

CONTENTS

Preface	VII
List of Contributors	
INTRODUCTION	1
P. Fritz and J.Ch. Fontes	
Definitions	11
Standards	17
Referentes	
CHAPTER 1. THE ISOTOPES OF HYDROGEN AND OXYGEN IN PRECIPITATION	21
J.R. Gat	
Introduction	21
Tritium in atmospheric waters	22
Stable isotope distribution in atmospheric waters: data	29
Models of the isotope fractionation during evaporation and condensation of water in the atmosphere	33
In-storm variation of isotopic composition, cloud models and hailstone studies ...	37
Stable isotope distribution in atmospheric waters: the global model	40
Referentes	44
CHAPTER 2. CARBON-14 IN HYDROGEOLOGICAL STUDIES	49
W.G. Mook	
Introduction	49
The abundante of ^{14}C	49
The ^{14}C age determination	52
^{14}C dating in groundwater	53
Summary	70
Referentes	71
CHAPTER 3. ENVIRONMENTAL ISOTOPES IN GROUNDWATER HYDROLOGY	75
J.Ch. Fontes	
Introduction	75
Basic principles	76
Groundwater recharge	82
Relations between surface- and groundwaters	98
Mechanism and componente of the run-off	102
Leakage between aquifers	108
Isotope hydrology of fractured rocks	113

X	
Mechanism of salinization	121
Groundwater dating	125
Conclusions	132
References	134
CHAPTER 4. ENVIRONMENTAL ISOTOPES IN ICE AND SNOW	141
H. Moser and W. Stichler	
Introduction	141
Isotope content of a snow cover in accretion	142
Isotope distribution during the reduction of a temperate snow cover	148
Isotope variations in the transition of snow to glacier ice	154
Snow and ice isotope hydrology	163
Historical glaciology	169
References	174
CHAPTER 5. ISOTOPIC EVIDENCE ON ENVIRONMENTS OF GEOTHERMAL SYSTEMS	179
A.H. Truesdell and J.R. Hulston	
Introduction	179
Isotope hydrology of geothermal systems	180
Geothermometry	195
Isotopic dating of geothermal waters	207
Origin of chemical constituents	211
Solid phase studies	214
Summary	216
Appendix - Methods of collection and analysis	217
References	219
CHAPTER 6. SULPHUR AND OXYGEN ISOTOPES IN AQUEOUS SULPHUR COMPOUNDS	227
F.J. Pearson, Jr. and C.T. Rightmire	
Introduction	227
Isotope fractionation	227
Geochemistry and isotope distribution of aqueous sulphur compounds	234
Field studies of groundwater systems	241
Summary	254
Referentes	255
CHAPTER 7. URANIUM DISEQUILIBRIUM IN HYDROLOGIC STUDIES	259
J.K. Osmond	
Introduction	259
Isotopic fractionation of ^{234}U	261
Mixing studies: continental waters	266
Mixing and uranium balances: marine waters	270
Aquifer interactions	272
Age dating	276
Summary	277
Appendix - Analytical techniques for ^{234}U and ^{238}U analysis	278
References	279

CHAPTER 8. OXYGEN AND HYDROGEN ISOTOPE EFFECTS IN LOW-TEMPERATURE MINERAL-WATER INTERACTIONS	283
S.M. Savin	
Introduction	283
Isotopic fractionations between minerals and water	284
Isotope effects during weathering and soil formation	294
Isotopic studies of marine sedimentation, halmyrolysis, authigenesis and early dia- genesis	298
Evaporite formation	308
Later diagenetic processes	310
Serpentization of ultramafic rocks	317
Effect of mineral-water interaction on the isotopic composition of pore water	319
Referentes	321
CHAPTER 9. THE ISOTOPIC COMPOSITION OF REDUCED ORGANIC CARBON	329
P. Deines	
Introduction	329
Photosynthesis and the carbon isotopic composition of plants	329
The carbon isotopic composition of organic matter in sediments	344
The carbon isotopic composition of fossil fuels	360
The carbon isotopic composition of atmospheric compounds	384
Referentes	393
CHAPTER 10. NITROGEN-15 IN THE NATURAL ENVIRONMENT	407
R. Létoille	
Introduction	407
t₅N in nature	410
Isotope fractionations	413
15N in organic matter and soils	417
15N in nitrates	420
15N in the hydrosphere	424
References	429
CHAPTER 11. SULPHUR ISOTOPES IN OUR ENVIRONMENT	435
H.R. Krouse	
Introduction	435
Terrestrial sulphur isotope abundances and cycling of mobile sulphur compounds ..	435
Elucidation of sources, mixing, and dispersion of sulphur compounds	440
Sulphur isotope fractionation during transformations of atmospheric and aqueous sulphur compounds	453
Sulphur isotope fractionation in the pedosphere	461
Sulphur isotopes elucidate uptake of industrial sulphur compounds by vegetation ..	463
Evaluation of anthropogenic and natural sources of sulphur compounds	46,5
Summary	46\$
References	467
CHAPTER 12. ENVIRONMENTAL ISOTOPES AS ENVIRONMENTAL AND CLIMATOLOGICAL INDICATORS	473
B. Buchardt and P. Fritz	
Introduction	473
The carbon and oxygen isotope composition of freshwater shells	474

Freshwater lakes and sediments	484
Deuterium in organic matter as paleoclimatic indicators	495
References	500
References Index	505
Subject Index	532