Rica  
Rift: Site 677, 281b  
*Thecocorythium trachelium*, Costa Rica Rift:  
Site 677, 259b  
*Uvigerina*, Costa Rica Rift: Site 677,  
isotope analyses, 295b-316b